Department of Energy
Carlsbad Area Office
P. O. Box 3090
Carlsbad, New Mexico 88221

MAY 2, 1997

MAY 1997
RECEIVED
HAZARDOUS WASTE
PROGRAM

Mr. Robert S. Dinwiddie, Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044-A Galisteo Street
Santa Fe, NM 87505

Reference: Transmittal of Supplemental Information for Solid Waste Management Units at the Waste Isolation Pilot Plant

Dear Mr. Dinwiddie:

This letter transmits a document entitled *Supplemental Information Requested by the New Mexico Environment Department for Solid Waste Management Units at the Waste Isolation Pilot Plant (DOE/WIPP 97-2220a)*. This document supplies information requested by you in a letter dated April 11, 1997. Your letter requested documentation in addition to that supplied in the U.S. Department of Energy (DOE), Carlsbad Area Office report, *Final Solid Waste Management Unit Assessment Report* (*DOE/WIPP 97-2220*, January 10, 1997). The DOE report presented information supporting requests for "No Further Action" determinations by NMED at solid waste management units (SWMUs) identified at the WIPP.

In response to your letter, DOE has compiled supplemental information in the attached document to further support No Further Action determinations at WIPP SWMUs. This document was written to respond to each of the three specific information requests the NMED had. The following discussion summarizes each NMED comment and the sections of the attached document which respond to the request.

NMED Information Request #1

Additional documentation was requested to support DOE's NFA requests at 23 mudpit SWMUs. The NMED requested that DOE provide records of sufficient detail to allow an independent determination on the presence or absence of hazardous constituents at each of these SWMUs, and to provide such records for all wells and/or boreholes drilled at each particular SWMU.

DOE Response

The records requested by NMED have been compiled and included in the enclosed document. The location of the compiled information in the enclosed document is presented on the next page for each of the 23 mudpit SWMUs.

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SWMU #	SWMU Name	Location of Information Requested
001b	H-2	Section 2.1, Table 1, Appendix A
001c	H-3	Section 2.2, Table 2, Appendix A
001d	H-5/P-21	Section 2.3, Table 3, Appendix B
001e	H-6/P-13	Section 2.4, Table 4, Appendix C
001r	D-123	Section 2.5, Table 5, Appendix D
001u	IMC-376	Section 2.6, Table 6, Appendix E
001v	IMC-456	Section 2.6, Table 6, Appendix E
001w	IMC-457	Section 2.6, Table 6, Appendix E
001y	WIPP-18	Section 2.7, Table 7, Appendix F
001z	WIPP-18	Section 2.7, Table 7, Appendix F
001aa	WIPP-21	Section 2.7, Table 7, Appendix F
001ab	WIPP-22	Section 2.7, Table 7, Appendix F
001ac	DSP-207	Section 2.5, Table 5, Appendix C
001ad	IMC-375	Section 2.6, Table 6, Appendix E
001ae	IMC-377	Section 2.6, Table 6, Appendix E
001af	H-16	Section 2.8, Table 8, Appendix G
001ah	H-19	Section 2.9, Table 9, Appendix H
001ai	WQSP-1	Section 2.10, Table 10, Appendix I
001aj	WQSP-2	Section 2.10, Table 10, Appendix I
001ak	WQSP-3	Section 2.10, Table 10, Appendix I
001al	WQSP-4	Section 2.10, Table 10, Appendix I
001am	WQSP-5	Section 2.10, Table 10, Appendix I
001an	WQSP-6/6a	Section 2.10, Table 10, Appendix I

Additional Material Safety Data Sheets (MSDSs) applicable to drilling activities at these SWMUs are included in Appendix J of the enclosed document. The information compiled by DOE indicates that the drilling media used at these sites were air, air foam, and/or saturated brines and brine mud's. The wells and boreholes at these sites were completed or plugged using standard, commercially available cement mixtures. Therefore, the information compiled by DOE provides additional support for NFA determinations, indicating that hazardous constituents were not used during drilling activities at these sites.

NMED Information Request #2

The NMED letter requested that DOE provide the sampling and analytical data referenced in the WIPP RCRA Facility Assessment (Section 4.7.2, page 4-50) as the "Facility West" location. The NMED also requested a complete copy of the NMED/WIPP Soil Sampling and Analysis Plan.

DOE Response

The "Facility West" data and the NMED/WIPP Soil Sampling and Analysis Plan are included as Appendix K in the enclosed document. Appendix K includes the analytical results reported by both DOE and NMED for the "Facility West" samples, as well as the analytical results for the dune blow out (i.e., "background") sample collected concurrently with the "Facility West" samples. Additional discussion of the "Facility West" sampling data is included as Section 3.0 of the enclosed document.

NMED Information Request #3

The NMED letter requested that DOE apply a robust statistical technique to assess background metals concentrations at the WIPP site based on background analytical data reported in the *Final Voluntary Release Assessment/Corrective Action Report (DOE/WIPP 96-2209)*, Section 1.4.1. Additionally, the NMED requested a new table summarizing statistically-based background concentrations.

DOE Response

A rigorous statistical assessment of background metals results is presented in Section 4.0 of the enclosed document, which includes a new table displaying statistical background concentrations for metals based on the results reported in the *Final Voluntary Release Assessment/Corrective Action Report (DOE/WIPP 96-2209)*. The approach used by DOE for calculation of these background concentrations is based on applicable EPA guidance for statistical assessments of analytical data. Supporting statistical calculation sheets are included in Appendix L.

The DOE is pleased to provide the enclosed document in response to the NMED letter, and believes this information to be sufficient for No Further Action determinations at the WIPP SWMU sites. If you have any questions, please call Craig Snider at 505-234-7452.

Sincerely,

George E. Dials
Manager

Enclosure

cc w/o enclosure:
C. Wayman, CAO
D. McFadden, CAO
J. Epstein, WID
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97-0844(UCF 5486)

WIPP Library
DOE/WIPP 97-2220a

Supplemental Information Requested by the New Mexico Environment Department for Solid Waste Management Units

1997
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HAZARDOUS WASTE
PROGRAM

May 1, 1997

Waste Isolation Pilot Plant
Carlsbad, New Mexico

Processing and final preparation of this report were performed by the Westinghouse Electric Corporation's Waste Isolation Division, the management and operating contractor for the Waste Isolation Pilot Plant, under U. S. Department of Energy contract DE-ACO4-86AL31950.

This document has been submitted as required to:

Office of Scientific and Technical Information
PO Box 62
Oak Ridge, TN 37831
(615) 576-8401

Additional information about this document may be obtained by calling (800) 336-9477. Copies may be obtained by contacting the National Technical Information Service, US Department of Commerce, 5285 Port Royal Road, Springfield, VA 22101.

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ACRONYMS

BLM	Bureau of Land Management
CA	Corrective Action
CFR	Code of Federal Regulations
CW	Chemical Wash
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSP	Duval Sulphur and Potash Company
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
FR	Federal Register
GWPRB	Groundwater Protection and Remediation Bureau
IMC	International Minerals Corporation
KCL	Potassium Chloride
KCl/NaCl	Potassium Chloride/Sodium Chloride
MSDS	Material Safety Data Sheets
NaCl	Sodium Chloride
NEPA	National Environmental Policy Act of 1969
NFA	No Further Action
NM	New Mexico
NMED	New Mexico Environmental Department
NPUTL	Non-parametric Upper Tolerance Limit
PDC	Pennsylvania Drilling Company
RA	Release Assessment
RA/CA	Release Assessment/Corrective Action
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SAND	Sandia National Laboratories Report
SNL	Sandia National Laboratories
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
USGS	U.S. Geological Survey
UTL	Upper Tolerance Limit
WID	Waste Isolation Division
WIPP	Waste Isolation Pilot Plant
WQSP	Water Quality Sampling Program
WRI	Water Resources Investigation Report

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Carlsbad Area Office has prepared this document as a supplement to the *Final Solid Waste Management Unit Assessment Report (DOE/WIPP 97-2220)*, dated January 10, 1997, which was submitted to the U.S. Environmental Protection Agency (EPA) Region VI Hazardous Waste Management Division and the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau. This document is specifically intended to respond to a letter from NMED dated April 11, 1997, (hereafter referred to as the "NMED letter") that requested additional documentation to support DOE's request for "No Further Action" (NFA) determinations at solid waste management units (SWMUs) identified at the Waste Isolation Pilot Plant (WIPP). The NMED letter specifically requested the following:

- Records of sufficient detail to allow NMED to perform an independent assessment of the presence or absence of hazardous constituents at the following mudpit SWMUs:

SWMU No.	SWMU Name
001b	H-2
001c	H-3
001d	H-5/P-21
001e	H-6/P-13
001r	D-123
001u	IMC-376
001v	IMC-456
001w	IMC-457
001y	WIPP-18
001z	WIPP-19
001aa	WIPP-21
001ab	WIPP-22
001ac	DSP-207
001ad	IMC-375
001ae	IMC-377
001af	H-16
001ah	H-19
001ai	WQSP-1
001aj	WQSP-2
001ak	WQSP-3
001al	WQSP-4
001am	WQSP-5
001an	WQSP-6/6a

- Copies of analytical data collected by NMED and DOE during the WIPP Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) for Evaporation Pond SWMU 007b. NMED also requested a copy of the NMED/WIPP Soil Sampling and Analysis Plan.

- A rigorous statistical assessment of soil background data collected for metals constituents at the WIPP site during the Voluntary Release Assessment/-Corrective Action (RA/CA) program *(DOE/WIPP 96-2209)*.

The information requested by NMED is presented in the succeeding sections of this document. The historical records and documentation supporting DOE's NFA requests are attached in appendixes for each SWMU of concern.

This document includes only information that is responsive to the NMED letter. It does not include detailed discussions of the SWMUs of concern, or discussions of the geology, hydrogeology, contaminant migration pathways, or action level concentrations applicable to the WIPP SWMUs. The reader is referred to the *Final SWMU Assessment Report (DOE/WIPP 97-2220)* and the *Final Voluntary RA/CA Report (DOE/WIPP 96-2209)* for such information.

2.0 MUDPIT AREAS OF CONCERN

The NMED letter identified 23 mudpit SWMUs for which additional documentation was required to support an NFA determination. Of these 23 mudpits, 16 were assessed by NMED during the RFA *(NMED/DOE/AIP 94/1)*. The remaining seven mudpit SWMUs, including the H-19 Hydropad and the WQSP well sites, were constructed after the RFA was published, and were identified in Chapter J of the RCRA Part B Permit Application, Revision 6. For the 16 mudpits assessed during the RFA, NMED determined that additional information was required for seven mudpits, while the remaining nine were not identified as areas of concern by the RFA.

DOE originally requested NFA determinations for the 23 mudpit SWMUs in the *Final SWMU Assessment Report (DOE/WIPP 97-2220)* and *Data Summary Report No. 4 (DOE/WIPP, 1996)*. DOE based the NFA requests on reviews of historical records and reports for each of the wells and boreholes of interest, as well as on comparisons to similar mudpit SWMUs that were sampled as part of the Voluntary RA/CA program *(DOE/WIPP 96-2209)*. The results of the Voluntary RA/CA program demonstrated that even at mudpit SWMUs identified as areas of concern by the RFA, concentrations of hazardous constituents were generally consistent with background ranges and were well below applicable risk-based action levels proposed in Title 40 of the Code of Federal Regulations (CFR), Part 264.514, the Subpart S rule.

The NMED letter requested additional historical records to support DOE's request for NFA determinations at the 23 mudpit SWMUs. Thus, this document has been prepared to provide the historical documentation to allow NMED to independently verify the presence or absence of hazardous constituents of concern at these mudpits. Copies of the historical records originally reviewed by DOE as part of the *Final SWMU Assessment Report (DOE/WIPP 97-2220)* are included as Appendixes to this document. These records have been augmented to include additional records currently available to DOE.

The records compiled in the Appendixes to this document are summarized for each mudpit SWMU of interest in the subsections below. Each subsection also includes a summary table which presents the principal drilling materials used at each site as discernible from the Appendix information. For mudpit SWMUs associated with WIPP geologic and hydrogeologic investigations (i.e., well and borehole sites designated by "H-", "P-", "WIPP-", and "WQSP-"), the compiled documentation generally includes the following:

- Investigation reports that include summary discussions of drilling activities, such as those prepared by the U.S. Geological Survey (USGS), Sandia National Laboratories (SNL), and DOE.

- Hole history data, completion diagrams, drilling logs/chronologies, and drilling-related correspondence from DOE files.

In comparison to WIPP-related drilling activities, less information is generally available for commercial potash exploration borings drilled before the WIPP facility was established (e.g., boreholes designated "D-", "DSP-", and "IMC-"). Information compiled by DOE for these boreholes generally includes the following:

- Sundry notices filed with the USGS and/or Bureau of Land Management (BLM), such as "Notice of Intention to Drill" forms, "Subsequent Report of Abandonment" forms. The first pages of borehole and/or core lithology logs filed with the USGS and/or BLM are also included to provide additional documentation concerning the drilling of each borehole.

- Additional file information available from the mining companies responsible for each specific borehole. Such information varies between boreholes, and may include brief summaries of drilling activities, instructions to drillers, and/or drillers' daily logs.

In an attempt to gather more information for the commercial boreholes, DOE contacted the following government offices:

- BLM Area Office, Carlsbad, NM
- BLM Area Office, Roswell, NM
- USGS Area Office, Carlsbad, NM
- USGS Regional Office, Albuquerque, NM
- New Mexico State Engineer's Office, Roswell, NM
- New Mexico Bureau of Mines and Reclamation, Socorro, NM

However, no additional historical records, applicable regulatory requirements, or other information concerning the commercial potash exploration borehole SWMUs were available.

To assist NMED in assessing drilling materials used at the 23 mudpit SWMUs of interest, DOE has compiled Material Safety Data Sheets (MSDSs) for drilling materials as one of the appendixes to this document (Appendix J). The compiled MSDSs include "typical" example materials with general applicability to drilling practices used at the mudpit sites (e.g., typical bentonite mud and mud gel formulations), as well as MSDSs for special formulations and additives used at specific mudpit sites (e.g., chemical washes). In general, MSDSs are not provided for nonhazardous commercially-available or prepared materials such as saturated brines, brine muds, and cement formulations.

2.1 H-2 Mudpit (SWMU 001b)

Four monitoring wells are located on the H-2 well pad. Three wells, H-2a, H-2b, and H-2c, were drilled in 1977 by the Pennsylvania Drilling Company (PDC) for the USGS and SNL as part of the initial WIPP hydrogeologic characterization. These wells were initially drilled to total depths ranging from 563 feet (H-2a) to 795 feet (H-2b and H-2c) for hydrologic testing of the Rustler-Salado contact and the Culebra and Magenta members of the Rustler formation. Hole history data that documents the initial drilling of these three wells are included in Appendix A. Also included in Appendix A are applicable sections from the *Interim Data Report on the Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Southeast New Mexico (USGS Water Resources Investigation [WRI] Report 79-98)*, which summarize the drilling and hydrologic testing activities performed at H-2a, H-2b, and H-2c.

The fourth well, H-2b2, was drilled in 1983 by PDC for SNL to a total depth of 660 feet. At this time, H-2a was also deepened from 563 feet to 672 feet. These drilling activities were performed to allow additional testing of the Culebra and Magenta members at the H-2 complex. The drilling of H-2b2 and the deepening of H-2a are summarized in *WIPP Hydrology Program, Hydrologic Data Report #1 (SAND85-7206)*. Applicable sections of this report that discuss the drilling processes and materials are included in Appendix A.

In 1989, well H-2b, renamed H-2b1, was converted to a Magenta Member monitoring well for additional hydrologic testing and water quality sampling. The conversion of this well is documented in *WIPP Hydrology Program, Hydrologic Data Report #8 (SAND89-7056)*. The applicable sections of this report are included in Appendix A.

Table 1 summarizes the materials used during drilling activities at the H-2 complex, as documented by the information in Appendix A. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 1, the principal drilling materials used at the H-2 wells were air, air foam, saturated brine, and clay- and brine-based muds and mud gels. The wells were completed using standard commercial cement mixtures and additives. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at the H-2 complex. The documentation in Appendix A supports DOE's request for a No Further Action determination at SWMU 001b.

Table 1: Summary of Compiled Documentation and Drilling Materials for SWMU 001b

Bore-hole Name	Compiled Documentation (see Appendix A)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-2a	(1) Hole history and hole diagram from WID files. (2) Summary of initial drilling from USGS WRI 79-98. (3) Summary of well deepening from SAND85-7206.	air, air foam, mud, soap, mud gel, attapulgite-starch mud, saturated brine	ready-mix cement, mud flush, thix set cement (w/ gilsonite, flocele, and $CaCl_2$), class C cement/poz mix (w/ salt and gel)	No documented use of materials containing hazardous constituents.
H-2b1	(1) Hole history and hole diagram from WID files. (2) Summary of initial drilling from USGS WRI 79-98. (3) Summary of hydrologic testing from SAND89-7056.	air, air foam, mud gel	ready-mix cement, mud flush, thix set cement (w/ gilsonite, flocele, and $CaCl_2$), class C cement/poz mix (w/ salt and gel)	No documented use of materials containing hazardous constituents.
H-2b2	(1) Summary of well installation and well configuration diagram from SAND85-7206.	saturated brine, attapulgite, caustic soda	cement	No documented use of materials containing hazardous constituents.
H-2c	(1) Hole history and hole diagram from WID files. (2) Summary of initial drilling from USGS WRI 79-98.	air, air mist, air foam, attapulgite e-starch mud, caustic soda, clay, saturated brine, drilling starch foam, mud gel	ready-mix cement, mud flush, thix set class C cement (w/ gilsonite and flocele), 50:50 poz mix/class C cement (w/ salt and gel), I-131 used as a tracer	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, and/or hole histories/chronologies.

Definitions

air foam:	air/water mist with added foaming agent (phosphate salts, anionic surfactants)
air mist:	air/water mist (possibly with a small amount of added foaming agent)
attapulgite:	brine-based bentonite or clay gel
bentonite:	colloidal clay
caustic soda:	sodium hydroxide
cement	commercially available cement mixture (calcium aluminates, silicates)
gilsonite:	natural asphalt
flocele:	cellophane-based mud thickener to improve circulation
gel:	bentonite gel
mud gel:	mud-based bentonite or clay gel
saturated brine:	brine containing 10 lbs/gal of NaCl or KCl
I-131:	Iodine-131 (tracer chemical)

2.2 H-3 Mudpit (SWMU 001c)

Four wells are located on the H-3 well pad. The first well, H-3 (later renamed H-3b1), was drilled in 1976 by PDC for the USGS and SNL as part of the initial WIPP hydrogeologic characterization. The H-3b1 borehole was drilled to a total depth of 894 feet to characterize the Rustler-Salado contact and the Culebra and Magenta members of the Rustler formation. The drilling of H-3b1 is summarized in the *Interim Data Report on the Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Southeast New Mexico (USGS WRI 79-98)*. The applicable sections of this report are included in Appendix A.

The H-3b2 and H-3b3 wells were drilled in 1983 to total depths of 725 feet and 730 feet, respectively, to expand the geological database for the WIPP site and provide additional sites for hydrologic testing of the Culebra member of the Rustler formation. The drilling of H-3b2 and H-3b3, performed by PDC, is summarized in *WIPP Hydrology Program, Hydrologic Data Report #1 (SAND85-7206)*. Applicable sections of this report that discuss the drilling processes and materials are included in Appendix A.

The fourth borehole at the H-3 complex, H-3d, was completed in 1987 to monitor and test transmissivity in the upper Forty-niner Member of the Rustler Formation and the Dewey Lake Formation. Additionally, H-3b1 was recompleted at this time as a Magenta Member well for water-level monitoring and water quality sampling. The drilling and conversion of these wells, performed by PDC, are documented in the sections of *WIPP Hydrology Program, Hydrologic Data Report #8 (SAND89-7056)* included in Appendix A.

Table 2 summarizes the materials used during drilling activities at the H-3 complex, as documented by the information in Appendix A. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 2, the principal drilling materials used at the H-3 wells were air, air foam, saturated brine, and clay- and brine-based muds and mud gels. The wells were completed using standard commercial cement mixtures. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at the H-3 complex. The documentation in Appendix A supports DOE's request for a No Further Action determination at SWMU 001c.

Table 2: Summary of Compiled Documentation and Drilling Materials for SWMU 001c

Bore-hole Name	Compiled Documentation (see Appendix A)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-3b1	(1) Summary of drilling from USGS WRI 79-98. (2) Summary of hydrologic testing from SAND89-7056.	air, air foam, brine mud	cement, I-131 used as a tracer	No documented use of materials containing hazardous constituents.
H-3b2	(1) Summary of drilling from SAND85-7206.	saturated brine, attapulgite and caustic soda	cement	No documented use of materials containing hazardous constituents.
H-3b3	(1) Summary of drilling from SAND85-7206.	saturated brine, attapulgite and caustic soda	cement	No documented use of materials containing hazardous constituents.
H-3d	(1) Summary of drilling and hydrologic testing from SAND89-7056	saturated brine	cement	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, and/or hole histories/chronologies.

Definitions

air foam: air/water mist with added foaming agent (phosphate salts, anionic surfactants)
attapulgite: brine-based bentonite or clay gel
bentonite: colloidal clay
caustic soda: sodium hydroxide
cement: commercially available cement mixture (calcium aluminates, silicates)
saturated brine: brine containing 10 lbs/gal of NaCl or KCl
I-131: Iodine-131 (tracer chemical)

2.3 H-5/P-21 Mudpit (SWMU 001d)

Three wells and one borehole are located on the H-5/P-21 well pad. Wells H-5a, H-5b, and H-5c were drilled in 1978 by PDC for the USGS and SNL as part of the initial WIPP hydrogeologic characterization. These wells were drilled to total depths of 824 feet (H-5a), 925 feet (H-5b), and 1076 feet (H-5c) to characterize the Rustler-Salado contact and the Culebra and Magenta members of the Rustler formation. The drilling of these wells is summarized in a report entitled *Results of Hydrologic Tests and Water Chemistry Analyses, Wells H-5a, H-5b, and H-5c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-19)*. The applicable sections of this report are included in Appendix B. The report states that special care was taken during the drilling of well H-5a, H-5b, and H-5c. Because these wells were used to assess water chemistry as well as hydrogeology at the WIPP site, drilling was conducted in a manner that minimized the potential for contamination.

The P-21 borehole was drilled by PDC in 1976 to assess the distribution and characteristics of potash resources in the vicinity of the proposed WIPP site. P-21 hole history data, included in Appendix B, document the drilling methods and materials used for this borehole.

Table 3 summarizes the materials used during drilling activities at the H-5/P-21 complex, as documented by the information in Appendix B. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 3, the principal drilling materials used at the site were air, air foam, saturated brine, and brine mud. The H-5 wells were completed and the P-21 borehole was plugged using standard commercial cement mixtures and additives. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at the H-5/P-21 complex. The documentation in Appendix B supports DOE's request for a No Further Action determination at SWMU 001d.

Table 3: Summary of Compiled Documentation and Drilling Materials for SWMU 001d

Bore-hole Name	Compiled Documentation (see Appendix B)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-5a	(1) Summary of drilling and hydrologic testing from USGS WRI 82-19.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
H-5b	(1) Summary of drilling and hydrologic testing from USGS WRI 82-19.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
H-5c	(1) Summary of drilling and hydrologic testing from USGS WRI 82-19.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
P-21	(1) Hole history data.	air foam, brine mud	mud flush, class C cement, 50% poz mix "A" (w/ gel and salt)	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, and/or hole histories/chronologies.

Definitions

air foam: air/water mist with added foaming agent (phosphate salts, anionic surfactants)
bentonite: colloidal clay
cement: commercially available cement mixture (calcium aluminates, silicates)
gel: bentonite gel
mud flush: wash used to clean borehole before cementing (no specific mixture defined)
saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.4 H-6/P-13 Mudpit (SWMU 001e)

Three wells and one borehole are located on the H-6/P-13 well pad. Wells H-6a, H-6b, and H-6c were drilled in 1978 by PDC for the USGS and SNL as part of the initial WIPP hydrogeologic characterization. These wells were drilled to total depths of 525 feet (H-6a), 640 feet (H-6b), and 741 feet (H-6c) to characterize the Rustler-Salado contact zone and the Culebra and Magenta members of the Rustler formation. The drilling of these wells is summarized in a report entitled *Results of Hydrologic Tests and Water Chemistry Analyses, Wells H-6a, H-6b, and H-6c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-8)*. The applicable sections of this report are included in Appendix C. The report states that special care was taken during the drilling of wells H-6a, H-6b, and H-6c. Because these wells were used to assess water chemistry as well as hydrogeology at the WIPP site, drilling was conducted in a manner that minimized the potential for contamination.

The P-13 borehole was drilled by PDC in 1976 to assess the distribution and characteristics of potash resources in the vicinity of the proposed WIPP site. P-13 hole history data, included in Appendix C, document the drilling methods and materials used for this borehole.

Table 4 summarizes the materials used during drilling activities at the H-6/P-13 complex, as documented by the information in Appendix C. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 4, the principal drilling materials used at the site were air, air foam, saturated brine, and brine mud. The H-6 wells were completed and the P-13 bore hole was plugged using standard commercial cement mixtures and additives. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at the H-6/P-13 complex. The documentation in Appendix C supports DOE's request for a No Further Action determination at SWMU 001e.

Table 4: Summary of Compiled Documentation and Drilling Materials for SWMU 001e

Bore-hole Name	Compiled Documentation (see Appendix C)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-6a	(1) Summary of drilling and hydrologic testing from USGS WRI 82-8.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
H-6b	(1) Summary of drilling and hydrologic testing from USGS WRI 82-8.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
H-6c	(1) Summary of drilling and hydrologic testing from USGS WRI 82-8.	air, air foam, saturated brine	cement	No documented use of materials containing hazardous constituents.
P-13	(1) Hole history data.	mud, air foam, saturated brine, brine mud	mud flush, 50:50 class C cement/poz mix "A" (w/ gel and salt)	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, and/or hole histories/chronologies.

Definitions

air foam: air/water mist with added foaming agent (phosphate salts, anionic surfactants)
attapulgite: brine-based bentonite or clay gel
bentonite: colloidal clay
cement: commercially available cement mixture (calcium aluminates, silicates)
gel: bentonite gel
mud flush: wash used to clean borehole before cementing (no specific mixture defined)
saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.5 D-123 and DSP-207 Mudpits (SWMUs 001r and 001ac)

Holes D-123 and DSP-207 were drilled on behalf of the Duval Sulphur and Potash Company (DSP) for potash exploration before the WIPP facility was established. D-123 was drilled in 1953 by Weaver Drilling Company to a total depth of 1880 feet. DSP-207 was drilled in 1958 by Joy Drilling Company to a total depth of 1613 feet. DOE obtained copies of the original Sundry Notices (i.e., "Notice of Intent to Drill" and "Subsequent Report of Abandonment" forms), as well as boring and core lithology logs, for these bore holes from the BLM office in Carlsbad. Additional drilling summary forms that document drilling activities for D-123 and DSP-207 were provided by Western Agricultural Chemicals, Inc., which acquired DSP's interest in these holes. The company files were reviewed for any other information (e.g., standard drilling procedures, regulatory requirements). As noted at the beginning of Section 2.0, DOE also checked with other state and federal agencies for information concerning these holes. However, additional records, procedures, or regulatory requirements applicable to the drilling of D-123 and DSP-207 were unavailable. Due to the age of these boreholes, DOE believes that the existence of additional information concerning the drilling of D-123 and DSP-207 is improbable.

The information compiled by DOE for the DSP bore holes is presented in Appendix D. The drilling materials used to complete D-123 and D-207, as documented in the Appendix D information, are presented in Table 5. As shown, the principal drilling materials used at the DSP holes were saturated brine and mud. The holes were plugged using standard commercial cement mixtures and drill cuttings. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used in the drilling of D-123 or DSP-207. The documentation in Appendix D supports DOE's request for a No Further Action determination at SWMUs 001r and 001ac.

Table 5: Summary of Compiled Documentation and Drilling Materials for SWMUs 001r and 001ac

Bore-hole Name	Compiled Documentation (see Appendix D)	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
D-123	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) DSP Drilling Summary. (4) Borehole and core lithology logs.[a]	saturated brine, mud	cement, cement (w/ 3% $CaCl_2$ and brine), cuttings	No documented use of materials containing hazardous constituents.
DSP-207	(1)Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) DSP Drilling Summary. (4) Borehole and core lithology logs.[a]	saturated brine, mud	cement, cement (w/ 3% $CaCl_2$ and brine), cuttings and soil	No documented use of materials containing hazardous constituents.

(a) The first pages of the borehole and lithology logs are included as sample pages in Appendix D, as these logs contain only geological information. The complete logs can be provided upon request.

Definitions

cement: commercially available cement mixture (calcium aluminates, silicates)
mud: generic reference to drilling mud (no composition specified)
saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.6 IMC-376, IMC-456, IMC-457, IMC-375, and IMC-377 Mudpits (SWMUs 001u, 001v, 001w, 001ad, and 001ae)

Potash exploration boreholes IMC-375, IMC-376, IMC-377, IMC-456, and IMC-457 were drilled by Boyles Brothers Drilling Company for the International Minerals and Chemicals Corporation (IMC). IMC-375 through -377 were drilled in 1965 to total depths of 1746 feet, 1702 feet, and 1876 feet, respectively. IMC-456 and IMC-457 were drilled in 1976 to total depths of 1975 feet and 1885 feet, respectively. DOE obtained copies of the original Sundry Notices (i.e., "Notice of Intent to Drill," "Subsequent Report of Abandonment," and "Recapitulation" forms), as well as boring and core lithology logs, for these bore holes from the BLM office in Carlsbad. For IMC-375, -376, and -377, internal IMC instructions to drillers, cementing reports, and Boyles Brothers Shift Reports (i.e., drilling logs/diaries) were provided by IMC. The company files and land leases were reviewed for other information (e.g., standard drilling procedures, regulatory requirements) applicable to drilling activities over the time periods of interest. As noted at the beginning of Section 2.0, DOE also checked with other state and federal agencies for information concerning these holes. However, additional records, procedures, or regulatory requirements applicable to the drilling of the five IMC boreholes of interest were unavailable. Due to the age of these boreholes, DOE believes that the existence of additional information concerning the drilling of these boreholes is improbable.

The information compiled by DOE for the IMC bore holes is presented in Appendix E. The drilling materials used to complete these bore holes, as documented in the Appendix E information, are presented in Table 6. As shown, the principal drilling materials used at the IMC boreholes were air and saturated brine. The boreholes were plugged using mud and standard commercial cement mixtures. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used during drilling activities. The documentation in Appendix E supports DOE's request for a No Further Action determination at SWMUs 001u, 001v, 001w, 001ad, and 001ae.

Table 6: Summary of Compiled Documentation and Drilling Materials for SWMUs 001u, 001v, 001w, 001ad, and 001ae

Bore-hole Name	Compiled Documentation (see Appendix E)	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
IMC-375	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) Recapitulation form (drilling summary). (4) Borehole and core lithology logs.[a] (5) IMC drilling instructions and cement report. (6) Driller dailies.	saturated brine, air	cement, mud	No documented use of materials containing hazardous constituents.
IMC-376	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) Recapitulation form (drilling summary). (4) Borehole and core lithology logs.[a] (5) IMC drilling instructions and cement report. (6) Driller dailies.	saturated brine, air	cement, mud	No documented use of materials containing hazardous constituents.
IMC-377	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) Recapitulation form (drilling summary). (4) Borehole and core lithology logs.[a] (5) IMC drilling instructions and cement report.	saturated brine, air	cement, mud	No documented use of materials containing hazardous constituents.
IMC-456	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) Recapitulation form (drilling summary). (4) Borehole and core lithology logs.[a]	saturated brine	cement	No documented use of materials containing hazardous constituents.
IMC-457	(1) Notice of Intention to Drill. (2) Subsequent Report of Abandonment. (3) Recapitulation form (drilling summary). (4) Borehole and core lithology logs.[a]	saturated brine	cement	No documented use of materials containing hazardous constituents.

(a) The first pages of the borehole and lithology logs are included as sample pages in Appendix E, as these logs contain only geological information. The complete logs can be provided upon request.

Definitions

cement: commercially available cement mixture(calcium aluminates, silicates)

mud: generic reference to drilling mud (no composition specified)

saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.7 WIPP-18, -19, -21, and -22 Mudpits (SWMUs 001y, 001z, 001aa, and 001ab)

Boreholes WIPP-18, -19, -21, and -22 were drilled in 1978 by PDC and Boyles Brothers Drilling company for the USGS and SNL to assist in the characterization of WIPP site geology. These holes were drilled to total depths of 1060 feet, 1038 feet, 1046 feet, and 1450 feet, respectively. The drilling of these holes is summarized in four Basic Data Reports prepared by SNL *(SAND79-0275, SAND79-0276; SAND79-0277, and SAND79-0278)*. The applicable sections of these reports are attached in Appendix F.

In 1985, WIPP-18, -19, -21, and -22 were recompleted as hydrologic monitoring wells for the Culebra dolomite. Recompletion activities are described in *WIPP Hydrology Program, Hydrologic Data Report #4 (SAND86-7166)*. Sections of this report describing well recompletion, well development, hydraulic testing, and water quality monitoring are included in Appendix F.

Table 7 summarizes the materials used during the drilling and recompletion activities at WIPP-18, -19, -21, and -22, as documented by the information in Appendix F. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 7, the principal drilling materials used at these sites were saturated brine and brine mud. These boreholes were originally plugged using brine mud and then recompleted as wells using standard commercial cement mixtures. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at these well sites. The documentation in Appendix F supports DOE's request for a No Further Action determination at SWMUs 001y, 001z, 001aa, and 001ab.

Table 7: Summary of Compiled Documentation and Drilling Materials for SWMUs 001y, 001z, 001aa, and 001ab

Bore-hole Name	Compiled Documentation (see Appendix F)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
WIPP-18	(1) Summary of drilling and geologic logging from SAND79-0275. (2) Summary of well development and hydrologic testing from SAND86-7166.	brine mud (w/ starch, other additives), saturated brine	brine mud, cement	No documented use of materials containing hazardous constituents.
WIPP-19	(1) Summary of drilling and geologic logging from SAND79-0276. (2) Summary of well development and hydrologic testing from SAND86-7166.	brine mud, saturated brine	brine mud, cement	No documented use of materials containing hazardous constituents.
WIPP-21	(1) Summary of drilling and geologic logging from SAND79-0277. (2) Summary of well development and hydrologic testing from SAND86-7166.	brine mud, saturated brine	brine mud, cement	No documented use of materials containing hazardous constituents.
WIPP-22	(1) Summary of drilling and geologic logging from SAND79-0278. (2) Summary of well development and hydrologic testing from SAND86-7166.	brine mud (w/ starch, drispac, and other additives), saturated brine	brine mud, cement	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, and/or hole histories/chronologies.

Definitions

attapulgite: brine-based bentonite or clay gel
bentonite: colloidal clay
cement: commercially available cement mixture (calcium aluminates, silicates)
gel: bentonite gel
drispac: non-toxic, cellulosic polyanionic polymer
saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.8 H-16 Mudpit (SWMU 001af)

Borehole H-16 was drilled in 1987 by PDC for SNL for hydrologic testing purposes, and was drilled to a total depth of 851 feet. Drilling and well completion activities are summarized in the SNL report entitled *Basic Data Report for Drill Hole H-16 (SAND89-0203)*. Hole history and completion records, drilling permits, and other applicable records documenting drilling activities are attached in Appendix G.

Table 8 summarizes the materials used during the drilling and recompletion activities at H-16, as documented by the information in Appendix G. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 8, the principal drilling material used at H-16 was saturated brine. After flushing with a biodegradable chemical wash, H-16 was completed using standard commercial cement mixtures. Therefore, the information compiled and reviewed by DOE includes no evidence that hazardous materials or materials containing hazardous constituents were used at this well. The documentation in Appendix G supports DOE's request for a No Further Action determination at SWMU 001af.

Table 8: Summary of Compiled Documentation and Drilling Materials for SWMU 001af

Bore-hole Name	Compiled Documentation (see Appendix G)	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-16	Hole history data, well completion information, drilling permits, miscellaneous drilling, logging, and cementing records from SAND89-0203.	saturated brine	CW-7 wash, RFC class A thixotropic cement, 70-30 Poz mix cement, ready-mix cement	No documented use of materials containing hazardous constituents.

Definitions

CW-7 wash: a biodegradable soap used for rinsing the borehole before cementing (includes anionic surfactants, alcohol glycol ether, siloxanes/silicones).

saturated brine: brine containing 10 lbs/gal of NaCl or KCl

2.9 H-19 Mudpit (SWMU 001ah)

The H-19 well pad area was constructed in 1995 for a tracer test program conducted by SNL to support performance assessment studies at WIPP. The H-19 project consists of several boreholes set on a large hydropad. Tracer chemicals were injected into the H-19b borehole while adjacent boreholes were being pumped. The transportation of tracer chemicals in the Culebra Formation was monitored to determine the transmissivity within this water bearing zone.

During the National Environmental Policy Act (NEPA) review of the tracer test program, the DOE submitted several lists of proposed drilling additives and tracer chemicals to the NMED Ground Water Protection and Remediation Bureau (GWPRB) to determine if a discharge permit would be required for the SNL tracer testing program. The GWPRB approved the submitted list of tracer chemicals and determined that a discharge plan would not be required for the drilling additives and tracer chemicals utilized during the SNL tracer test program. Listings and supporting documentation for the tracer chemicals and drilling additives used at the H-19 hydropad were provided in *the Final SWMU Assessment Report (DOE/WIPP 97-2220)* and *Data Summary Report No. 4 (DOE/WIPP, 1996)*. The drilling additives used at H-19 are summarized in Table 9. Additional supporting MSDS information for these materials is included in Appendix J.

Because the DOE was actively involved with evaluating the potential impacts of drilling activities during the Voluntary RA/CA program, drilling and tracer test circulation waters were collected in a synthetically-lined evaporation pond. Additionally, all drill cuttings were collected in lined mudpits. Once drill cuttings were completely dried, the mudpit contents were sampled for analysis according to the toxicity characteristic leaching procedure (TCLP). After the TCLP data demonstrated that the mudpit contents were non-hazardous, the mudpits were excavated and disposed of at an off-site disposal facility. Thus, due to the level of regulatory review during the H-19 tracer test program, the implementation of management plans, and the sampling and removal of the mudpit constituents, the DOE believes that a "No Further Action" determination is appropriate for the H-19 hydropad. The TCLP analytical results for the H-19 mudpit sampling and correspondence which documents the excavation and removal of the mudpits are attached as Appendix H.

Table 9: Summary of Compiled Documentation and Drilling Materials for SWMU 001ah

Bore-hole Name	Compiled Documentation[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
H-19b0	Work plans. Material Safety Data Sheets. Correspondence with NMED.	air, air mist, EZ MUD, saturated brine, attapulgite, detergent, defoamer	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b1	Work plans. Material Safety Data Sheets. Correspondence with NMED.	air, air mist, EZ MUD, saturated brine, attapulgite, detergent, defoamer	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b2	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b3	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine, attapulgite, chemical flush	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b4	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine, attapulgite, chemical flush	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b5	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b6	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine, attapulgite	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.
H-19b7	Work plans. Material Safety Data Sheets. Correspondence with NMED.	saturated brine, attapulgite, mud, air	70:30 poz mix (w/ salt and bentonite)/ class C cement (w/ $CaCl_2$); miscellaneous tracers [b]	Hazardous constituents precluded by sampling data and excavation/removal of mudpit contents.

(a) See *Final SWMU Assessment Report (DOE/WIPP 97-2220)* and *Data Summary Report No. 4 (DOE/WIPP, 1996)*.

(b) See *Final SWMU Assessment Report* for list of tracers used. These materials were used only in trace quantities, and no discharge plan was required by NMED for the H-19 tracer test programs.

Definitions

air foam:	air/water mist with added foaming agent (phosphate salts, anionic surfactants)
attapulgite:	brine-based bentonite or clay gel
bentonite:	colloidal clay
cement:	commercially available cement mixture (calcium aluminates, silicates)
chemical flush:	wash used to clean borehole before cementing (no specific mixture defined)
defoamer:	non-hazardous, proprietary, silicon-based blend
detergent:	generic reference to surfactant materials (no composition specified)
EZ MUD:	polyacrylamide/polyacrylate based mud
gel:	bentonite gel
mud:	generic reference to drilling mud (no composition specified)
saturated brine:	brine containing 10 lbs/gal of NaCl or KCl

2.10 WQSP Well Mudpits (SWMUs 001ai, 001aj, 001ak, 001al, 001am, and 001an)

The Water Quality Sampling Program (WQSP) wells were drilled by West Texas Water Well Service for DOE in 1994 for sampling of the principal water bearing zones in the vicinity of the WIPP site. As discussed in the *Final SWMU Assessment Report (DOE/WIPP 97-2220)*, the WQSP wells were not intended to function as RCRA monitoring wells; however, each of these wells was designed and constructed to meet RCRA monitoring well criteria. Special consideration was placed on the selection of drilling additives and the use of inert casing and pump materials to assure that water quality was not affected by drilling operations. The WQSP wells were intended to provide representative, reproducible, and defensible water quality data that were free of well construction bias.

WQSP-1, -2, -3, -4, -5, and -6/6a were drilled to total depths of 737 feet, 846 feet, 879 feet, 800 feet, 681 feet, 617 feet, and 225 feet, respectively. Wells WQSP -1 through -6 were completed in the Culebra formation, whereas well WQSP-6a was completed in the Dewey Lake formation. Drilling and well completion activities were summarized in the *Basic Data Report for WQSP-1, WQSP-2, WQSP-3, WQSP-4, WQSP-5, WQSP-6, and WQSP-6a (DOE/WIPP 95-2154)*. Applicable sections of this report are attached as Appendix I.

Table 10 summarizes the materials used during the drilling and recompletion activities at the WQSP well sites, as documented by *DOE/WIPP 95-2154*. Additional supporting MSDS information for these materials is included in Appendix J. As shown in Table 10, the principal drilling materials used at the WQSP wells were air, air foam, saturated brine, and clay- and brine-based mud gels (e.g., attapulgite). The wells were completed using Portland cement and bentonite clay. Therefore, this information provides no evidence that hazardous materials or materials containing hazardous constituents were used at these well sites. The documentation in Appendix I supports DOE's request for a No Further Action determination at SWMUs 001ai, 001aj, 001ak, 001al, 001am, and 001an.

Table 10: Summary of Compiled Documentation and Drilling Materials for SWMUs 001ai, 001aj, 001ak, 001al, 001am, and 001an

Bore-hole Name	Compiled Documentation (see Appendix I)[a]	Drilling Media	Plugging/Cementing Media and Miscellaneous Materials	Conclusions
WQSP-1	Drilling program summary and hole history data from DOE/WIPP 95-2154. 9/3 - 9/6	air, air foam	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-2	Drilling program summary and hole history data from DOE/WIPP 95-2154. 9/6 - 9/10	air, air foam, saturated brine, attapulgite, mud	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-3	Drilling program summary and hole history data from DOE/WIPP 95-2154. 10/20 - 10/26	air, air foam, foaming agents, bleach[b]	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-4	Drilling program summary and hole history data from DOE/WIPP 95-2154. 10/5 - 10/7	air, air foam	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-5	Drilling program summary and hole history data from DOE/WIPP 95-2154. 10/2 - 10/3	air, air foam, bleach[b]	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-6	Drilling program summary and hole history data from DOE/WIPP 95-2154. 9/22 - 9/[illegible]	air, air foam, saturated brine, attapulgite	Portland cement, bentonite	No documented use of materials containing hazardous constituents.
WQSP-6a	Drilling program summary and hole history data from DOE/WIPP 95-2154. 10/28 - [illegible]	air, air foam, saturated brine, attapulgite	Portland cement, bentonite	No documented use of materials containing hazardous constituents.

(a) Compiled summary information includes summary reports of drilling activities, hole completion diagrams, core logs, and/or hole histories/chronologies.

(b) Small quantities of bleach were used (< 5 gallons).

Definitions

air foam: air/water mist with added foaming agent (phosphate salts, anionic surfactants)
attapulgite: brine-based bentonite or clay gel
bentonite: colloidal clay
cement: commercially available cement mixture (calcium aluminates, silicates)
foaming agents: unspecified surfactant
gel: bentonite gel
saturated brine: brine containing 10 lbs/gal of NaCl or KCl

3.0 ANALYTICAL RESULTS FOR SWMU 007b, EVAPORATION POND

As discussed in the *Final SWMU Assessment Report (DOE/WIPP 95-2220)*, soil sample splits were collected by NMED and DOE during the RFA at the former Evaporation Pond, SWMU 007b. This sampling event was conducted on October 7, 1992, in accordance with the NMED/WIPP Soil Sampling and Analysis Plan (SAP). In response to the request in NMED's letter dated April 11, 1997, a complete copy of the this SAP is attached to this addendum as Appendix J. The analytical results reported by both NMED and DOE for the SWMU 007b split sample, denoted as the "Facility West" sample location, are also included in Appendix J. For comparison purposes, Appendix J includes results for the "background" soil sample collected during the RFA sampling event. This background sample was collected from a dune blow out approximately one-quarter mile due west of the WIPP facility.

A summary of the data included in Appendix ~~J~~ K is presented in Table 11. The background concentration data presented in the table represent the analytical results for the dune blow out sampling location. Only one background sample was collected at a depth of 2.5 to 3 feet, and this sample was analyzed only by DOE; no NMED split results were reported. The results for this sample are presented for comparison to both the shallow and deep samples collected within the SWMU. Both the DOE sample results and the NMED split results are presented for the shallow sample collected at SWMU 007b. No NMED split sample results were reported for the deep sample.

For each sample depth, Table 11 presents the total concentration measured within the SWMU for each metal, and compares this value to the background concentration measured near the SWMU and to the applicable Subpart S action level. The data presented in Table 11 demonstrate that total metals concentrations measured in SWMU 007b are generally consistent with background concentrations presented in Table 11, as well as the statistically-based background concentrations from the WIPP Voluntary RA/CA program as described in Section 4.0. Detected concentrations are well below the applicable proposed Subpart S action levels.

Table 11: Comparison of Total Metals Results to Action Levels SWMU 007b, Evaporation Pond

Metal Analyte	Background Concentration (mg/kg) (1)(2)(7)	DOE SWMU Concentration (mg/kg) (1)(3)(7)	NMED SWMU Concentration (mg/kg) (1)(6)(7)	Subpart S Level (mg/kg) (4)
1.2 feet bgs				
Total Barium (Ba)	11	44	51	6000
Total Cadmium (Cd)	0.5 U	0.5 U	5 U	80
Total Chromium (Cr)	3	8	10	400
Total Lead (Pb)	5 U	6	No Data	400 (5)
Total Nickel (Ni)	2 U	5	7	2000
Total Silver (Ag)	1 U	1 U	5 U	400
Total Arsenic (As)	10 U	10 U	1.6	80
3.6 feet bgs				
Total Barium (Ba)	11	32	No Data	6000
Total Cadmium (Cd)	0.5 U	0.5 U	No Data	80
Total Chromium (Cr)	3	7	No Data	400
Total Lead (Pb)	5 U	6	No Data	400 (5)
Total Nickel (Ni)	2 U	4	No Data	2000
Total Silver (Ag)	1 U	1 U	No Data	400
Total Arsenic (As)	10 U	10 U	No Data	80

mg/kg Milligrams per kilogram
bgs Below ground surface

1) Results are presented in mg/kg, wet weight.
2) Background soil concentration from sample collected west of facility; 2.5 to 3 feet bgs.
3) Maximum concentration measured in shallow and deep soil samples collected from within SWMU 007b, Evaporation Pond.
4) Action levels taken from Appendix D of proposed 40 CFR 264.521(d), FR Vol. 55, No. 145.
5) No action levels are included in Subpart S for lead. The provided action level of 400 mg/kg is the residential soil cleanup level recommended by the EPA Office of Solid Waste (EPA, 1994).
6) NMED analytical results for split sample (shallow sample)
7) The following data qualifiers are used as defined in the USEPA National Functional Guidelines for Organic and Inorganic Data Review (EPA, 1994):
   - J Result should be considered an estimated value
   - U Analyte was not detected; value is the method reporting limit
   - UJ Analyte was not detected; however the reporting limit presented should be considered an estimated value

4.0 STATISTICAL EVALUATION OF BACKGROUND METALS DATA

As part of the WIPP Voluntary RA/CA field sampling, soil samples were collected from mudpits and analyzed for total metals constituents. In addition, background (or upgradient) samples were collected in the vicinity of the mudpits. Because some of the target metals for the sampling occur naturally in soils, including the WIPP Land Withdrawal Area, it is necessary to distinguish between concentrations that represent the potential for releases of metals constituents and background constituents of the target metals. This section of the report presents the statistical methods used to evaluate background concentrations of target metals, results of the analyses, and appropriate total metals background concentrations for the WIPP Voluntary RA/CA sampling.

Two populations of sample results were examined. The first population consisted of analytical results for background samples collected 12 to 24 inches below ground surface (i.e., shallow samples). The second population consisted of analytical results for background samples collected more than 24 inches below ground surface (i.e., deep samples).

The general logic and statistical methods used in this analysis are consistent with the EPA guidance documents "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities - Interim Final Guidance (EPA, 1989) and "Addendum to the Interim Final Guidance" (EPA, 1992). Specific descriptions of the statistical methods and techniques can be found in these two documents. This guidance was developed for data analysis for ground-water sampling results; however, the statistical methods defined in the guidance are well-defined and are directly applicable to the background metals analysis results obtained as part of the WIPP Voluntary RA/CA. The methods have been employed in numerous previous studies at other facilities and are recommended by EPA for both water and soil sampling programs.

4.1 Tolerance Intervals

For detection monitoring programs, compliance point samples are assumed to come from the same population as background samples, until significant evidence of contamination can be shown. To test this hypothesis, a 95 percent coverage tolerance interval can be constructed for the background data. Once the interval is constructed, results for compliance samples can be compared to the upper tolerance limit (UTL). The procedure for constructing the tolerance interval must consider the number of detected and non-detected sample results, and the distribution of the background results (e.g., normal or lognormal).

4.1.1 Non-parametric Tolerance Interval

When the number of non-detected values in a population exceeds 50 percent, or the data are not normally or lognormally distributed, it is not possible to explicitly calculate a UTL. EPA guidance recommends selecting the highest measured value as the UTL. The highest value is referred to as the non-parametric upper tolerance limit (NPUTL). For situations where no detected data exist it is not possible to construct either a UTL or NPUTL. For these situations, the laboratory reporting limit allows only qualitative evaluations to be made for the data.

Appendix L contains a summary of the background total metals concentration results obtained during the WIPP Voluntary RA/CA. A separate table is included for shallow and deep samples. As indicated in Table 12, a NPUTL was defined for cadmium and mercury in both the deep and shallow samples. A NPUTL was defined for thallium in the shallow samples. No limit could be established for nickel, selenium or silver because only one sample was analyzed for these metals and the results were non-detected for the three metals. Similarly for thallium results in the deep samples, no detected values exist and therefore no limit can be established. For these data sets, the laboratory reporting limit serves as an initial estimate of background concentrations.

4.1.2 Tests for Normality

For small data sets, EPA recommends that distributional testing be performed on the natural logarithms of the data to test for a lognormal distribution. If the data are lognormally distributed, tests for normality can be performed with the logged data. If the data are not lognormally distributed, the tests can be performed on the original data to test for normality. If the data are neither lognormally or normally distributed a non-parametric technique should be used.

For the remaining metals, the data sets were evaluated with the Shapiro-Wilk test (see Section 1.1.4 of EPA 1992). This test is recommended for data sets with less than 50 observations to test the premise that data are normally distributed. The Shapiro-Wilk test statistic (W) was calculated for the data sets to test for both lognormal and normal distributions. For these data, if the computed W value is less than the critical 5 percent value for a sample size of 14 (i.e., W = 0.874), the data show significant evidence of non-normality. One-half the laboratory reporting limit was substituted for non-detected values for these data sets.

The Shapiro-Wilk test results indicate that the arsenic and the lead data sets are lognormally (and normally) distributed for the shallow samples. The shallow chromium data are neither lognormally nor normally distributed. The NPUTL was selected for the shallow chromium data. For the deep sample results,

Table 12: Background Concentration Summary

Compound	Shallow Samples		Deep Samples		Published Concentration, (ppm) Carlsbad
	Background Concentration, ppm	Derivation	Background Concentration, ppm	Derivation	
Arsenic	3.3	UTL (ln)	3.3	UTL (ln)	6.5
Barium	120	NPUTL	91	UTL (ln)	500
Cadmium	0.7	NPUTL	1.8	NPUTL	No Data
Chromium	26	NPUTL	8.2	UTL	50
Lead	3.2	UTL (ln)	7.1	UTL (ln)	<10
Mercury	0.06	NPUTL	0.04	NPUTL	0.051
Thallium	30	NPUTL	20	LRL	No Data
Nickel	2	LRL	2	LRL	20
Selenium	0.4	LRL	0.4	LRL	0.2
Silver	1	LRL	1	LRL	No Data

UTL - upper tolerance limit
UTL (ln) - upper tolerance limit for natural logarithms of data (the concentration has been calculated from the logarithmic UTL value).
NPUTL - non-parametric upper tolerance limit
LRL - laboratory reporting limit
ppm - parts per million

arsenic, barium, and lead results are lognormally distributed, and the chromium data are normally distributed.

For the data sets that were lognormally distributed, the 95 percent UTL was calculated using the natural logarithms of the data and the method defined in Section 6.2.2 of EPA guidance document (EPA, 1989). For these data sets, the antilog of the calculated UTLs is reported in Table 12. For the deep chromium data set that was normally distributed (and not lognormally distributed), the 95 percent UTL was calculated directly, and is included in Table 12.

4.1.3 Outlier Testing

Potential outliers in the data sets were evaluated using the methodology defined in Section 8.2 of the EPA guidance (EPA, 1989). The outlier test assumes that the data set is normally distributed. EPA recommends that the outlier test be performed on the natural logarithms of the data instead of the original observations. The test evaluates only the highest value in a data set. Data that are lognormally distributed can be tested using the logarithms of the values. If the data are normally distributed and not lognormally distributed, the test can be performed on the original observations. The test is not applicable unless one of these criteria is met. The critical test statistic (T_n) for 14 samples and the upper 5 percent significance level is 2.371. If the calculated value is above the critical value, the value is considered to be a potential outlier.

The outlier test was used for the shallow sample arsenic and lead data sets and for the arsenic, barium, chromium, and lead in the deep sample data sets. The test was performed on the reported deep sample data values for chromium. For the other data sets, the test was performed on the natural logarithms of the data. No potential outliers were identified in these data sets.

4.2 Published Background Data

As a point of comparison to the background values calculated above, published geometric mean metal background concentrations were obtained from "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States" (USGS Professional Paper 1270, 1984). These data are included in Table 12. The UTL and NPUTL values defined for the WIPP background samples are similar to or lower than the values obtained from the reference.

4.3 Summary

Based on an analysis of background total metals data for shallow and deep samples collected in the vicinity of the WIPP SWMUs, statistically-derived background concentrations have been defined for the majority of the total metals analysis results. For a few of the metal data sets, no statistical analysis was

possible because no detected concentrations were obtained. For these metals, the laboratory reporting limit serves as an initial estimate of background.

The background concentration calculated for the deep and shallow sample data sets agree well and compare favorably to other reported metals concentrations for the site vicinity. Final recommendations for metal background concentrations are presented in Table 12.

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WP 02-EM2. WIPP Site Effluent and Hazardous Materials Sampling Plan, Westinghouse Electric Corporation, Waste Isolation Division, Carlsbad, NM.

Appendix A

Compiled Information for SWMUs 001b and 001c (H-2 and H-3)

Hole History Data for Boreholes H-2a, H-2b1, and H-2c (12 pages total).

Interim Data Report on the Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Southeast New Mexico (USGS WRI 79-98), pages through 36-71.

WIPP Hydrology Program, Waste Isolation Pilot Plant, SENM, Hydrologic Data Report #1 (SAND85-7206), Section A, pages 4 through 12.

WIPP Hydrology Program, Waste Isolation Pilot Plant, Southeastern New Mexico, Hydrologic Data Report #8 (SAND89-7056), Part D, Sections 3.0 through 5.0, pages D-8 through D-20.

Hole History Data for Boreholes H-2a, H-2b1, and H-2c (12 pages total).

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 5-16-77 APPROVED:

DLE No.:	ERDA H 2 A	W. O. No.:		I. D. No.:	
USER:	Sandia Lab	TYPE HOLE:	Hydrologic		
LOCATION:	New Mexico	COUNTY:	Eddy	AREA:	Los Medanos
SURFACE COORDINATES:	720' FNL, 3584' FEL, Sec. 29, T22S, R31E **			GROUND ELEVATION:	3377.3'
RIG ON LOCATION:		SPUDDED:	2-14-77	COMPLETED:	2-21-77
CIRCULATING MEDIA:	Air to 188', air foam to 513'				
No. of COMPRESSORS & SIZE:					

BORE HOLE RECORD			CASING RECORD								
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CM
0'	4'	Excav.		(6' x 6'	cellar)			0'	4'	Dirt
4'	33'	18"	10-3/4" (O.D.)			Used		4'	33'	54
33'	513'	8-3/4"	5.921"	24#		J-55		0'	511'	260
513'	563'	4-3/4"								

TOTAL DEPTH: 563' MANDREL DEPTH PLUGS:

JUNK:

LOGGING DATA: Caliper SURVEYS PAGE: CORING PAGE:

BOTTOM HOLE COORDINATES: REFERENCE:

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Move Rig up & down	____ days	Equipment Repair	0.04 days	Drilling Time	1.83 da
Secured w/o Crew	2.33 days	Caving	____ days	Trip Time	0.31 da
*	0.31 days	Lost Circ.	____ days	Single Shot Survey Time	____ da
Logging	0.10 days	Fishing	____ days		____ da
Hydrologic Tests	0.05 days	W.O. Equipment & Supplies	0.21 days	Total	2.13 da
Casing	0.32 days	Work Stuck Drill Pipe	0.13 days	Total Suspended Time	____ day
Cement	0.22 days		____ days	Non-Operational Time	4.03 day
Coring	0.57 days		____ days	Operational Delay Time	0.38 day
Drill Out Cmt. & Shoe	0.13 days		____ days	Working Time	2.13 day
TOTAL	4.03 days	TOTAL	0.38 days	TOTAL ELAPSED TIME	6.54 day

REMARKS: Time Breakdown thru 2-21-77

* Nipple Up 0.13 days

Lay Down Drill Pipe 0.18 days

Rig No.	Name	Type	
1	Penn. Drlg. Co.	Failing 2000	6.54 day
			____ day
			____ day
			____ day
			____ day
			____ day

** Hole drilled on a 60' triangle with H 2 B and H 2 C.

ERDA H 2 A
HOLE HISTORY

Excavated a 6' x 6' x 4' deep cellar and lined with 3" x 12" boards.

1-24-77 Moved in Link Rat Hole, Inc., auger and drilled 18" hole from 4' to 33'. Ran 10-3/4" O.D. used casing to 33'.

1-25-77 Cemented annulus with 54 ft^3 of ready mix cement.

1-27-77 Welded on a 10-3/4" x 6-5/8" casing head.

2-14-77 Moved in Pennsylvania Drilling Company rig #1 and rigged up. Drilled out cement from 31' to 33' and 8-3/4" hole from 33' to 57' using air.

2-15-77 Drilled 8-3/4" hole from 57' to 188'. Hole started making water at 185'. Pulled out of hole and ran bailer to obtain a water sample. Ran bit back in the hole and drilled 8-3/4" hole from 188' to 234'. Mist drilled using air foam.

2-16-77 Drilled 8-3/4" hole from 234' to 511'. Blew hole with air. Pumped in 80 barrels of mud, no returns.

2-17-77 Laid down drill pipe. Ran USGS caliper log. Ran 13 joints (525.40') of 6-5/8" O.D., 24#, J-55 casing in the hole with a Halliburton guide shoe on bottom and a float collar at 468'. Landed casing at 511'. Centralizers were placed at 469', 350' and 270'. Rigged up Halliburton and circulated casing with 75 barrels of mud. Cemented annulus with 1000 gallons of mud flush ahead of 50 sacks Thix-Set cement with 10# per sack of gilsonite, 1/4# per sack of Flocele and 2% calcium chloride followed by 125 sacks of 50% Class "C" cement, 50% Pozmix with 19.4# per sack of salt and 2% gel. Total slurry volume was 260 ft^3. Circulated 80 sacks of cement to surface. Sealed displacement plug with 1000 psi, plug holding. Cement in place at 1508 hours. Secured rig at 1600 hours waiting on cement.

2-18-77 Rig secured to 1600 hours. Set 6-5/8" O.D. casing on slips in the casing head with 15,000# tension. Cut off casing and set in rotating head. Made up 5-3/4" drilling assembly and ran in hole. Secured with crew at 2100 hours waiting on cement.

2-19-77 Secured to 0 hours. Drilled out cement and float equipment. Pulled out of hole. Made up 4-3/4" x 2-1/4" core bit and coring assembly. Measured in hole and corrected depth to 513'. Cut core #1 from 513' to 563', recovered 50'. Made 3 runs with a 3-1/2" x 30' bailer, hole dry. Laid down drilling assembly.

2-20-77 Rig secured.

2-21-77 Rig secured to 0800 hours. Rigged down. Hole completed 2-21-77.

ERDA H 2 A

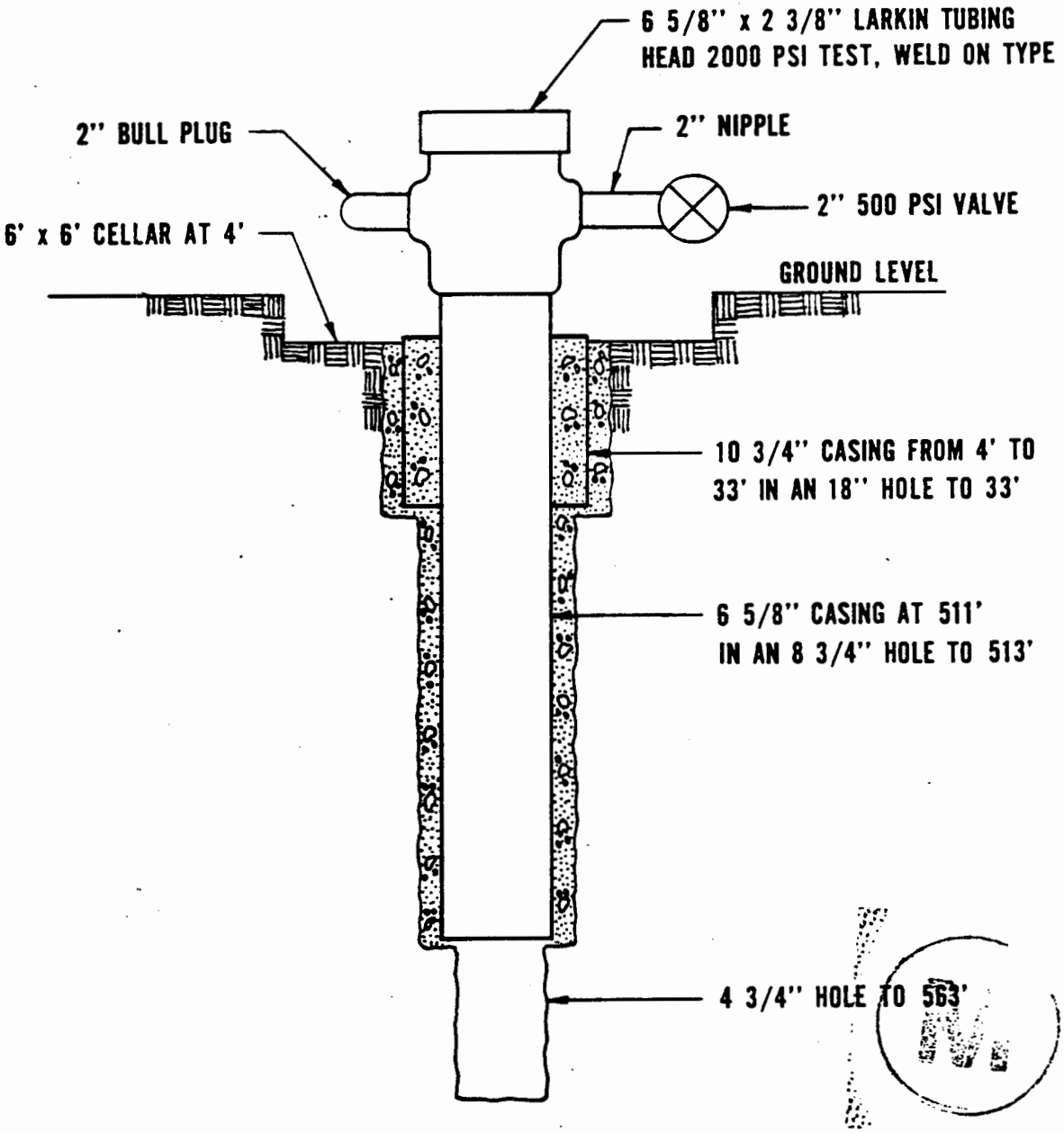
ADDITIONAL WORK

2-22-77 Moved in Pennsylvania Drilling Company rig #2 and rigged up to bail. Ran 3½" x 30' bailer in the hole and found oil in the hole due to a retainer oil seal failure. Washed hole with 50 gallons of water and 4 gallons of soap. Recovered 40 gallons of water. Moved out rig.

2-24-77 Cut off the 10-3/4" casing head and installed 6-5/8" x 2-3/4" tubing hanger on the 7-5/8" O.D. casing.
6 5/8

H 2 A

AS BUILT HOLE CONDITIONS
AS OF 2/21/77



NOT TO SCALE

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 5-19-77 APPROVED:

HOLE No.:	ERDA H 2 B	W.O. No.:		I.D. No.:	
USER:	Sandia Lab	TYPE HOLE:	Hydrologic		
LOCATION:	New Mexico	COUNTY:	Eddy	AREA:	Los Medanos
SURFACE COORDINATES:	720' FNL, 3584' FEL, Sec. 29, T 22S, R31E*			GROUND ELEVATION:	
RIG ON LOCATION:		SPUDDED:	2-7-77	COMPLETED:	2-14-77
CIRCULATING MEDIA:	Air to 185', air foam to 661'.				
No. of COMPRESSORS & SIZE:					

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CMT
0'	4'	Excav.		(6' x 6' cellar)				0'	4'	Dirt
4'	33'	18"	10-3/4" (O.D.)			Used		4'	33'	54
33'	611'	8-3/4"	5.921"	24"		J-55		0'	609'	282
611'	661'	4-3/4"								

TOTAL DEPTH: 661' MANDREL DEPTH PLUGS:

JUNK:

LOGGING DATA: SURVEYS PAGE: CORING PAGE:

BOTTOM HOLE COORDINATES: @ REFERENCE:

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Nipple Up	0.33 days	Equipment Repair	____ days	Drilling Time	1.79 days
Secured w/o Crew	2.33 days	Caving	____ days	Trip Time	0.08 days
Lay Down Drill Pipe	0.13 days	Lost Circ.	____ days	Single Shot Survey Time	0.04 days
Logging	____ days	Fishing	____ days		____ days
Hydrologic Tests	0.33 days	W.O. Equipment	____ days	Total	1.19 days
Casing	0.44 days	Work Stuck Drill Pipe	0.33 days	Total Suspended Time	____ days
Cement	0.17 days		____ days	Non-Operational Time	4.73 days
Coring	0.72 days		____ days	Operational Delay Time	0.33 days
Drill Out Shoe	0.28 days		____ days	Working Time	1.91 days
TOTAL	4.73 days	TOTAL	0.33 days	TOTAL ELAPSED TIME	6.97 days

REMARKS: Time breakdown thru 2-14-77. Perforated 6-5/8" O.D. casing from 510' to 538' with 3 holes per foot (4-6-77).

* Hole drilled on a 60' triangle with H2A and H2C.

Rig No.	Name	Type	
1	Penn. Drlg. Co.	Failing 2000	6.97 days
			____ days
			____ days
			____ days
			____ days

ERDA H 2 B
HOLE HISTORY

Excavated a 6' x 6' x 4' deep cellar and lined with 3" x 12" boards.

1-24-77 Moved in Link Rat Hole, Inc., auger and drilled 18" hole from 4' to 33'. Ran 10-3/4" O.D. used casing to 33'.

1-25-77 Cemented annulus with 54 ft^3 of ready-mix cement.

1-27-77 Welded on a 10-3/4" x 6-5/8" casing head.

2-7-77 Moved in Pennsylvania Drilling Company rig #1 and rigged up. Drilled out cement from 31' to 33' and 8-3/4" hole from 33' to 185' with air.

2-8-77 Hole making water, changed over to mist drilling with air foam. Drilled 8-3/4" hole from 185' to 544'.

2-9-77 Drilled 8-3/4" hole from 544' to 611'. Blew hole dry. Mixed up bentonite and fresh water and filled hole, viscosity 36 seconds. Pulled out of hole, worked bit thru tight hole from 190'. Ran 16 joints (643.06') of 6-5/8" O.D., 24#, J-55 casing with a float shoe on bottom and centralizers at 406' and 568'. Casing ran free to 602' and washed down to 609'.

2-10-77 Casing set at 609'. Cemented annulus using Halliburton with 1000 gallons of mud flush followed by 10 barrels of water ahead of 50 sacks of Thix-Set cement with 10# per sack of gilsonite, 1/4# per sack of Flocele and 3% calcium chloride followed by 140 sacks of 50% Class cement, 50% Pozmix with 2% gel and 19.4# per sack of salt. Cement circulated to surface while still mixing Pozmix cement. Total slurry volume was 282 ft^3. Displaced cement with 21.8 barrels of water. Seated plug in float shoe with 700 psi, float held. Cement in place at 0515 hours. Secured rig at 0800 hours waiting on cement.

2-11-77 Rig secured to 1600 hours. Tagged top of cement at 7' in the annulus. Set 6-5/8" O.D. casing on slips in the casing head with 15,000# tension. Cut off casing and set in rotating head. Made up 5-3/4" drilling assembly and ran in hole.

2-12-77 Drilled out cement and shoe, cleaned out to 611'. Pulled out of hole. Made up 3-4/3" x 2¼" core bit and coring assembly. Cut core #1 from 611' to 639' using air foam, recovered 28'. Cut core #2 from 639' to 661', recovered 22'.

2-13-77 USGS ran water test. Bailed hole dry. Secured rig at 0800 hours.

2-14-77 Ran USGS water test. Rigged down. Hole completed.

ADDITIONAL WORK

2-24-77 Cut off the 10-3/4" casing head and installed 6-5/8" x 2-3/8" tubing head on the 6-5/8" O.D. casing.

4-4-77 Moved Pennsylvania Drilling Company rig #2 and rigged up. Ran Lynes packer in the hole on 2-3/8" O.D. tubing and set at 585.90'. Top of latch on tool at 578.09'. Moved out rig.

4-6-77 Moved in rig #2 and rigged up. Perforated 6-5/8" O.D. casing from 510' to 538' with 3 holes per foot using McCullough. Moved out rig.

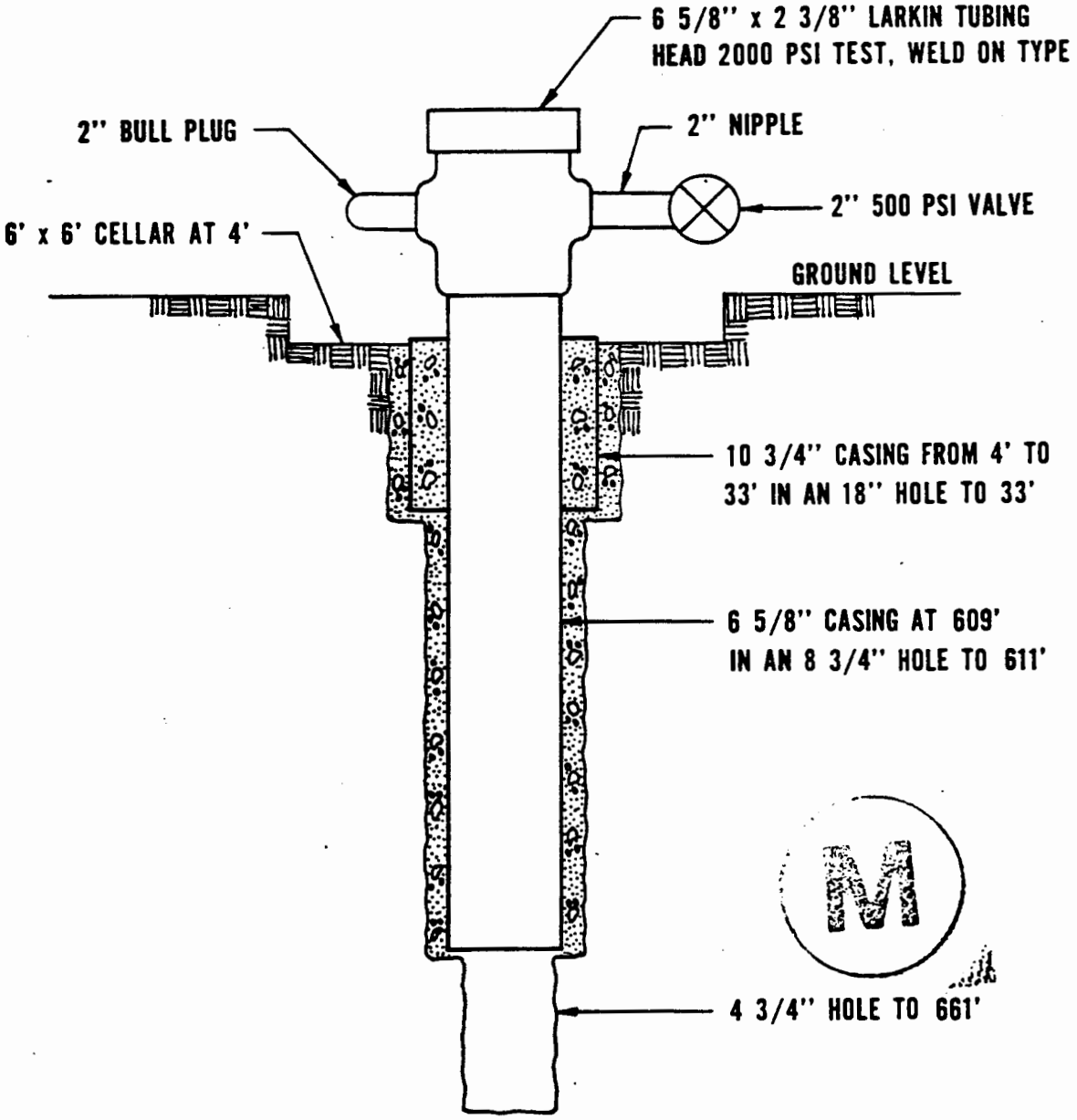
4-7-77 Moved in rig #2 and rigged up.

4-8-77 Bailed hole dry, recovered 396 gallons of water. Moved out and released rig at 1200 hours.

5-13-77 Moved in rig #2 and rigged up. Ran 2-3/8" O.D. tubing in the hole and released packer. Pulled tubing. Picked up Lynes electronic sentry system. Ran packer in the hole on 2-3/8" O.D. tubing and set at 500'. Swabbed tubing dry and knocked out shear plug. Moved out rig.
USGS per B. ORR using 578' G.L. to Center of packer

H 2 B

AS BUILT HOLE CONDITIONS
AS OF 2/14/77



NOT TO SCALE

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 5-20-77 APPROVED:

HOLE No.:	ERDA H 2 C	W. O. No.:		I. D. No.:	
USER:	Sandia Lab	TYPE HOLE:	Hydrologic		
LOCATION:	New Mexico	COUNTY:	Eddy	AREA:	Los Medanos
SURFACE COORDINATES:	720' FNL, 3584' FEL, Sec. 29, T22S, R31E*			GROUND ELEVATION:	
RIG ON LOCATION:	1-27-77	SPUDDED:	1-28-77	COMPLETED:	2-5-77
CIRCULATING MEDIA:	Air to 186', air foam to 795'				
No. of COMPRESSORS & SIZE:					

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CMT.
0'	4'	Excav.		(6' x 6' cellar)				0'	4'	Dirt
4'	33'	18"	10-3/4" (O.D.)			Used		4'	33'	54
33'	743'	8-3/4"	5.921"	24#		J-55		0'	742'	339
743'	795'	4-3/4"								

TOTAL DEPTH: 795' MANDREL DEPTH PLUGS:

JUNK:

LOGGING DATA: Dresser Atlas and USGS and Triangle Ser. Logs. SURVEYS PAGE: CORING PAGE:

BOTTOM HOLE COORDINATES: REFERENCE:

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Lay Down Drill Pipe	0.15 days	Equipment Repair	0.07 days	Drilling Time	2.58 day
Secured w/o Crew	1.75 days	Caving	___ days	Trip Time	0.38 day
Nipple Up	0.29 days	Lost Circ.	___ days	Single Shot Survey Time	0.13 day
Logging	1.22 days	Fishing	___ days		___ day
Hydrologic Tests	0.15 days	W.O. Equipment & Supplies	0.08 days	Total	3.09 day
Casing	0.18 days	Clean Plugged Bit	0.17 days	Total Suspended Time	___ day
Cement	0.82 days		___ days	Non-Operational Time	5.34 day
Coring	0.51 days		___ days	Operational Delay Time	0.32 day
Drill Out Cmt. & Shoe	0.27 days		___ days	Working Time	3.09 day
TOTAL	5.34 days	TOTAL	0.32 days	TOTAL ELAPSED TIME	8.75 day

REMARKS: Time breakdown thru 2-5-77. Perforated 6-5/8" O.D. casing from 624' to 652' with 3 holes per foot (3-7-77).

* Hole drilled on a 60' triangle with H 2 A and H 2 B.

Rig No.	Name	Type	
1	Penn. Drlg. Co.	Failing 2000	8.75 day
			___ day
			___ day
			___ day
			___ day
			___ day

ERDA H 2 C

HOLE HISTORY

Excavated a 6' x 6' x 4' deep cellar and lined with 3" x 12" boards.

1-24-77 Moved in Link Rat Hole, Inc., auger and drilled 18" hole from 4' to 33'. Set 33' of 10-3/4" O.D. used casing.

1-25-77 Cemented annulus with 54 ft^3 of ready-mix cement.

1-27-77 Moved in Pennsylvania Drilling Company rig #1 and rigged up. Welded a 10-3/4" x 6-5/8" casing head on the 10-3/4" O.D. casing. Made up 8-3/4" drilling assembly and drilled out cement from 31' to 33' and formation to 80' using air.

1-28-77 Drilled 8-3/4" hole from 80' to 181' and plugged bit. Pulled out of hole and found bottom 10' of drill collars wet. Ran back in hole and drilled 8-3/4" hole from 181' to 186' with no returns. Changed over to mist drilling with air foam. Drilled 8-3/4" hole from 186' to 327'.

1-29-77 Drilled 8-3/4" hole from 327' to 551'.

1-30-77 Drilled 8-3/4" hole from 551' to 584'. Secured rig at 0800 hours.

1-31-77 Rig secured to 0800 hours. Ran fluid probe, fluid level at 452'. Unloaded hole and drilled 8-3/4" hole from 584' to 715'. Pulled out of hole.

2-1-77 Ran USGS logs. Ran 8-3/4" bit in the hole and drilled from 715' to 740' and pulled out of hole. Ran USGS logs. Measured in hole and corrected total depth to 743'. Filled hole with 8.6# per gallon, 36 second viscosity mud. Pulled out of hole and ran Dresser Atlas logs.

2-2-77 Completed logging. Laid down drill pipe. Rigged to run casing. Ran 19 joints (763.15') of 6-5/8" O.D., 24#, J-55 casing with a Halliburton combination float shoe and collar on bottom. Landed casing at 741.85' G.L. with top of float collar at 739.15'. Centralizers at 260', 461', 581' and 701'. Cemented annulus using Halliburton with 1000 gallons of mud flush ahead of 50 sacks of Thix Set Class "C" cement with 10# of gilsonite and 1/2# per sack of Flocele followed by 180 sacks of 50% Pozmix, 50% Class "C" cement, 2% gel and 19.4# per sack of salt. Displaced plug with 25.8 barrels of water. Bumped plug with 700 to 1100 psi. Circulated out 30 barrels of cement. Cement in place at 2140 hours. Total slurry volume was 339 ft^3.

2-3-77 Set slips in the 10-3/4" casing head with 15,000# tension on the 6-5/8" O.D. casing. Installed packing element around the casing. Cut off and beveled top of casing. Secured rig at 1600 hours.

2-4-77 Rig secured to 0800 hours. Rigged up Grant rotating head. Made up 5-3/4" drilling assembly and ran in hole. Tagged plug at 738.80', drilled out plug and float equipment, cleaned out to 743' with air foam. Pulled out of hole and made up 4-3/4" x 2-1/4" coring assembly. Ran in hole.

2-5-77 Cut core #1 from 743' to 795' using air foam, blew hole with air, recovered 52' of core. Ran fluid probe. Rigged down and moved to ERDA H 2 B. Drilling operations completed.

ADDITIONAL WORK

2-23-77 Moved in Pennsylvania Drilling Company rig #2 and rigged up. Bailed hole dry, recovered 5 gallons of water. Moved out rig.

2-24-77 Cut off the 10-3/4" casing head and installed 6-5/8" x 2-3/8" tubing head on the 6-5/8" O.D. casing.

3-3-77 Moved in Pennsylania Drilling Company rig #2 and rigged up. Ran Lynes 4-5/8" O.D. x 2" bore projection-injection packer in the hole on 2-3/8" O.D. tubing. Set packer at 731.90'. Released tubing from packer and pulled tubing. Top of packer latch on tool at 724.25' with 2-3/8" fishing neck. Bailed hole dry. Moved out rig.

3-7-77 Moved in Pennsylvania Drilling Company rig #2 and rigged up. Ran McCullough 20' gun and perforated from 652' to 632' with 3 holes per foot. Hole dry, gun swelled, left no junk in hole. Ran 8' gun and perforated from 632' to 624' with 3 holes per foot. Moved out rig.

3-8-77 Moved in rig #2 and rigged up. Found fluid level at 624'. Bailed hole and recovered 264 gallons of water. Fluid level at 657.2'. Moved out rig.

3-16-77 Moved in rig #2 and rigged up. Bailed hole dry, recovered 516 gallons of water. Moved out rig.

3-21-77 Ran Triangle Service, Inc., tracer-temperature log using Iodine #131 and a Halliburton pump truck.

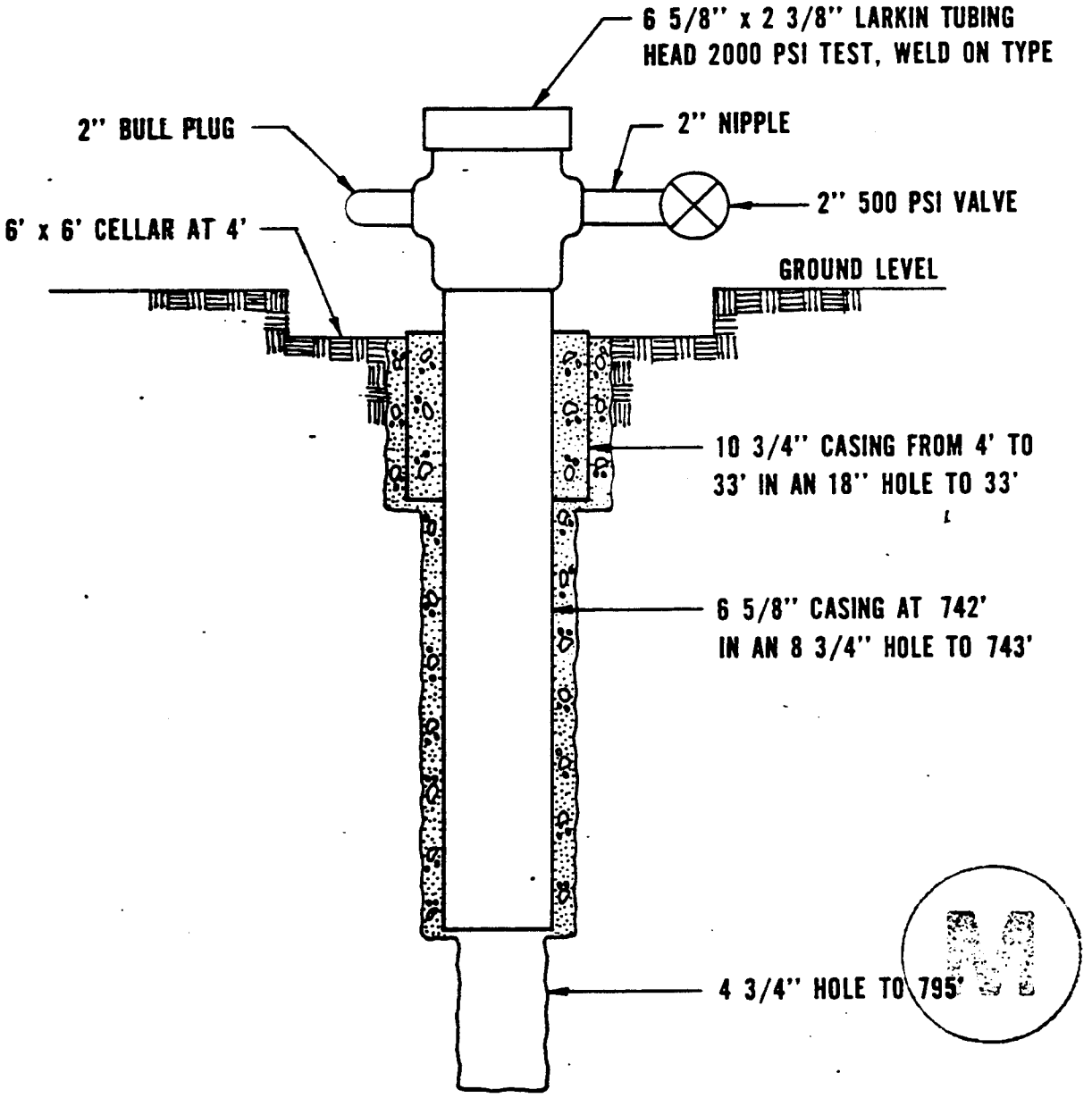
3-23-77 Moved in rig #2 and rigged up. Bailed hole dry. Moved out rig.

3-24-77 Moved in rig #2 and rigged up.

3-25-77 Ran Lynes latch on tool in the hole on 2-3/8" O.D. tubing and latched onto packer. Swabbed tubing and knocked out shear plug in bottom of packer. USGS monitored fluid levels.

H 2 C

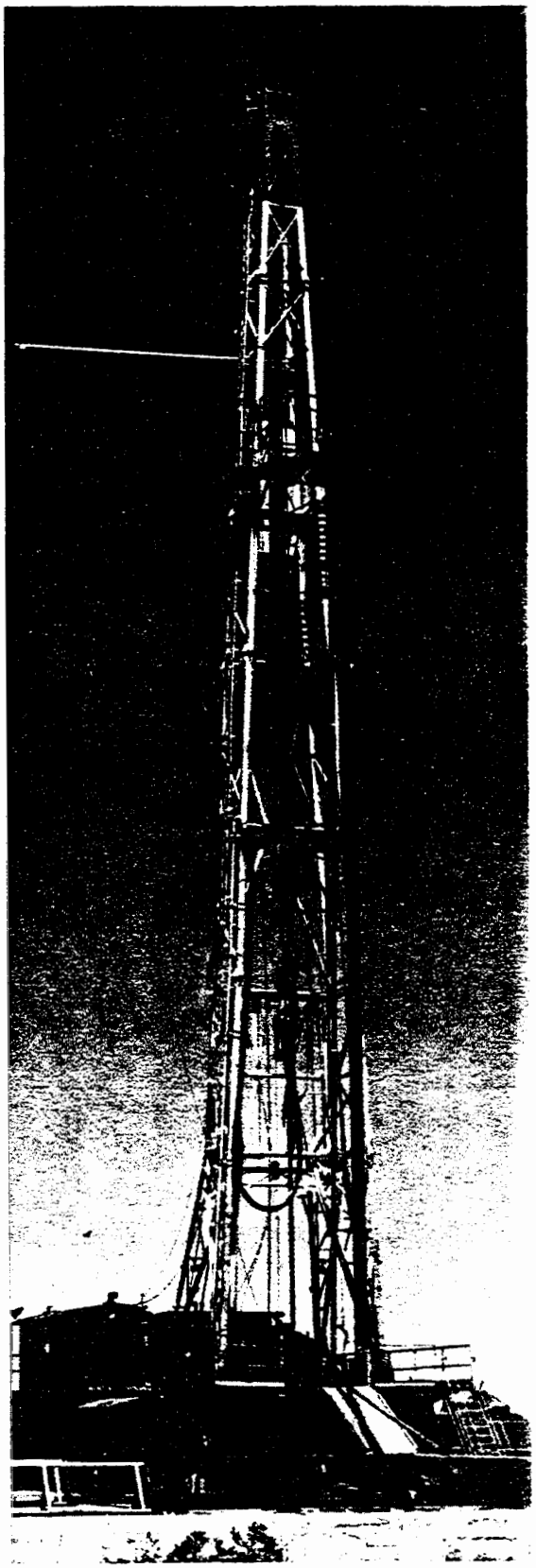
AS BUILT HOLE CONDITIONS
AS OF 2/5/77



NOT TO SCALE

Interim Data Report on the Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Southeast New Mexico (USGS WRI 79-98), pages 36 through 71.

INTERIM DATA REPORT ON THE GEOHYDROLOGY OF THE PROPOSED WASTE ISOLATION PILOT PLANT SITE SOUTHEAST NEW MEXICO



PREPARED IN COOPERATION WITH THE DEPARTMENT OF ENERGY

U.S. GEOLOGICAL SURVEY
WATER-RESOURCES
INVESTIGATIONS 79-98

Tubing with a latch-on tool was run on May 13, 1977 to the packer set at 651.3 feet and the tubing was opened to the Culebra zone allowing long-term monitoring of liquid levels in the Culebra through the tubing and of the Magenta in the annulus. The test hole configuration is shown in figure 4. Measurements through October 1977 suggest that the liquid levels in the Culebra were approaching prepumping levels at about 390 feet (table 7) and those in the Magenta at about 249 feet (table 8).

Well H-3

Drilling history.—ERDA Hydro No. 3 (H-3) is located 3,200 feet FNL and 140 feet FEL of sec. 29, T.22 S., R.31 E., in Eddy County, New Mexico. The elevation of the land surface at the drill site is 3,388.7 feet above mean sea level. An abbreviated well chronology is included in table 9.

Surface casing was set on July 15, 1976, to a depth of 38 feet. The test hole was spudded on July 27, 1976. A moist zone was detected in drill cuttings at 175 feet and drilling continued to a depth of 553 feet where geophysical logs were run and hydrologic tests were conducted. After eight hours, no liquid was detected in the open hole. Drilling with air continued until water was encountered at 570 feet where mist drilling was started.

The drill pipe and bit were removed from the hole at 600 feet and a single packer was set at 530 feet to isolate the liquid zone from the rest of the hole. The zone appeared productive and after 30 hours of monitoring the liquid level had risen to 301 feet. After the packer was released and pulled from the hole, drilling of the hole continued from 600 to 894 feet using air mist (1 gallon soap per barrel of water). Geophysical logs were run by the U.S. Geological Survey after drilling was completed. The hole was then cleaned prior to hydrologic testing. After testing (August 2-10, 1976) the hole was reamed in preparation for running casing. The liquid was displaced with brine mud and borehole geophysical logs were run by Dresser Atlas (fig. 7).

Drill-stem tests in the open hole indicated the necessity for further hydraulic testing and the hole was cased on August 12 to a depth of 891 feet. The final hole configuration and well construction specifications are included in figure 8.

Table 7.—Long-term liquid-level recovery data, well H-1 (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 675-703 ft below land surface]

Method of testing: A modified drill-stem test was conducted. The packer was opened after being shut in for 1.5 months.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
5-13-77	1200 (est.)	0	-	Sheared packer plug to open tubing to zone
	1523	203	373.6	-
5-25-77	1120	17,240	388.1	-
6-16-77	1726	49,286	385.65	-
6-23-77	1340	59,140	389.32	-
8- 4-77	1255	119,575	392	-
9- 4-77	1241	164,201	389	-
10- 2-77	0955	204,355	390	-

Table 8.--Long-term liquid-level recovery data, well H-1 (Magenta Dolomite Member of Rustler Formation)

[Perforated interval 562-590 ft below land surface]

Method of testing: Long-term monitoring in annulus was conducted.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
5-10-77	0930	1,105 hrs.	-	Bailed for sample (51 bailers) 612 gallons
5-12-77	-	-	-	Ran tubing to packer
5-13-77	-	-	-	Ran tubing to packer
5-25-77	1130	-	268.05	-
6-16-77	1720	-	260.2	-
6-23-77	1350	-	258	-
8- 4-77	1250	-	254	-
9- 3-77	1214	-	252	-
10- 3-77	1340	-	249	-

Table 9.--Chronology of well H-3

[All depth measurements adjusted to ground level 3,388.7 ft above mean sea level]

Date	
1976	
July 15	Surface pipe set.
July 27	Hole spudded; moisture detected at 175 ft.
July 28	USGS geophysical logs at 384 ft total depth.
July 29	USGS geophysical logs at 524 ft total depth.
July 30	Rotary drilled to 600 ft; liquid encountered at 570 ft; single-inflatable packer set at 530 ft.
July 30-Aug. 1	Liquid levels monitored; released and pulled packer.
Aug. 2	Rotary drilled to 894 ft total depth; USGS ran geophysical logs.
Aug. 3	Set inflatable-straddle packer 800-868 ft; Rustler-Salado contact drill-stem test.
Aug. 3-4	Set inflatable-straddle packer 703-780 ft; salt-residue drill-stem test.
Aug. 6-8	Set inflatable-straddle packer 672-703 ft; drill-stem test in the Culebra.
Aug. 9-10	Set inflatable-straddle packer 558-605 ft; drill-stem test in the Magenta.
Aug. 10-11	Reamed hole for casing.
Aug. 11	Dresser Atlas geophysical logs.
Aug. 12	Casing landed 891 ft; cemented; hole temporarily abandoned.

Table 9.--Chronology of well H-3 - Continued

Date	
1977	
Jan. 17-18	Bailed hole dry.
Jan. 20	Drilled cement plug (804-864 ft).
Jan. 21	Bailed hole dry.
Jan. 22	Perforated casing (Rustler-Salado contact, 813-837 ft).
Jan. 22-Feb. 23	Liquid levels monitored.
Feb. 23	Bailed hole dry and sampled (Rustler-Salado).
Feb. 23-Mar. 4	Liquid levels monitored.
Mar. 4	Set inflatable packer (793.5); tubing pulled; hole bailed dry.
Mar. 7	Perforated casing (Culebra, 675-703 ft).
Mar. 9	Bailed hole.
Mar. 9-17	Liquid levels monitored.
Mar. 17	Bailed hole and sampled (Culebra).
Mar. 21	McCullough radioactive tracer survey (^{131}I).
Mar. 23	Bailed hole dry.
Mar. 24	Reran tubing to packer; reopened Rustler-Salado zone.
Mar. 24-30	Liquid levels monitored.
Mar. 30	Closed packer to pull tubing; dropped packer; fishing; pulled packer.
Mar. 31	Set inflatable packer (793.5 ft); pulled tubing.
Apr. 1	Set inflatable packer (652.6 ft).
Apr. 6	Perforated casing (Magenta, 562-590 ft).

Table 9.--Chronology of well H-3 - Concluded

Date	
1977	
Apr. 6-7	Bailed hole.
Apr. 7	Liquid levels monitored.
May 10	Bailed hole and sampled (Magenta).
May 13	Ran tubing with airline; latched on to packer; reopened to Culebra.
May 13-Oct. 1	Monthly measurements.

COMPANY Dresser Atlas

WELL H-3

LOCATION 3200' FROM NORTH LINE,

140' FROM EAST LINE

SECTION 29 TOWNSHIP 22 S.

RANGE 31 E.

PERMANENT DATUM IS LAND SURFACE,

ELEVATION 3388.7'

MEASURING POINT IS KELLY BUSHING

WHICH IS 6 FEET ABOVE PERMANENT

DATUM

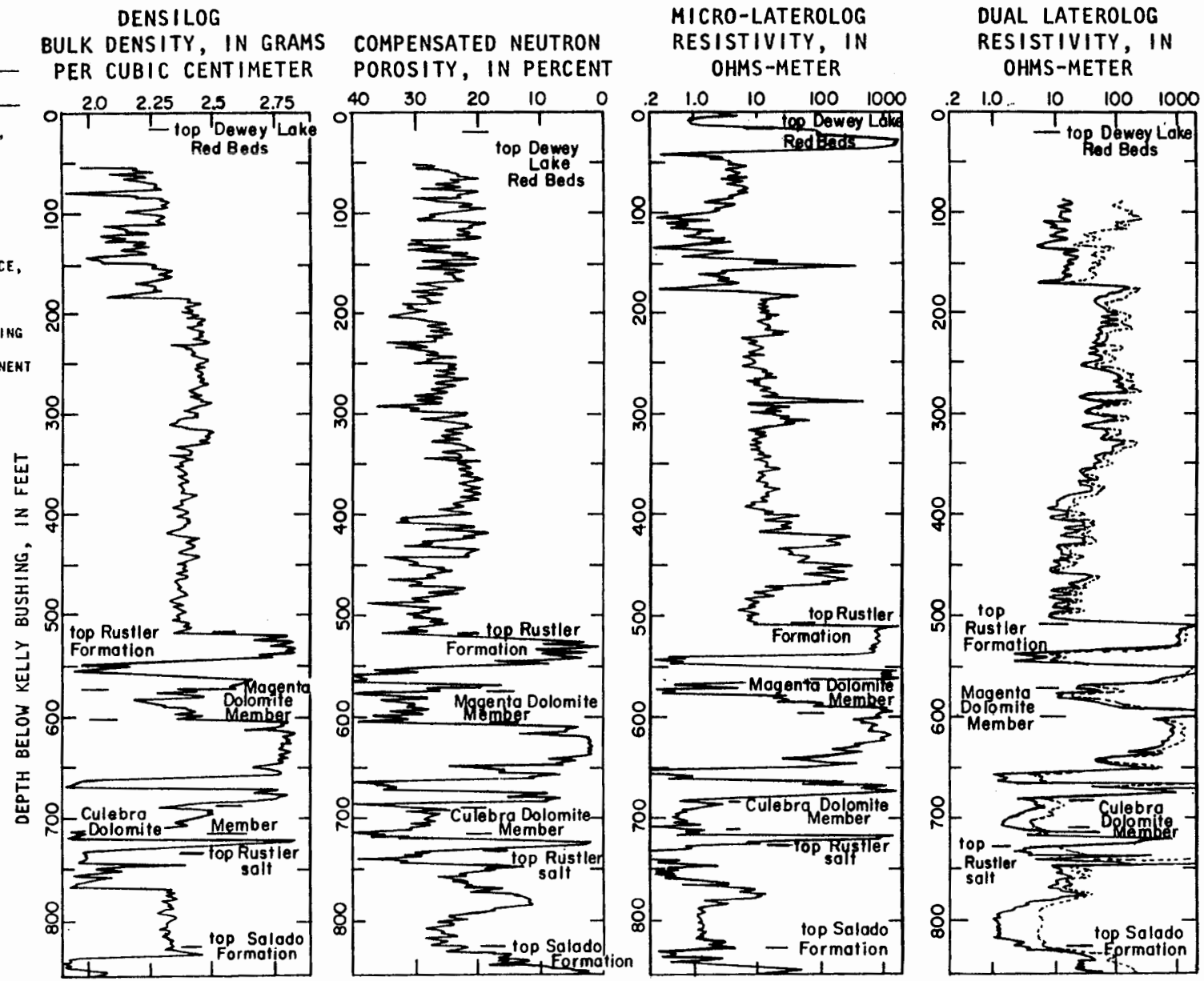
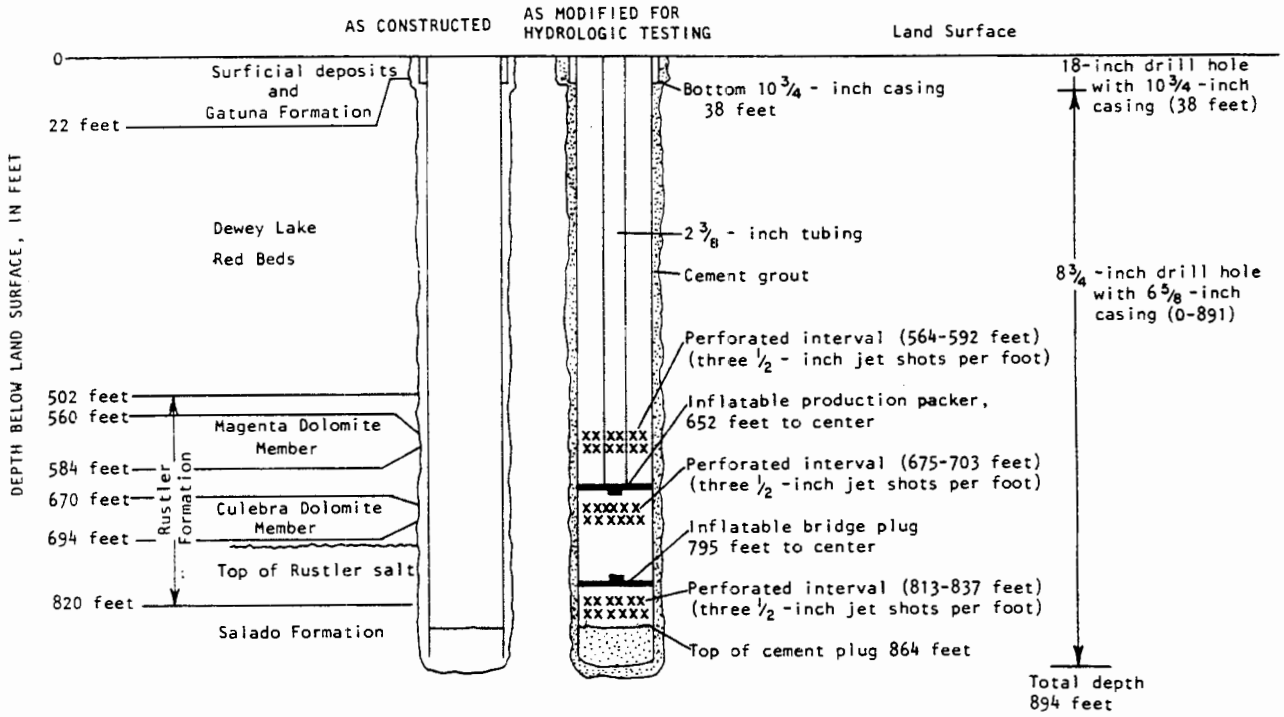


Figure 7.--Selected geophysical logs for well H-3.



LOCATION: 3,200 feet from north line, 140 feet from east line, section 29, Township 22 South, Range 31 East, Eddy County, New Mexico

ELEVATION: 3,388.7 feet (ground level)

DEPTH DRILLED: 894 feet (864 feet to top cement plug)

DATE COMPLETED: August 12, 1976

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Auger 18-inch hole (0-38 feet)
Rotary 7 7/8-inch hole with air and air mist (38-894 feet)
Ream 8 3/4-inch hole (38-894 feet)
Rotary cement plug (804-864 feet)

WELL CASING RECORD: 10 3/4-inch outside diameter steel surface pipe (0-38 feet) cemented to surface, 6 5/8-inch outside diameter steel casing, 24 pounds, 1.43 gallons per foot (0-891 feet), cemented to surface (cement plug to 804 feet, drilled to 864 feet)

GEOPHYSICAL LOGS:

Shown in figure 7: Compensated Densilog, Microlaterolog, Dual Laterolog, Compensated Neutron

Not shown in figure 7: BHC Acoustilog, Differential Temperature, Gamma

Figure 8.--Well H-3 construction, completion, and specifications.

Hydrologic testing.--As in H-1, modified drill-stem tests of ERDA H-3 were conducted at the contact between the Rustler and Salado Formations, the Culebra Dolomite Member of the Rustler, a possible salt-residue zone in the Rustler, and the Magenta Dolomite Member of the Rustler (fig. 9).

The drill-stem test of the contact between the Rustler and Salado Formations (potential "brine aquifer" horizon) was made in an interval of open hole from 800 to 868 feet using an inflatable straddle packer to isolate the interval from the rest of the hole (fig. 9). After the tubing was swabbed, the packer was opened and after 16.5 hours of monitoring, the test zone had produced only 1.8 gallons of liquid. Low permeability resulting in long intervals of recovery time thus precluded continued testing. An attempt was made to swab and develop the zone but the formation would not yield liquid.

The drill-stem test of the Culebra was made using an inflatable straddle packer to isolate an interval of open hole from 672 to 703 feet (fig. 9). The tubing was opened to the test zone and after 21.5 hours the liquid level had risen in the tubing only 13.5 feet, representing 2.1 gallons of produced liquid. Low formation yields resulting in long recovery periods were again characteristic of this interval. The test zone was swabbed with a recovery of only 10 gallons of liquid.

The drill-stem test of the suspected salt-residue zone (picked from geophysical logs) was made in an interval of open hole from 703 to 780 feet which had been isolated from the rest of the hole by inflatable straddle packers (fig. 9). The tubing was opened to the test zone and after 26 hours of monitoring the formation had produced only 2 gallons of liquid.

Two drill-stem tests were made on the Magenta Dolomite Member. Data from the first drill-stem test on the Magenta, with a single packer at 530 feet, was suspect because liquid monitoring in the annulus indicated possible communication around the packer, therefore, a second drill-stem test of the Magenta was made in an isolated interval of open hole from 558 to 608 feet (fig. 9). The zone was developed by swabbing and after 37.5 hours of monitoring, the zone produced 23 gallons of liquid. Swabbing of the zone after the drill-stem test produced 442 gallons of liquid.

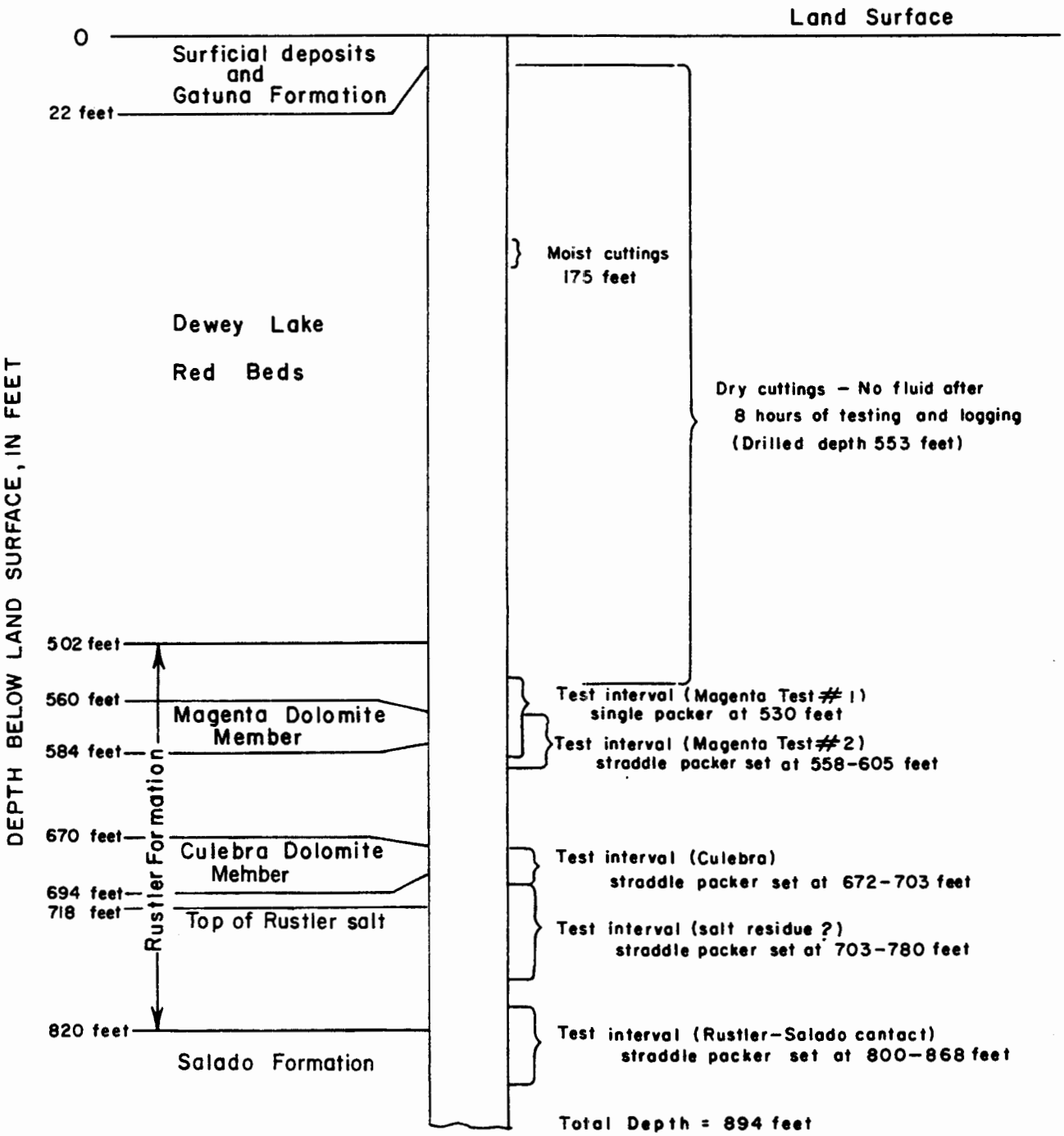


Figure 9.--Open-hole intervals tested in well H-3.

After casing was set and cemented on August 12, 1976, H-3 was temporarily abandoned until January 20, 1977. At that time the cement at the bottom of the hole was drilled out and the hole was bailed dry. On January 22, the casing opposite the Rustler-Salado contact was perforated from 813 to 837 feet (fig. 8). Liquid levels were monitored in the hole and after 32 days the liquid level had risen from 850 to 824 feet, about 12 feet below the top perforations (table 10) and was still rising. Thirty-seven gallons of liquid were produced from the test interval. The hole was bailed and a liquid sample was collected for chemical analyses on February 23, 1977 (table 2). An inflatable packer was run on tubing and set at 793.5 feet on March 4, sealing off the Rustler-Salado perforations from the rest of the hole. Casing adjacent to the Culebra was perforated in a dry hole from 675 to 703 feet on March 7 (fig. 8). A total of 480 gallons of liquid was bailed from the hole after perforating. After 8 days, the liquid level had risen from 550 to 410 feet (table 11) and 200 gallons of liquid had been produced from the formation. On March 17 the hole was bailed (168 gallons) and a liquid sample was collected for chemical analyses (table 2).

A tracer (^{131}I) and temperature survey was run on the perforated interval of the Culebra on March 21, 1977, to determine the interval of liquid loss and to detect possible communication or channeling within the cemented annulus. The survey was run with liquid injection rates of approximately 8 gal/min with a total of 450 gallons of liquid injected into the formation. The radioactive tracer (fig. 10) indicated major liquid losses of 36 percent in the interval from 684 to 692 feet and of 64 percent in the interval from 692 to 695 feet. There was no indicated flow below 696 feet. The tracer survey also gave no indication of communication or channeling within the cemented annulus above or below the perforated interval. After the injection test, the hole was bailed dry.

On March 24 a latch-on tool on tubing was run and latched onto the bridge packer that had been set at 793.5 feet. The tubing was then opened to the Rustler-Salado contact and liquid levels were monitored for six days (table 10). There was very little change in water levels from those of the test made on February 23. The zone was shut in and tubing was removed from the hole.

Table 10.--Liquid-level recovery data, well H-3 (Rustler-Salado contact)

[Perforated interval 812-837 ft below land surface]

Method of testing: The casing was perforated and liquid levels were monitored.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
1-22-77	0836	0	-	Perforated zone 813-837 ft
	0945	69	850	-
	1000	84	850	-
	1015	99	850	-
1-23-77	1042	1,566	851.0	-
1-24-77	1130	3,054	850.6	-
1-27-77	1100	7,344	848.0	-
2- 2-77	1220	16,064	842.2	-
2- 6-77	1100	21,744	837.6	-
2-12-77	1400	30,564	832.3	-
2-15-77	1532	34,976	831.1	-
2-17-77	1540	37,864	829.3	-
2-23-77	1051	46,215	823.6	-

End test - bailed, shut in

Table 10.--Liquid-level recovery data, well H-3 (Rustler-Salado contact) - Concluded

Method of testing: The shear plug was knocked out, opening the zone to the tubing for monitoring.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
3-24-77	1429	0	-	Packer opened
	1448	19	820.4	-
3-25-77	1324	1,335	825.3	-
3-26-77	1240	2,691	821.7	-
3-27-77	1048	3,939	819.7	-
3-28-77	1150	5,481	822.0	-
3-29-77	1149	6,920	823.3	-
		shut in		

Table 11.--Liquid-level recovery data, well H-3 (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 675-703 ft below land surface]

Method of testing: The casing was perforated, the hole was bailed dry, and liquid levels were monitored.

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
3- 7-77	-	-	-	-	Perforated
3- 9-77	0700	0	-	-	Bailed 480 gallons 40 runs
	0947	167	0	-	-
	0955	175	8	549.9	-
	0957	177	10	545.3	-
	0958	178	11	541.8	-
	0959	179	12	539.8	-
	1000	180	13	536.8	-
	1005	185	18	523.5	-
	1010	190	23	511.6	-
	1015	195	28	500.8	-
	1020	200	33	491.0	-
	1030	210	43	473.7	-
	1040	220	53	458.6	-
	1050	230	63	446.9	-
	1100	240	73	437.1	-
	1120	260	93	425.3	-
	1141	281	114	419.4	-
	1201	301	134	417.7	-
	1234	334	167	417.1	-
	1318	378	211	416.8	-
	1413	433	266	416.4	-
	1952	772	605	415.6	-
3-10-77	0935	1,595	1,428	414.5	-
	1105	1,685	1,518	414.4	-
3-11-77	1258	3,238	3,071	411.2	-
3-12-77	1022	4,522	4,355	411.4	-
3-13-77	1218	6,078	5,911	411.7	-
3-14-77	1642	7,782	7,615	411.3	-
3-15-77	1712	9,252	9,085	410.0	-
3-17-77	1204	11,824	11,657	409.8	-

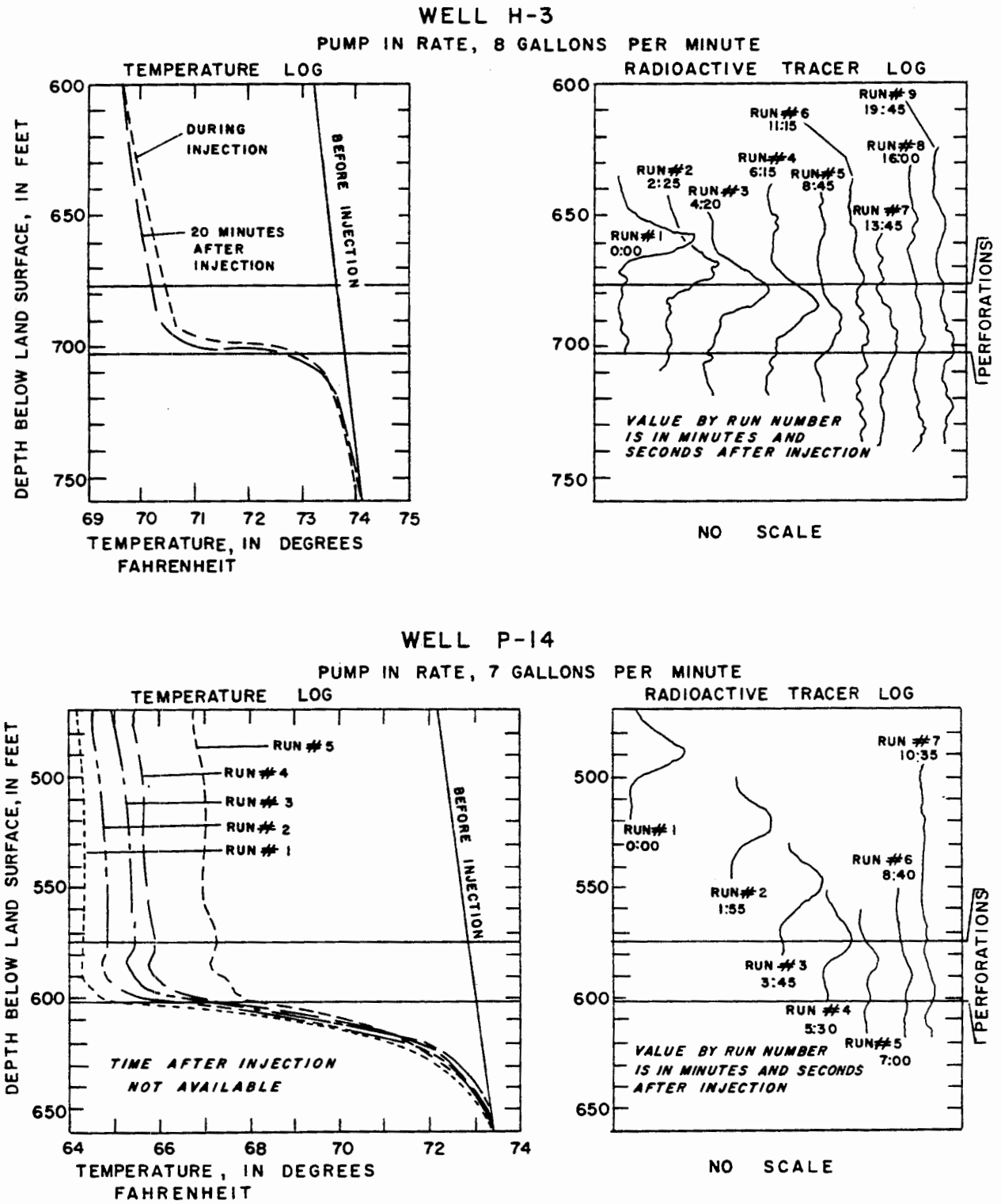


Figure 10.--Radioactive tracer (tracejector) and temperature logs in the Culebra Dolomite Member of Rustler Formation for wells H-3 and P-14.

An inflatable-retrievable bridge packer was set at 652.6 feet, sealing the Culebra from the rest of the hole. The tubing was pulled on April 6, 1977; the zone opposite to the Magenta was then perforated from 564 to 592 feet (fig. 8). The hole was bailed on April 6 to develop the test zone. On April 7, 360 gallons of liquid were bailed from the hole in 1 hour with a resultant drop of only 6 feet in the liquid level. Liquid levels were monitored for 33 days in which time the liquid recovered from 405 to 401 feet (table 12). The well was bailed on May 10 (624 gallons) and a sample was collected for chemical analyses (table 2). On May 25 the liquid level was 299 feet, which was 102 feet higher than the measurement made prior to bailing on May 10 (table 12). This difference probably resulted from blocked perforations on the early tests. Tests indicated that the zone was productive and may lend itself to pump testing at a later time.

Tubing with a latch-on tool was run to the bridge packer on May 13. The Culebra was then reopened to the tubing and the test hole was put into a long-term dual-completion phase (fig. 8). The Culebra was monitored through the tubing and the Magenta in the annulus. As of October 1977 periodic measurements indicate that liquid levels were becoming stabilized. The Culebra liquid level was at about 405 feet (table 13) and the Magenta liquid level at about 245 feet (table 14).

Well complex H-2

Drilling program.--Modified open-hole drill-stem tests in H-1 and H-3 required long-term testing and monitoring because of the low permeabilities. For this reason, the H-2 drilling program was altered. The alternative program was to drill a closely spaced nest of three holes (fig. 1), one for each potential liquid-bearing zone. The individual holes were drilled to a point above the zone, and casing was run and cemented to the surface. The zone was then cored and prepared for open-hole testing (table 15). The zones tested included the Rustler-Salado contact and the Culebra and Magenta Dolomite Members of the Rustler Formation.

Drilling history.--The H-2 complex (H-2a, H-2b, and H-2c) consists of three closely spaced holes around a point 720 feet FNL and 3,584 feet FEL, sec. 29, T.22 S., R.31 E. The ground level at the drill site is 3,377.1 feet above mean sea level. The three holes were located in a close triangular array (fig. 1) which provided an opportunity for later interference testing between holes and for evaluation of possible vertical hydraulic connection between zones. An abbreviated well chronology is included in table 15.

Table 12.--Liquid-level recovery data, well H-3 (Magenta Dolomite Member of Rustler Formation)

[Perforated interval 564-592 ft below land surface]

Method of testing: The casing was perforated, the hole was bailed, and liquid levels were monitored.

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
4- 6-77	-	-	-	-	Perforated zone
4- 7-77	0955	-	-	405.1	Bailed 30 runs
	1000	0	-	-	(360 gallons)
	1100	-	0	-	-
	1110	-	10	411.1	-
	1120	-	20	410.8	-
	1130	-	30	409.6	-
	1145	-	45	409.1	-
	1200	-	60	408.8	-
	1210	-	70	408.6	-
	1755	-	415	408.4	-
4- 8-77	1130	-	1,470	404.1	-
4-11-77	1839	-	6,219	402.0	-
4-12-77	1156	-	7,256	402.7	-
4-13-77	1342	-	8,802	402.7	-
4-14-77	1125	-	10,105	402.4	-
4-15-77	1202	-	11,582	401.5	-
4-22-77	1010	-	21,550	401.1	-
5- 6-77	1022	-	41,722	401.0	-
5-10-77	0855	-	47,395	401.3	-

End test - bailed

Table 13.--Long-term liquid level recovery data, well H-3 (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 675-703 ft below land surface]

Method of testing: The tubing was reopened to zone for long-term monitoring.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
5-12-77	1200	0	-	-
5-13-77	1536	1,656	403.7	Sheared plug in inflatable-packer to open zone to tubing
5-25-77	1225	18,745	405.1	-
6-23-77	1245	60,525	405.2	-
8- 4-77	1320	121,040	404.8	-
9- 4-77	1229	165,629	404	-
9-28-77	1200	200,160	407	-

Table 14.—Long-term liquid-level recovery data, well H-3 (Magenta Dolomite Member of Rustler Formation)

[Perforated interval 564-592 ft below land surface]

Method of testing: Tubing was opened to the Culebra interval, and liquid levels were monitored on a long-term basis.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
5-10-77	1300	0	-	Bailed 52 bailers = 624 gallons
5-25-77	1230	21,570	299	-
6-23-77	1312	63,372	249.7	-
8- 4-77	1340	79,240	250.0	-
9- 3-77	1159	122,339	249	-
10- 3-77	1305	210,245	248.0	-

Table 15.--Chronology of well complex H-2

[All depth measurements adjusted to ground level, 3,377 ft above mean sea level]

Well H-2a

Date	
1977	
Jan. 24-25	Surface pipe set.
Feb. 14	Hole spudded.
Feb. 15	Open hole tested (0-188 ft) 5 hours; no appreciable liquid.
Feb. 16	Rotary drilled to 513 ft.
Feb. 17	USGS ran caliper log; casing landed at 511 ft and cemented.
Feb. 19	Magenta cored (513-563 ft); hole bailed dry.
Feb. 22	Hole cleaned up, bailed, and liquid sampled.
Feb.22-Apr. 6	Liquid levels monitored.
Apr. 6-Oct. 1	Monthly measurements.

Table 15.--Chronology of well complex H-2 - Continued

Well H-2b

Date	
1977	
Jan. 24-25	Surface pipe set.
Feb. 7	Hole spudded; moist cuttings 185 ft.
Feb. 10	Rotary drilled to 611 ft; casing landed at 609 ft and cemented.
Feb. 12	Culebra cored (611-661 ft).
Feb. 13	Hole bailed dry.
Feb. 13-21	Liquid levels monitored.
Feb. 22	Hole bailed dry and sampled.
Feb.22-Apr. 1	Liquid levels monitored.
Apr. 4	Inflatable packer set at 585.9 ft and tubing pulled.
Apr. 6	Perforated casing (Magenta 510-538 ft).
Apr. 8	Hole bailed dry.
Apr. 8-May 13	Liquid levels monitored.
May 13	Packer released and pulled; Sentry device set below inflatable packer at 578 ft; tubing opened to Culebra.
May 13-Oct. 1	Monthly measurements.

Table 15.--Chronology of well complex H-2 - Concluded

Well H-2c

Date	
1977	
Jan. 24-25	Surface pipe set.
Jan. 27	Hole spudded; moist zone at 181 ft; first liquid at 515 ft.
Jan. 31	Rotary drilled to 743 ft.
Feb. 1	USGS geophysical logs.
Feb. 2	Dresser Atlas geophysical logs; casing landed at 742 ft; cement.
Feb. 4-5	Rustler-Salado contact cored (743-795 ft).
Mar. 3	Set inflatable packer at 731.9 ft; pulled tubing; bailed dry.
Mar. 7	Perforated casing, (Culebra, 624-652 ft).
Mar. 8	Bailed hole.
Mar. 8-16	Liquid levels monitored.
Mar. 16	Hole bailed and sampled (Culebra).
Mar. 21	Ran radioactive tracer survey (^{131}I) and temperature log.
Mar. 23	Bailed hole dry.
Mar. 25	Reran tubing; reopened Rustler-Salado zone to tubing.
Mar. 25-May 25	Liquid levels monitored.
May 25-Oct. 1	Monthly measurements.

Hole H-2c was spudded on January 27, 1977 and moisture was detected in the drill cuttings at 181 feet. Drilling continued from 181 to 188 feet with no cutting returns; at this time the circulating medium was changed to air mist. Drilling continued with air mist to a depth of 615 feet where liquid was encountered. After the depth of liquid entry was noted, drilling continued to a total depth of 743 feet. Geophysical logs were run by the U.S. Geological Survey after drilling was completed. The hole was then conditioned, loaded with mud gel, and logged by Dresser Atlas (fig. 11).

Hole H-2c was designed to test the Rustler-Salado contact. Casing was set and cemented on February 2 to a depth of 741.6 feet below land surface. After waiting 36 hours for the cement to set, the casing was blown dry and the interval from 743 to 795 feet was cored with air mist, with 100 percent core recovery. A lithologic description of the core, the final hole configuration, and well-construction specifications are included in figure 12.

Hole H-2b was spudded on February 7, 1977. At 185 feet, moisture was detected in the cuttings and partial loss of drill cuttings occurred. The circulating medium was changed to air mist (3 gal/min with soap). No additional liquid was detected and the hole was drilled to 611 feet below land surface. After the hole was loaded with mud gel, casing was set and cemented on February 10 to 609 feet below land surface. After the cement had set for 36 hours, the casing was blown dry. The interval from 611 to 661 feet was cored using air mist, with 100 percent core recovery. A lithologic description of the core, final hole configuration, and well-construction specifications are included in figure 13.

Hole H-2a was spudded on February 14, 1977. At 185 feet, moisture was detected in the cuttings, and drilling continued to 188 feet with no return of cuttings. The drill pipe was removed and the hole was monitored for five hours. During monitoring, very little liquid was detected in the hole. After the test was completed, drilling continued with air mist to a casing depth of 513 feet below land surface. The hole was loaded with mud gel and casing was set and cemented to a depth of 511 feet. After the cement had set for 36 hours, the casing was blown dry. The interval from 513 feet to 563 feet was cored using air mist, with 100 percent core recovery. A lithologic description of the core, final hole configuration, and well-construction specifications are included in figure 14.

Hydrologic testing.--Hydrologic testing on H-2c began February 5, 1977 with monitoring of liquid produced from the Rustler-Salado cored interval, and continued through February 23, 1977. The test interval produced only 14 gallons of liquid, raising the water level 15 feet. On February 23, 1977, the hole was bailed dry and samples were recovered for chemical analyses (table 2).

COMPANY Dresser Atlas

WELL H-2C

LOCATION 720' FROM NORTH LINE,

3584' FROM EAST LINE

SECTION 29 TOWNSHIP 22 S.

RANGE 30 E.

PERMANENT DATUM IS LAND SURFACE,

ELEVATION 3377.1'

MEASURING POINT IS LAND SURFACE

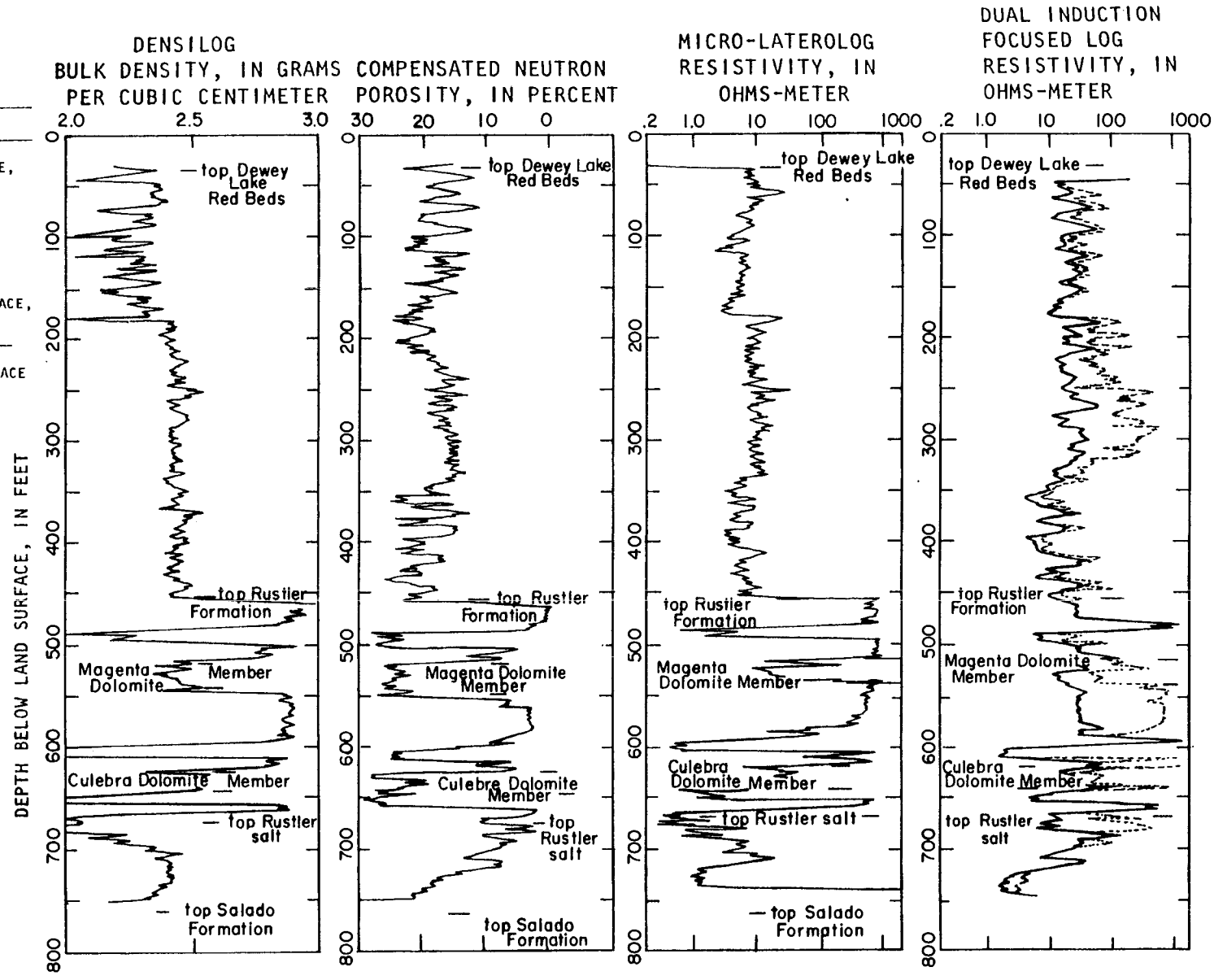
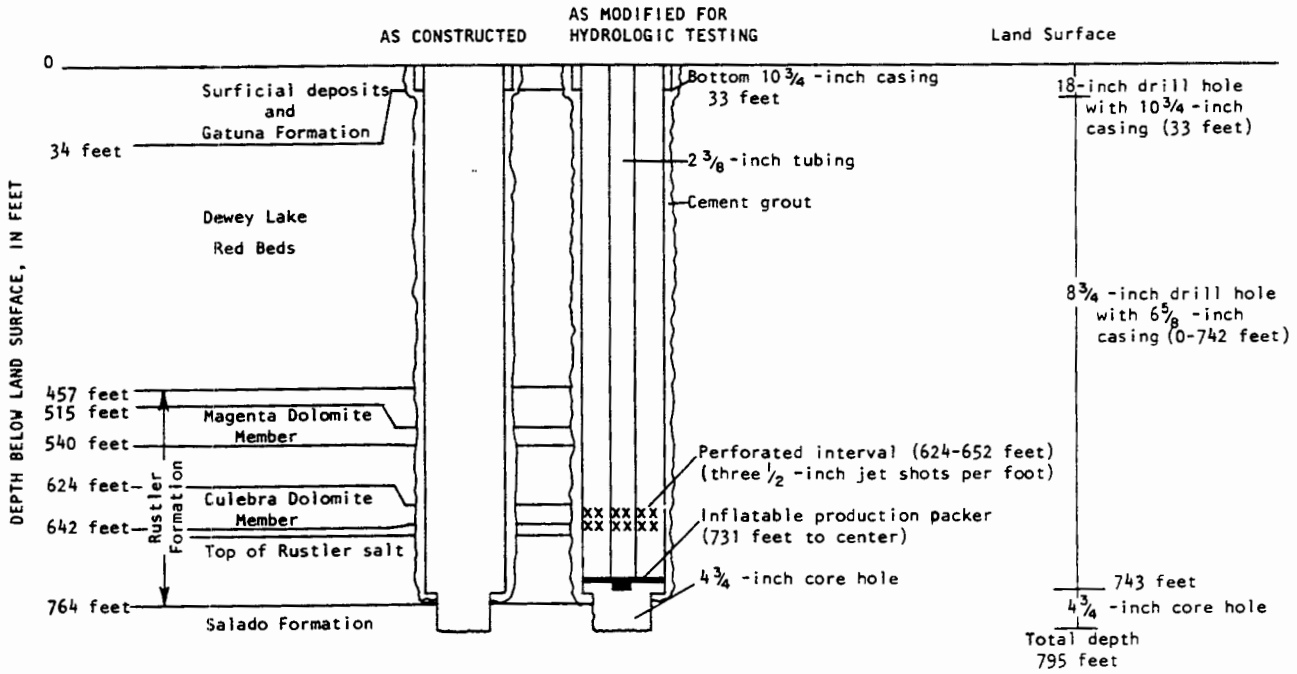


Figure 11. Selected geophysical logs for well H-2c.



LOCATION: 720 feet from north line, 3,584 feet from east line, section 29, Township 22 South, Range 31 East, Eddy County, New Mexico

ELEVATION: 3,377.1 feet (ground level)

DEPTH DRILLED: 795 feet

DATE COMPLETED: February 5, 1977

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Auger 18-inch hole (0-33 feet), Rotary 8 3/4-inch hole with air and air mist (33-743 feet), Core 4 3/4-inch hole with air mist (743-795 feet) (cut 2 1/4-inch diameter core)

WELL CASING RECORD: 10 3/4-inch steel casing (0-33 feet) cemented to surface; 6 5/8-inch outside diameter steel casing; 24 pounds; 1.43 gallons per foot (0-742 feet); centralizers at 260 feet, 460 feet, 580 feet and 700 feet; cemented to surface

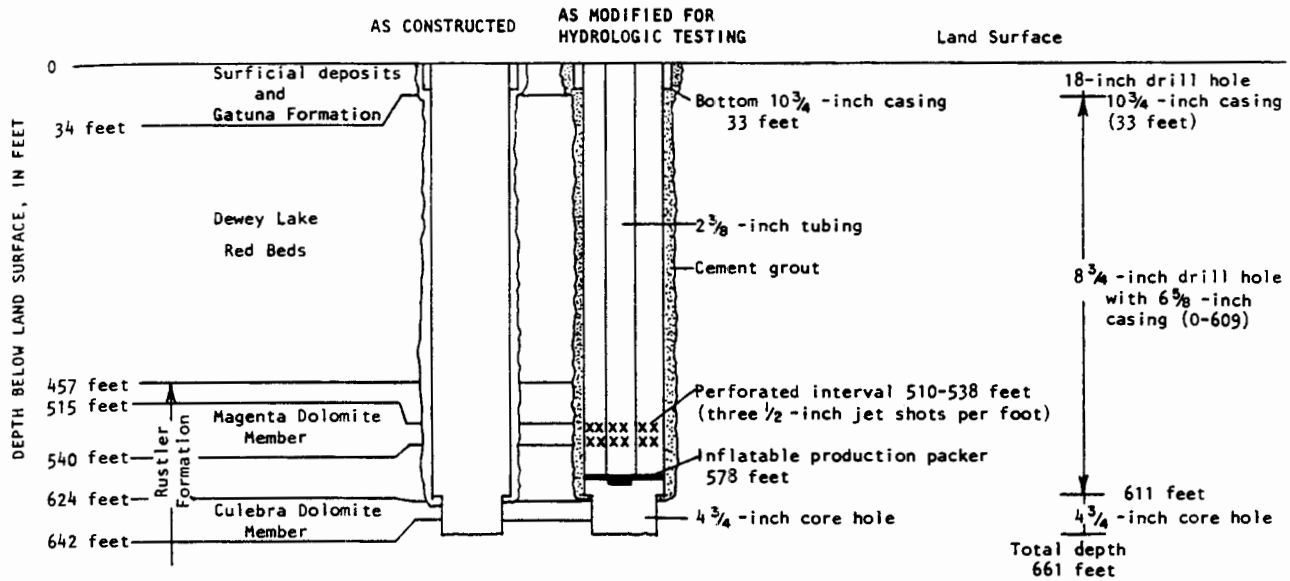
GEOPHYSICAL LOGS:

Shown in figure 11: Compensated Densilog, Dual Laterolog, Microlaterolog, Compensated Neutron
Not shown inuigure 11: BHC Acoustilog, 4-Arm Caliper, USGS Lithologic log, Gamma

CORE DESCRIPTION: Rustler-Salado cored interval (743-795 feet)

Depth (feet)	Description
743 - 762.2	Gray mudstone with pink halite vugs and clear halitic fracture fillings, gradational downward to banded, red, halitic mudstone.
762.2 - 764.1	Red-brown halitic mudstone.
764.1 - 767.3	Red-brown, argillaceous halite.
767.3 - 772.5	Red-orange polyhalitic halite with polyhalite blebs and bands.
772.5 - 773.5	Red-brown halitic clay and red-brown argillaceous halite.
773.5 - 795.6	Light pink to light red-orange polyhalitic halite, minor clay partins, with brown halitic clay at base.

Figure 12.--Well H-2c construction, completion, and specifications.



LOCATION: 720 feet from north line, 3,584 feet from east line, section 29, Township 22 South, Range 31 East, Eddy County, New Mexico

ELEVATION: 3,377.1 feet (ground level)

DEPTH DRILLED: 795 feet

DATE COMPLETED: February 5, 1977

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Auger 18-inch hole (0-33 feet); Rotary 8 3/4-inch hole with air and air mist (33-611 feet); Core 4 3/4-inch hole with air mist (611-661 feet) (cut 2 1/4-inch diameter core)

WELL CASING RECORD: 10 3/4-inch outside diameter casing (0-33 feet) cemented to surface; 6 5/8-inch outside diameter steel casing, 24 pounds, 1.43 gallons per foot (0-609 feet), centralizers at 406 feet and 568 feet, cemented to surface

GEOPHYSICAL LOGS: (See H-2C)

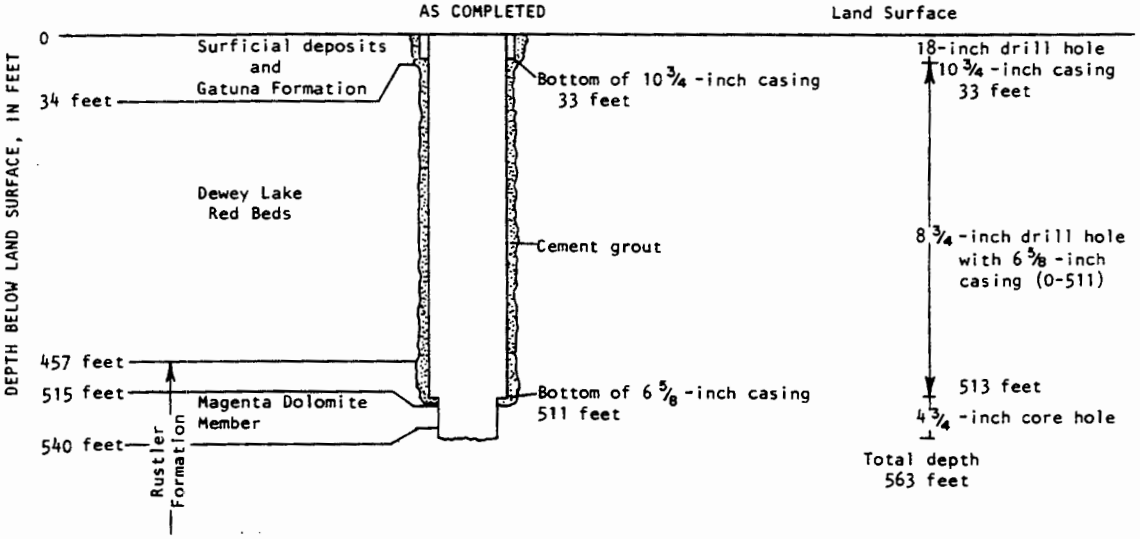
CORE DESCRIPTION:

Culebra Dolomite cored interval (611-661 feet)

Depth (feet)	Description
611 - 624.2	Dense gray anhydrite, massive to banded
624.2 - 642.0	Brown silty dolomite with selenitic fracture fillings and crystals, pitted and fractured from 629.5 to 642.0 feet
642.0 - 644.0	Gray mudstone
644.0 - 652.0	Red-brown selenitic siltstone
652.0 - 660.7	Dense gray anhydrite

Figure 13.--Well H-2b construction, completions, and specifications.

Figure 13.--Well H-2b construction, completion, and specifications.



LOCATION: 720 feet from north line, 3,584 feet from east line, section 29, Township 22 South, Range 31 East, Eddy County, New Mexico

ELEVATION: 3,377.1 feet (ground level)

DEPTH DRILLED: 563 feet

DATE COMPLETED: February 19, 1977

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Auger 18-inch hole (0-33 feet); Rotary 8 3/4-inch hole with air and air mist (33-513 feet); Core 4 3/4-inch hole with air mist (513-563 feet) (cut 2 1/4-inch diameter core)

WELL CASING RECORD: 10 3/4-inch outside diameter steel casing (0-33 feet) cemented to surface
6 5/8-inch outside diameter steel casing; 24 pounds; 1.43 gallons per foot (0-511 feet); centralizers at 270 feet, 350 feet, and 469 feet; cemented to surface

GEOPHYSICAL LOGS: (See H-2C)

CORE DESCRIPTION:

Magenta Dolomite cored interval (513-563 feet)

Depth (feet)	Description
511.7 - 513	Cement
513.0 - 514.6	Dense gray anhydrite
514.6 - 539.6	Gray-brown silty dolomite with some fractures in the interval 537.5-539.6 feet
539.6 - 563	Brown-gray banded anhydrite

Figure 14.--Well H-2a construction, completion, and specifications.

An inflatable-retrievable production packer was set at 731.9 feet on March 3, 1977, sealing off the Rustler-Salado cored interval from the rest of the hole, and the tubing was pulled.

On March 7, 1977, the casing was perforated from 624 feet to 652 feet (fig. 12). The hole was bailed March 8, and Culebra zone fluid levels were monitored until March 16, at which time the water level had risen to 352.4 feet below land surface (table 16). On March 16 the hole was bailed and samples were taken for chemical analyses (table 2).

A tracer (^{131}I) and temperature survey made on March 21, 1977, in H-2c indicated no significant upward or downward movement within the cemented annulus. Movement of the radioactive tracer outward from the borehole occurred from 631 to 644 feet; the majority of this liquid loss occurred from 640 to 644 feet (fig. 6). This coincides with the core description from H-2b (fig. 13) which indicated the occurrence of pitted dolomite from 629.5 feet to 642 feet, and with significant fracturing from 635 to 642 feet. No flow was indicated within the casing below 644 feet. The survey was run down the casing with a fluid pump-in rate of approximately 8 gal/min for a total of 697 gallons injected into the test interval. On March 23 the hole was bailed to remove contaminants.

On March 25, a latch-on tool was run on tubing to the packer and the tubing was opened to the Rustler-Salado interval. The well was placed into a long-term dual-completion monitoring phase, with Rustler-Salado water-level measurements being made in the tubing and Culebra water-level measurements being made in the annulus (fig. 12). As of October 1, 1977, the Culebra water level was approaching prepumping levels at 355 feet (table 17) and the Rustler-Salado zone was still recovering, with a change in water levels of 34 feet from September to October (table 18).

Hydrologic testing of H-2b began on February 13, 1977 by bailing liquid from the Culebra cored interval (611 to 661 feet). The hole was bailed nearly dry and liquid levels were monitored from February 13 to February 21, 1977, at which time the liquid level stood at 352 feet below land surface (table 19). On February 22, 1977, the hole was again bailed dry and water samples were taken for chemical analyses (table 2). After liquid levels were monitored from February 22, 1977 to March 7, 1977, the Culebra zone in H-2c was again bailed and the response was noted in H-2b. On March 16, 1977, the test was repeated with close monitoring of H-2b liquid levels (table 19). The first response was detected 54 minutes after bailing commenced.

Table 16.--Liquid-level recovery data, well H-2c (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 624-648 ft below land surface]

Method of testing: Casing was perforated, the hole was bailed, and liquid levels were monitored.

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
3- 8-77	1020	0	-	-	22 bailers, 264 gallons
	1122	62	0	-	-
	1143	83	21	656.4	-
	1146	86	24	655.0	-
	1150	90	28	654.7	-
	1155	95	33	653.6	-
	1200	100	38	652.4	-
	1210	110	48	650.0	-
	1220	120	58	647.5	-
	1230	130	68	645.4	-
	1245	145	83	643.2	-
	1300	160	98	639.2	-
	1315	175	113	635.2	-
	1330	190	128	631.8	-
	1345	205	143	628.9	-
	1400	220	158	625.4	-
	1415	235	173	622.5	-
	1430	250	188	619.2	-
	1445	265	203	616.5	-
	1500	280	218	613.4	-
	1625	365	303	596.5	-
	1840	500	438	571.8	-
	1935	555	493	563.0	-
3- 9-77	0730	1,270	1,208	474.6	-
	1255	1,595	1,533	446.6	-
3-10-77	0905	2,805	2,743	392.6	-
3-11-77	1156	4,416	4,354	367.2	-
3-12-77	1053	5,793	5,731	360.7	-
3-13-77	1247	7,347	7,285	355.5	-
3-14-77	1242	8,782	8,720	353.0	-

Table 16.--Liquid level recovery data, well H-2c (Culebra Dolomite Member of Rustler Formation) - Concluded

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
3-15-77	1603	10,423	10,361	354.0	-
3-16-77	1200	11,620	11,558	352.4	-

Bailed - end of test

Table 17.--Long-term liquid-level recovery data, well H-2c (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 624-648 ft below land surface]

Method of testing: Long-term monitoring began following dual completion of the well.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)	Remarks
3-25-77	1100	0	-	Ran tubing in hole
3-27-77	1006	2,826	352.5	-
3-28-77	1348	4,488	352.6	-
3-29-77	1024	5,724	352.2	-
4- 7-77	1030	18,690	348.2	-
4-12-77	1126	25,946	353.8	-
4-14-77	1227	28,887	353.5	-
4-15-77	1251	30,351	352.7	-
4-22-77	0950	40,250	351.7	-
5- 6-77	1045	60,465	351.7	-
5-25-77	1000	87,780	348.8	-
6-23-77	1415	129,795	354.2	-
8- 4-77	1230	190,170	354	-
9- 4-77	1921	233,781	350	-
10- 6-77	1020	280,760	355.9	-

Table 18.--Long-term liquid-level recovery data, well H-2c

(Rustler-Salado contact)

[Perforated interval 743-795 ft below land surface]

Method of testing: The packer plug was sheared to open the zone to the tubing and liquid levels were monitored.

Date	Clock time	Time since test began (min)	Water level (ft below land surface)
3-25-77	1133	0	-
	1143	10	753.4
3-26-77	1032	1,379	768.1
	1135	1,442	768.7
3-27-77	0954	2,781	768.4
3-28-77	1330	4,437	769.4
3-29-77	1008	5,675	769.6
4- 1-77	1555	10,342	767.6
4- 4-77	1100	14,367	767.3
4- 7-77	1020	18,647	765.4
4-12-77	1115	25,902	761.3
4-14-77	1218	28,845	759.4
4-15-77	1244	30,311	759.2
4-22-77	0945	40,212	757.1
5- 6-77	1040	60,427	751.1
5-25-77	1006	87,753	746
8- 4-77	1300	190,167	689
9- 4-77	1915	235,182	640
10- 2-77	1015	274,962	606

Table 19.--Liquid-level recovery data, well H-2b (Culebra Dolomite Member of Rustler Formation)

[Perforated interval 611-661 ft below land surface]

Method of testing: H-2b was bailed dry and liquid levels were monitored.

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
2-13-77	0600	0	-	-	10 bailers = 70 gallons
	0630	30	0	-	-
	0724	84	54	636.9	-
	0736	96	66	632.9	-
	0748	108	78	628.9	-
	0758	118	88	625.8	-
	0830	150	120	616.7	-
	0900	180	150	607.4	-
	0930	210	180	602.1	-
	1000	240	210	596.6	-
	1045	285	255	589.9	-
	1130	330	300	580.9	-
	1200	360	330	578.6	-
	1230	390	360	572.4	-
	1920	800	770	516.5	-
2-14-77	0815	1,575	1,545	458.0	-
	1545	2,025	1,995	423.3	-
2-15-77	0820	3,020	2,990	389.1	-
	1355	3,355	3,325	380.6	-
2-16-77	1145	4,665	4,635	364.9	-
2-17-77	0200	5,520	5,490	359.7	-
	1120	6,080	6,050	358.8	-
2-21-77	1527	12,087	12,057	352.1	-

Bailed end of test

Table 19.--Liquid-level recovery data, well H-2b (Culebra Dolomite Member of Rustler Formation) - Continued

Method of testing: The hole was bailed and liquid levels were monitored.

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
2-22-77	1315	0	-	-	38 bailers = 470 gallons
	1520	125	0	-	-
	1528	133	8	630.6	-
	1715	240	115	600.0	-
2-23-77	1535	1,580	1,455	462.0	-
2-24-77	0933	2,658	2,533	421.5	-
2-25-77	1220	4,265	4,140	398.2	-
2-26-77	1128	5,653	5,528	358.4	-
2-27-77	1158	7,123	6,998	354.8	-
2-28-77	1523	8,768	8,643	352.7	-
3- 1-77	1435	10,160	10,035	352.6	-
3- 4-77	1150	14,315	14,190	351.6	-
3- 7-77	1310	18,715	18,590	351.4	-
3- 8-77	-	-	-	-	Bailed H-2c

Method of testing: H-2c was bailed and liquid levels in H-2b were monitored.

3-16-77	1310	0	-	353.0	Commenced bailing H-2c, 1 run every 4 minutes, 12 gallons per bailer
	1320	10	-	353.0	-
	1325	15	-	353.0	-
	1340	30	-	353.0	-
	1351	41	-	353.0	-
	1400	50	-	353.1	-
	1405	55	-	353.1	-
	1415	65	-	353.1	-

Table 19.--Liquid-level recovery data, well H-2b (Culebra Dolomite Member of Rustler Formation) - Concluded

Date	Clock time	Time since pumping started (min)	Time since pumping stopped (min)	Water level (ft below land surface)	Remarks
3-16-77	1422	72	-	353.1	-
	1430	80	-	353.2	-
	1453	103	-	353.2	-
	1520	130	-	353.3	-
	1524	134	-	353.4	-
	1542	152	-	353.5	-
	1559	169	-	353.6	-
	1612	182	-	353.7	-
	1635	205	-	353.9	-
	1645	215	-	354.0	-
	1656	226	-	354.1	-
	1719	249	-	354.4	-
	1740	270	-	354.6	-
	1800	290	-	354.9	-
	2224	554	-	358.0	-
	2235	565	-	358.1	-
3-17-77	0850	1,180	-	362.7	-
	1300	1,430	-	361.1	-
3-25-77	0943	12,753	-	351.2	trace injector test conducte on H-2c, 3-22
3-26-77	1153	14,323	-	352.6	-
3-28-77	1407	17,337	-	351.9	-
3-29-77	0948	18,518	-	351.6	-
4- 1-77	1510	23,160	-	350.1	-

Shut in

An inflatable production packer was set at a depth of 585.9 feet on April 4, 1977. On April 6, the casing was perforated from 510 to 538 feet for testing the Magenta (fig. 13). The hole was bailed to develop the perforated interval, after which the Magenta zone liquid levels were monitored from April 8, 1977 to May 6, 1977 (table 20). These test data, when compared with the H-2a open-hole Magenta test, indicate that liquid communication between the formation and the cased hole is not as efficient as in an open borehole in which the maximum surface area of the formation is exposed to the borehole.

On May 13, 1977, a latch-on tool was run on tubing to the packer in H-2b and the packer was then released and pulled from the hole. A Lynes Sentry pressure-monitoring system was placed beneath the packer, and the packer was rerun on tubing to 578 feet. The packer was inflated, tubing was swabbed, and the Culebra was opened to the tubing. Long-term dual-completion monitoring began in H-2b with the Culebra liquid levels being measured through the tubing and the Magenta liquid levels being measured in the annulus. The final hole configuration and well-construction specifications are included in figure 13. On October 1, 1977, the Culebra liquid level was approaching prepumping levels at 351 feet (table 21) and the Magenta liquid level was slowly recovering 47 feet below Magenta liquid levels in H-2a (tables 22 and 23).

Testing on the Magenta cored interval in H-2a began February 22, 1977, when the hole was bailed and a water sample was taken for chemical analyses (table 2). Liquid levels were monitored throughout the rest of the year (table 23). On April 9, 1977, the Magenta interval was bailed in H-2b and a slight effect was noted in the Magenta in H-2a. By October 1, 1977, a liquid level in H-2a was at about 249 feet below land surface (table 23).

Well P-14

Drilling history.--P-14 is located 312 feet from the south line (FSL) and 613 feet from the west line (FWL) of sec. 24, T.22 S., R.30 E., in Eddy County, New Mexico. The elevation of the ground surface at the drill site is 3,358.1 feet above mean sea level.

WIPP Hydrology Program, Waste Isolation Pilot Plant, SENM, Hydrologic Data Report #1 (SAND85-7206), Section A, pages 4 through 12.

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WIPP Hydrology Program

Waste Isolation Pilot Plant, SENM

Hydrologic Data Report #1

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Prepared by Sandia National Laboratories Albuquerque, New Mexico 87185 and Livermore, California 94550 for the United States Department of Energy under Contract DE-AC04-76DP00789

Printed September 1985

A. Drilling and Recompletions, 1983-1984

Hydrologic test wells have been completed at twelve sites, termed hydropads, for the purpose of testing the water-bearing units in the Rustler Formation. In addition, other holes which were drilled for other purposes have been recompleted to serve as hydrologic test wells. Two of the hydropads, H-1 and H-12, contain only a single well. Eight of the hydropads, H-3, H-4, H-5, H-6, H-8, H-9, H-10, and H-11, contain three wells. Two hydropads, H-2 and H-7, have been completed with four wells. These hydropads contain a total of 34 wells. A summary of the units accessible for testing in each of the wells is given in Table II.A.1. The locations of the hydropads are shown in Figure II.A.1 (Site Location Map).

The majority of the wells in the WIPP site were completed prior to 1983. During 1983, ten hydrological test holes (H-2a, H-2b2, H-3b2, H-3b3, H-7b2, H-9a, H-11b1, H-11b2, H-11b3, and H-12) were drilled or deepened to the first occurrence of halite in the Rustler Formation below the Culebra Dolomite Member. The purpose of the drilling was to expand the geological data base and provide additional sites for hydrological testing of the Culebra Member. In 1984, H-2a, H-2b2, H-9a, and H-11b2 were recompleted with screen across the Culebra and casing to the surface to prevent caving.

The holes were drilled using rotary rock-bit and diamond-coring techniques. Both oilfield-style and continuous wireline coring methods were employed, the former when core orientation was needed.

Table II.A.1:

Summary of Hydropad Well Completions

	Accessible Units		
	Magenta	Culebra	Rustler/Salado Contact
H-1	X	X	X
H-2a	X	X	
H-2b	X	X	
H-2b2		X	
H-2c		X	X
H-3	X	X	X
H-3b2		X	
H-3b3		X	
H-4a	X	X	
H-4b		X	
H-4c		X	X
H-5a	X	X	
H-5b		X	
H-5c		X	X
H-6a	X	X	
H-6b		X	
H-6c		X	X
H-7a	X		
H-7b		X	
H-7b2		X	
H-7c		X	X
H-8a	X		
H-8b		X	
H-8c			X
H-9a	X	X	
H-9b		X	
H-9c		X	X
H-10a	X		
H-10b		X	
H-10c			X
H-11b1		X	
H-11b2		X	
H-11b3		X	
H-12		X	

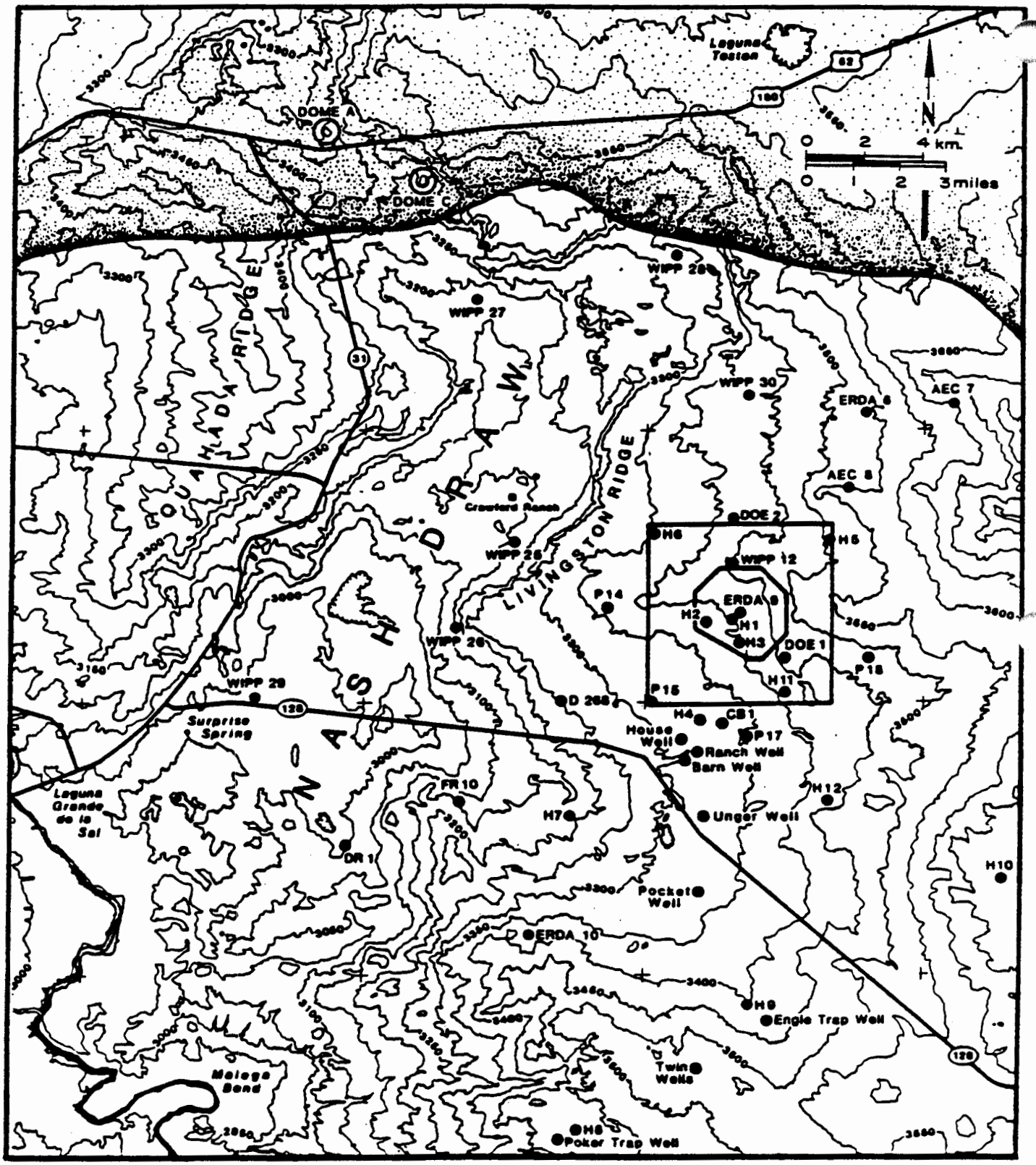

Figure II.A.1. Site location map.

The drilling was done using as little commercial mud material as possible. The reasons behind this were both to contain costs and to avoid the introduction of foreign material to the zone of interest which could alter its physical and chemical properties.

The basic drilling fluid was NaCl-saturated brine (10 pounds/gal) purchased from Rowland Trucking Co., Carlsbad, NM. For "spudding in" (beginning the hole), attapulgite and caustic soda were added to insure sufficient carrying capacity to clean the hole. As the drilling progressed, clay material from the Dewey Lake Red Beds furnished sufficient viscosity to make further additions of attapulgite unnecessary. The Culebra Member was drilled with clear brine to minimize plugging of the formation and introduction of foreign material.

The exception to this general drilling procedure was the drilling of H-7b2 where large quantities of drilling starch were used in an attempt to control the loss of circulation. The problem could not be solved and the drilling had to be completed using foam.

Partial loss of circulation was common in most of the holes penetrating the upper 200 feet of the Dewey Lake Formation. It generally diminished as drilling progressed, evidently due to plugging with clay material from the underlying formation.

Attapulgite-starch mud was used in recompletions of H-9a and H-2a to clean caved material from the hole and stabilize sloughing zones until the intermediate casing could be run and cemented. The Culebra was then washed out with clear brine and screen was set.

Following are brief summaries of basic drilling data for the hydrological test holes drilled or deepened in 1983-1984. All drilling and completions were performed by Pennsylvania Drilling Co. of Artesia, New Mexico.

H-2a. The a-hole on the H-2 pad was originally drilled to 563' and cased to 511' (6-5/8" OD, J-55, 24 lb/ft). Deepening of H-2a began on 12 July 1983. The hole was drilled to 616' with a 4-3/4" tricone bit and then cored with a 4-3/4" OD diamond core bit to 672'. A packer was set in anhydrite above the Culebra Member so that water levels in both the Magenta and Culebra Members could be monitored. By April 1984, the hole had degraded so much that it was necessary to reenter the hole, set casing to the top of the Culebra (4-1/2" OD, J-55, 9.5 lb/ft to 623') and place a screen assembly across the Culebra. The present hole configuration is shown in Figure II.A.2.

H-2b2. The H-2b2 hole was drilled for monitoring and testing of the Culebra Member of the Rustler Formation. Drilling commenced on 16 July 1983. The hole was drilled with a 7-7/8" tricone bit to 450', cored from 450'-465' with a 4-3/4" diamond core bit, reamed and drilled (with 7-7/8") to 500', and then cored again to 560'. The hole was reamed and again drilled (with 7-7/8") to 585' and then cored (4-3/4") to 660' (TD). The hole was reamed with a 7-7/8" bit to 620' and 5-1/2" OD, J-55, 15.5 lb/ft casing set to 620'. By April 1984, problems with hole instability necessitated the placement of a screen across the Culebra to maintain the hole in open condition. This was done on the first two days of May 1984. The present well configuration is shown in Figure II.A.3.

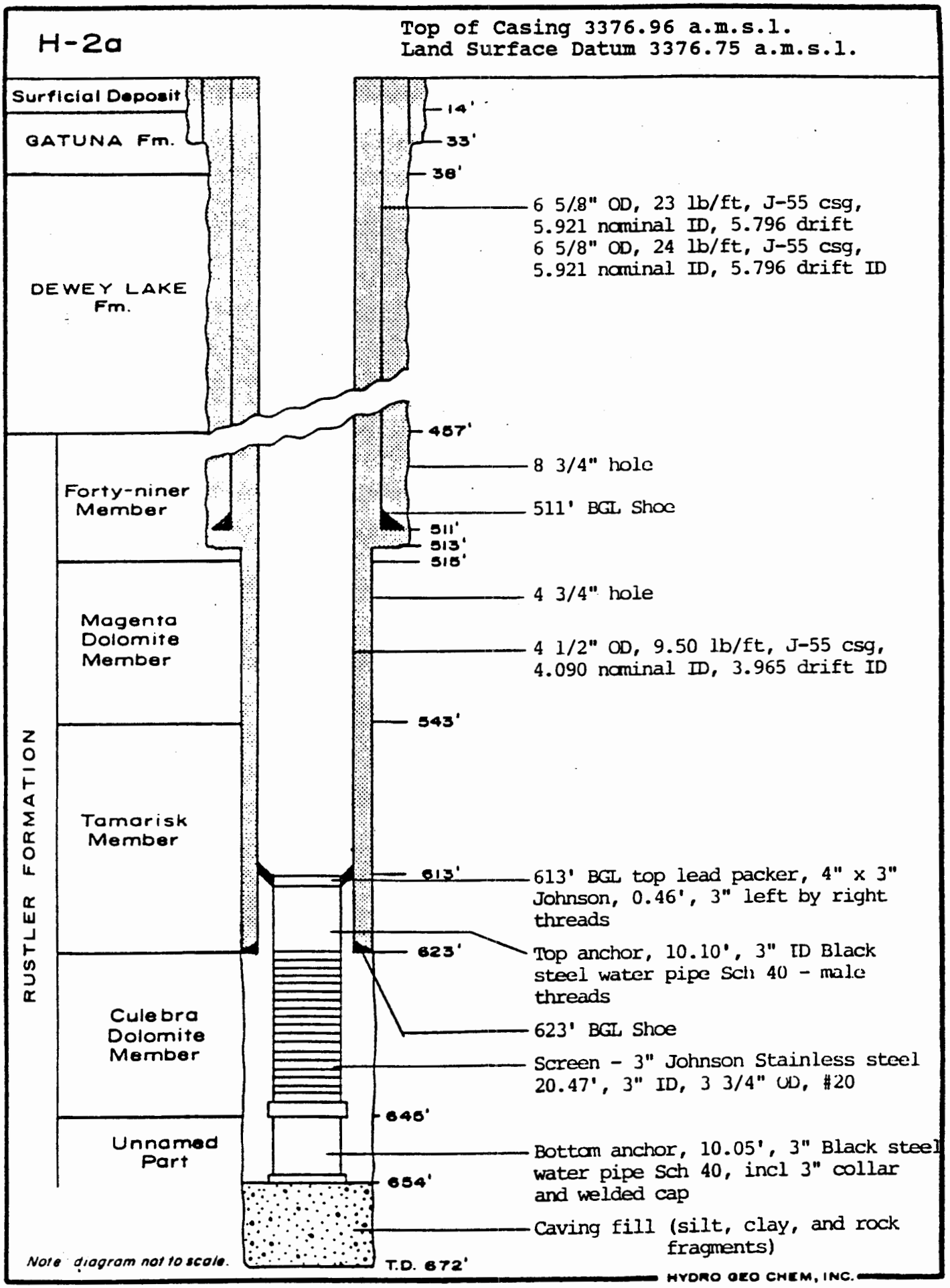

Figure II.A.2. Configuration of H-2a as of 1 May 1984

H-3b2. The H-3b2 well is one of two wells drilled to complete a triangular array on the H-3 pad. H-3b2 was cored to 725' with a 4-3/4" diamond core bit and reamed to approximately 673' with a 7-7/8" bit. Casing (5-1/2" OD, J-55, 15.5 lb/ft) was run to 672.7' and cemented on 11 November 1983.

H-3b3. The H-3b3 well is the second of the two wells drilled to complete a triangular array on the H-3 pad. The well was cored (4-3/4" diamond) to 730' and reamed (7-7/8") to 673'. Reaming was completed on 8 December 1983. H-3b3 was logged on 15 December 1983 and was kept open for testing purposes until 30 January 1984 when 5-1/2" OD casing (J-55, 15.5 lb/ft) was run to 670.5' and cemented. The current configurations of both H-3b2 and H-3b3 are shown in Figure II.A.4.

H-7b2. The H-7b2 well was drilled due to the inability to deepen H-7a economically. H-7b2 permits testing of the Culebra with a 3-well array. The H-7 location presents formidable difficulties to drilling and coring due to persistent problems with lost circulation. Surface casing (9-5/8" OD) was set to about 20' on 27 August 1983 and drilling with a 7-7/8" bit commenced on 2 September 1983. The hole was drilled to 50' and then coring begun. The coring was plagued by poor recovery and lost circulation. H-7b2 was reamed to 128' and drilled (8-3/4") to 233' from 12 to 16 September 1983. Seven-inch casing (J-55, 20 lb/ft, 6.456" ID) was run (with difficulty) to 230.19' and cemented on 17 September 1983. The cement was drilled out on 19 September and the hole cleaned to 233' where coring was once again attempted using 4-3/4" OD core bit. A cavity was drilled into at 234' and the bit dropped to 235.5' with complete loss of return. On 20 September, coring with foam was begun and

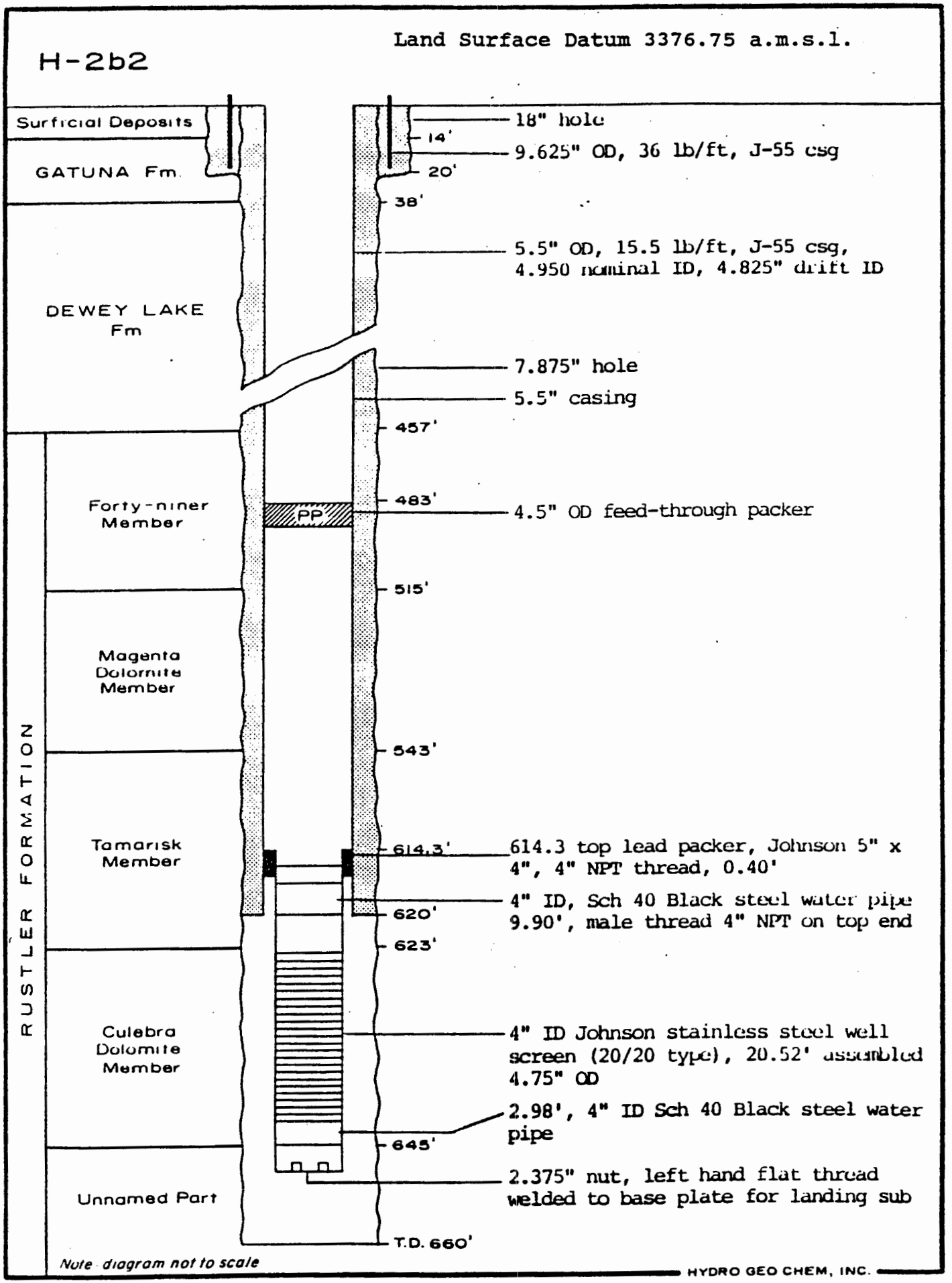

Figure II.A.3. Configuration of H-2b2 as of 3 May 1984

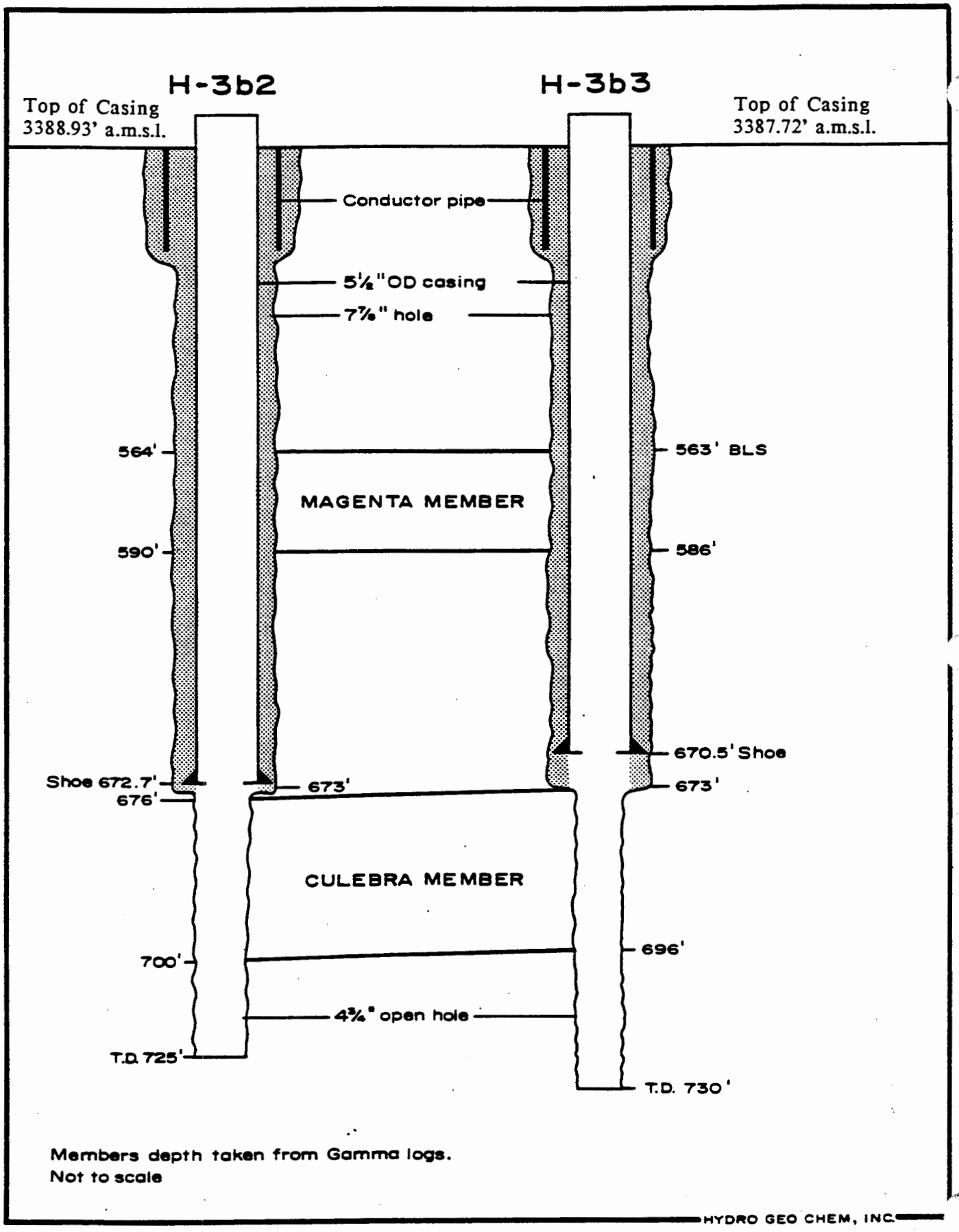

Figure II.A.4. Configuration of H-3b2 and H-3b3.

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Parts: A - H-11 Multipad Pumping and Convergent-Flow Tracer Test
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C - AEC-7 and D-268 Slug Tests
D - H-2b1, H-3b1, and H-3d Slug and Pulse Tests
E - Hydraulic Effects of Air-Intake Shaft Construction
F - Water-Level Data

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3.0 HISTORY OF WELL CONSTRUCTION AND TESTING

3.1 H-2bl

Observation-well H-2bl was drilled and cased in February 1977 by the U.S. Geological Survey in cooperation with the U.S. Department of Energy and SNL as part of the initial hydrogeologic characterization of the WIPP site (Mercer and Orr, 1979). The well was rotary drilled through the Magenta dolomite and a 6-5/8-inch casing was set and cemented from ground surface to the top of the Culebra Dolomite Member of the Rustler Formation, about 70 feet below the base of the Magenta. H-2bl was drilled with air-mist for circulation and cuttings removal. The borehole was filled with a "mud gel" before setting the casing (Mercer and Orr, 1979). After coring and testing the Culebra interval, a retrievable bridge plug was set above the Culebra interval and the Magenta interval was shot perforated and tested by bailing. After the initial construction-and-testing period, a PIP was installed in H-2bl and the well was used to monitor Magenta and Culebra water levels. The PIP separating the Culebra and Magenta had to be removed and replaced several times in 1987 and 1988 because of leaks and other technical problems. In April 1989, the PIP was replaced with a retrievable bridge plug set below the Magenta interval and H-2bl was converted to a Magenta monitoring well for hydrologic testing and water-quality sampling.

A Baker Service Tools 4-1/4-inch PIP was set on 2-3/8-inch tubing above the Magenta interval on April 20, 1989 (Calendar Day 110) to minimize wellbore volume and reduce test-zone volume. Testing was performed in the 2-3/8-inch tubing with a BASKI 1-1/2-inch inflatable minipacker. The configuration of H-2bl at the beginning of the testing period is shown on Figure 3.1. After testing, the PIP was removed from H-2bl and the well was returned to service as a Magenta observation well on July 13, 1989 (Calendar Day 193).

3.2 H-3bl

Observation-well H-3bl (originally called H-3) was drilled and cased in July and August 1976 by the U.S. Geological Survey in cooperation with the U.S. Department of Energy and SNL as part of the initial hydrogeologic characterization of the WIPP site (Mercer and Orr, 1979). The well was rotary drilled into the upper Salado Formation to a total depth of 894 feet BGS. After drilling to 600 feet BGS, a PIP was set at 530 feet BGS and the water-level rise in the PIP's 2-3/8-inch tubing due to inflows over the isolated interval, 530 to 600 feet BGS, was measured. This interval includes the Magenta dolomite. After reaching total depth, drill-stem tests were conducted on the Rustler/Salado contact zone (800 to 868 feet BGS), the Rustler "salt-residue zone" in the unnamed lower member (703 to 780 feet BGS), the interval from 672 to 703 feet BGS, which includes most of the Culebra dolomite, and the interval from 558 to 605 feet BGS, which includes the Magenta dolomite. The drill-stem tests were conducted using an inflatable double-packer test tool (Mercer and Orr, 1979). H-3bl was drilled with air-mist as the drilling fluid and the borehole was reamed and filled with brine before conducting commercial geophysical logs and setting and cementing a 6-5/8-inch casing to a total depth of 891 feet BGS (Mercer and Orr, 1979).

In 1977, the Rustler/Salado contact and the Culebra dolomite intervals in H-3bl, in that order, were each shot perforated, isolated, and bailed. The Culebra interval was also geophysically logged. After perforating and testing the Culebra interval, a retrievable PIP was set above the Culebra interval, and the Magenta interval was shot perforated, and tested by bailing. After testing the Magenta, tubing was reattached to the PIP and H-3bl was used to monitor Magenta and Culebra water levels from 1977 to 1987. In 1987, the PIP was replaced with a retrievable bridge plug set below the Magenta interval and H-3bl was converted to a Magenta monitoring well for water-level monitoring and water-quality sampling.

A Baker Service Tools 4-1/4-inch PIP was set on 2-3/8-inch tubing above the Magenta interval on July 14, 1989 (Calendar Day 195) to minimize wellbore volume and reduce test-zone volume. Testing was performed in the 2-3/8-inch tubing with a BASKI 1-1/2-inch inflatable minipacker. The configuration of H-3b1 at the beginning of the testing period is shown on Figure 3.2. After testing, the PIP in H-3b1 was removed and the well was returned to service as a Magenta observation well.

3.3 H-3d

Well H-3d was drilled in April 1987 to provide additional hydrologic information on the Dewey Lake Red Beds and Forty-niner claystone in the area south of the center of the WIPP site. H-3d was drilled to a depth of approximately 555 feet BGS in the lower part of the Forty-niner Member of the Rustler Formation using brine as a drilling fluid. After drilling, an air compressor was used to evacuate the borehole fluid on three separate occasions. A Baker Service Tools 5-5/8-inch PIP was installed from 515 to 518 feet BGS in the upper anhydrite of the Forty-niner Member. In addition, 3/4-inch plastic tubing was installed in the annulus of H-3d for water-level-sounder access. The well has been used as an observation well to monitor the water levels in the Forty-niner and the Dewey Lake Red Beds as reported in Stensrud and others (1988a, 1988b, and Part F of this Hydrologic Data Report). The configuration of H-3d at the beginning of the testing period is shown on Figure 3.3.

4.0 TESTING RESULTS

4.1 Fluid-Pressure Responses to Slug and Pulse Testing

4.1.1 H-2b1 Slug and Pulse Testing

One slug-withdrawal test and one pulse-injection, slug-injection test sequence were performed on the Magenta dolomite interval in H-2b1 from

April 25 through July 31, 1989 (Calendar days 115 to 212). In both test sequences, the amount of over- or underpressure was approximately 80 psig. Figure 4.1 is a time-versus-pressure sequence plot of the initial buildup period and the slug-withdrawal and pulse tests performed at H-2bl. The first pressure-buildup period shown on the plot is the recovery response to the shutting in of the test interval with the minipacker. The first attempt to shut in the formation failed because of a leaking minipacker. A replacement minipacker was installed about 6 hours later. Figure 4.2 shows the results of the slug-injection test in H-2bl. The progress of this test was monitored by measuring water levels in H-2bl with the Solinst electric water-level sounder (Section 2.4) after deflating and removing the minipacker. Tabulated data for the slug and pulse tests at H-2bl are presented in Tables D2.1 and D2.2, Appendix D2.0.

4.1.2 H-3bl Slug and Pulse Testing

A pulse-withdrawal, slug-withdrawal test sequence in H-3bl was followed by a slug-injection test on the perforated Magenta dolomite interval in H-3bl from July 17 to August 4, 1989 (Calendar Days 198 to 216). The tests were conducted with under- and overpressures of about 90 psig. Figure 4.3 is a time-versus-pressure sequence plot of the tests performed in H-3bl. The initial fluid-pressure recovery shown on the plot is the recovery response to the shutting in of the test interval with the minipacker. Figure 4.3 shows that the formation fluid pressure returned to pretest or near-pretest pressures in approximately one day. Tabulated data for the pulse and slug testing at H-3bl are presented in Table D2.3, Appendix D2.0.

4.1.3 H-3d Pulse and Slug Testing

A pulse-withdrawal, slug-withdrawal test sequence of the Forty-niner claystone was conducted in H-3d from June 21 to August 15, 1989

(Calendar Days 172 to 227). A pulse-injection test was also attempted, but the results indicate that the minipacker may have moved during reinflation, causing the test to recover too fast. The pulse-injection test is therefore not considered a valid test. After the attempted pulse-injection test, the minipacker was deflated and removed from the well on July 7, 1989 (Calendar Day 188). The borehole was bailed to a depth of 459 feet below the top of the tubing and the minipacker was reinstalled and set on July 7, 1989 (Calendar Day 188). However, the transducer installed with the minipacker failed and the assembly was removed to replace the transducer. The minipacker was reinstalled on July 13, 1989 (Calendar Day 194). The withdrawal tests were chosen for the Forty-niner because of the anticipated low permeability of the claystone, and because the injection of non-formation water into the unit was not considered desirable. The tests were conducted with underpressures of about 90 psig. Figure 4.4 is a time-versus-pressure sequence plot of the pulse tests performed in H-3d. The initial fluid-pressure recovery shown on the plot is the recovery response to the shutting in of the test interval with the minipacker. Figure 4.5 shows the results of the slug-withdrawal test. Because of the low permeability of the Forty-niner, the slug-withdrawal-test recovery was measured with a Solinst electric water-level sounder as described in Section 2.4. Figure 4.4 shows that the formation fluid-pressure recovery to pretest or near-pretest pressures was much faster for the pulse-withdrawal test than for the slug-withdrawal test (Figure 4.5). Tabulated data for the pulse and slug testing at H-3d are presented in Tables D2.4 and D2.5, Appendix D2.0.

4.2 Water-Quality Data

Water-quality measurements of electrolytic conductivity, specific gravity, and water temperature were made on fluid removed from H-2bl, H-3bl, and H-3d during bailing. Tabulated water-quality data are provided in Table D3.1, Appendix D3.0.

4.3 Barometric-Pressure Data

Figure 4.6 is a plot of barometric pressure versus time during the testing operations at H-2bl, H-3bl, and H-3d. The data were recorded by the DAS at the H-2 and H-3 hydropads and are considered to represent barometric-pressure fluctuations affecting the WIPP site during the testing period. Tables D2.1 and D2.3, Appendix D2.0, include the tabulated barometric-pressure data along with the fluid-pressure data collected by the DAS.

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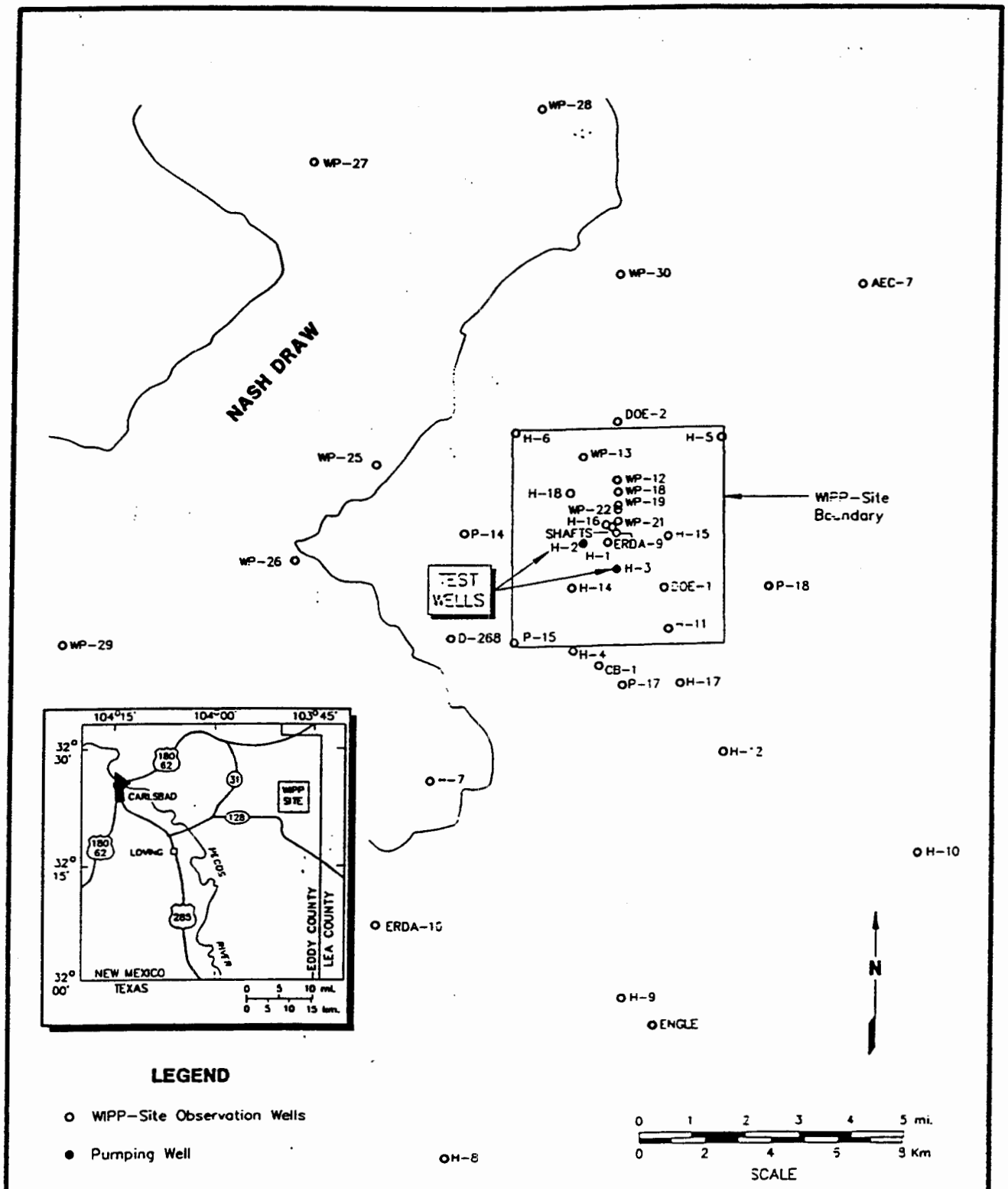
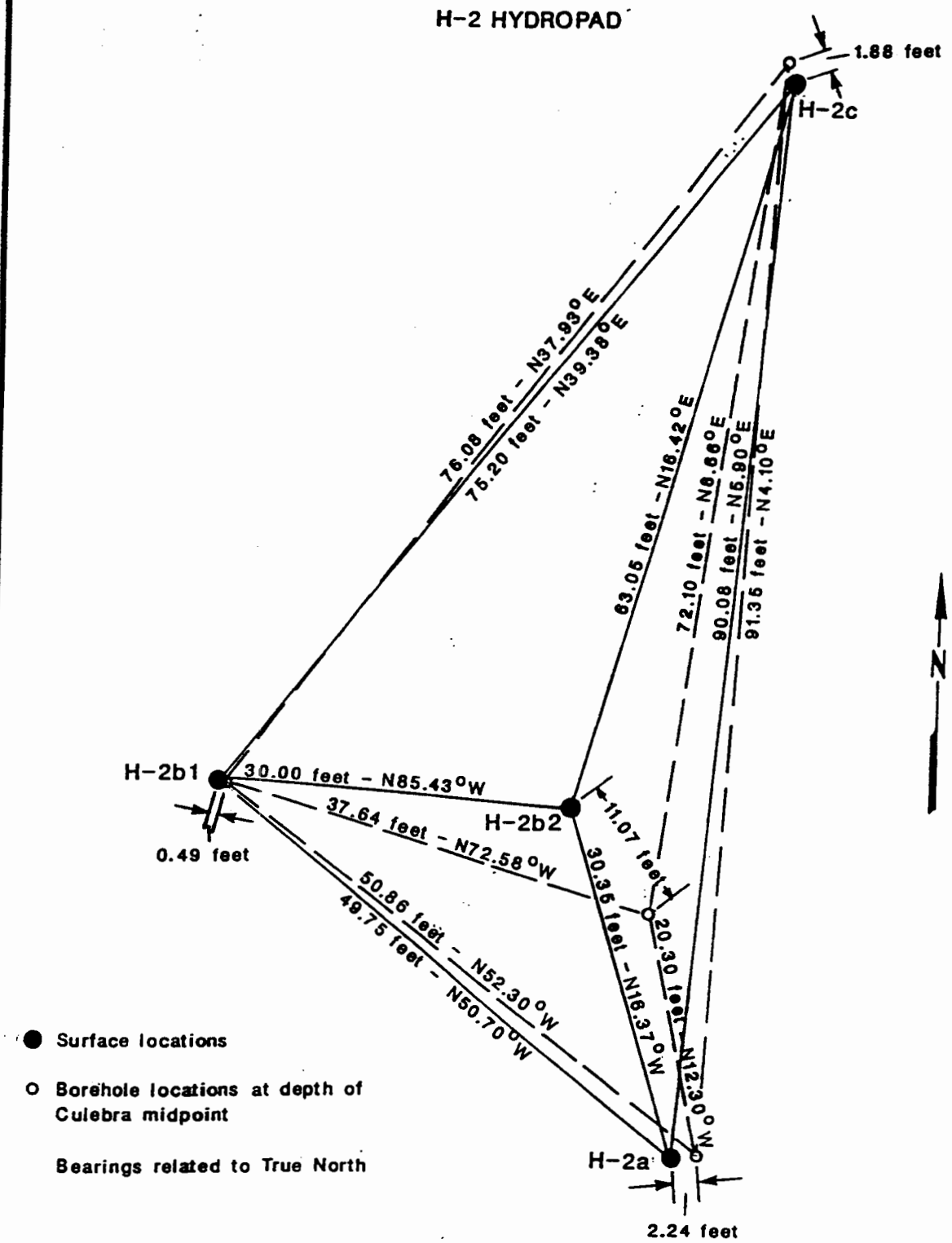
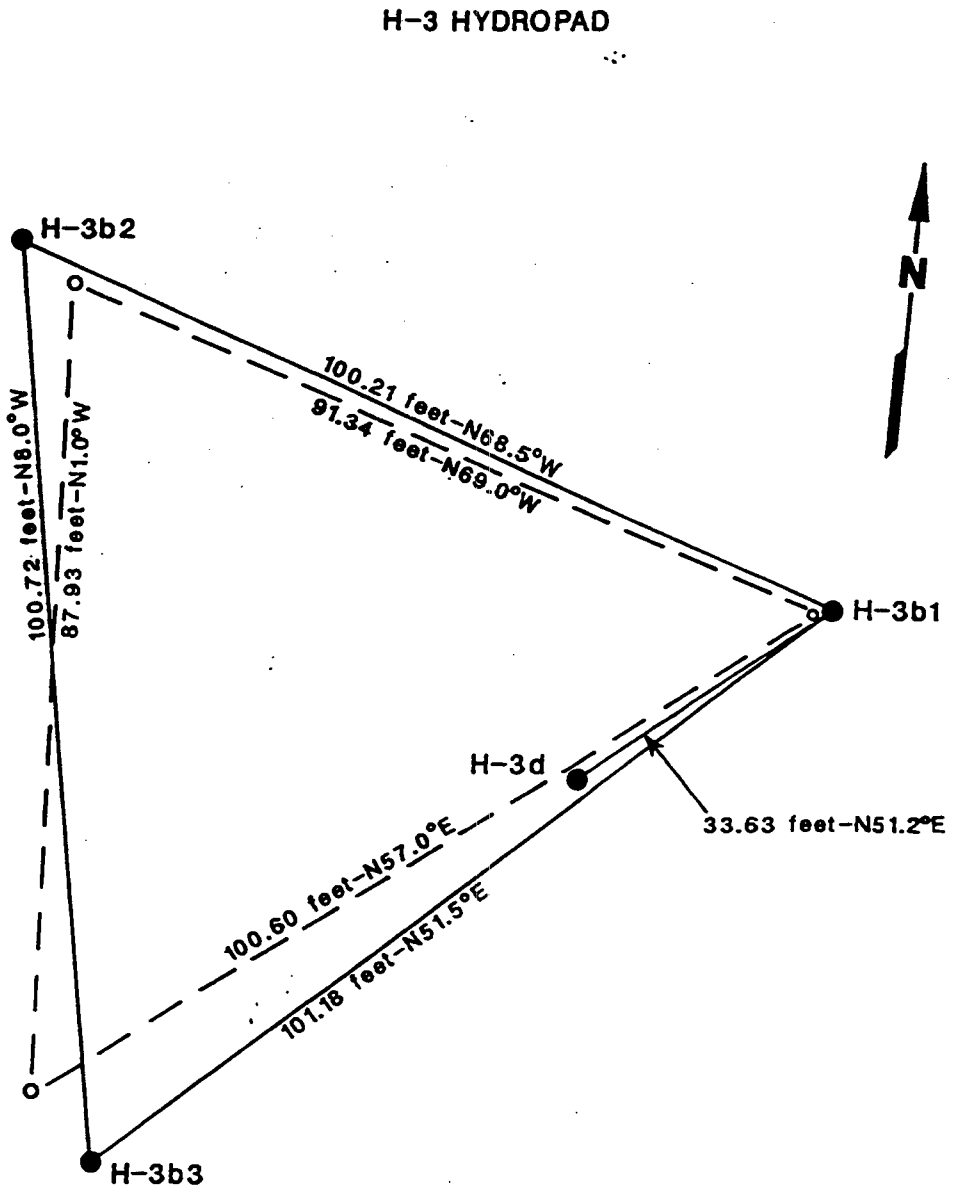


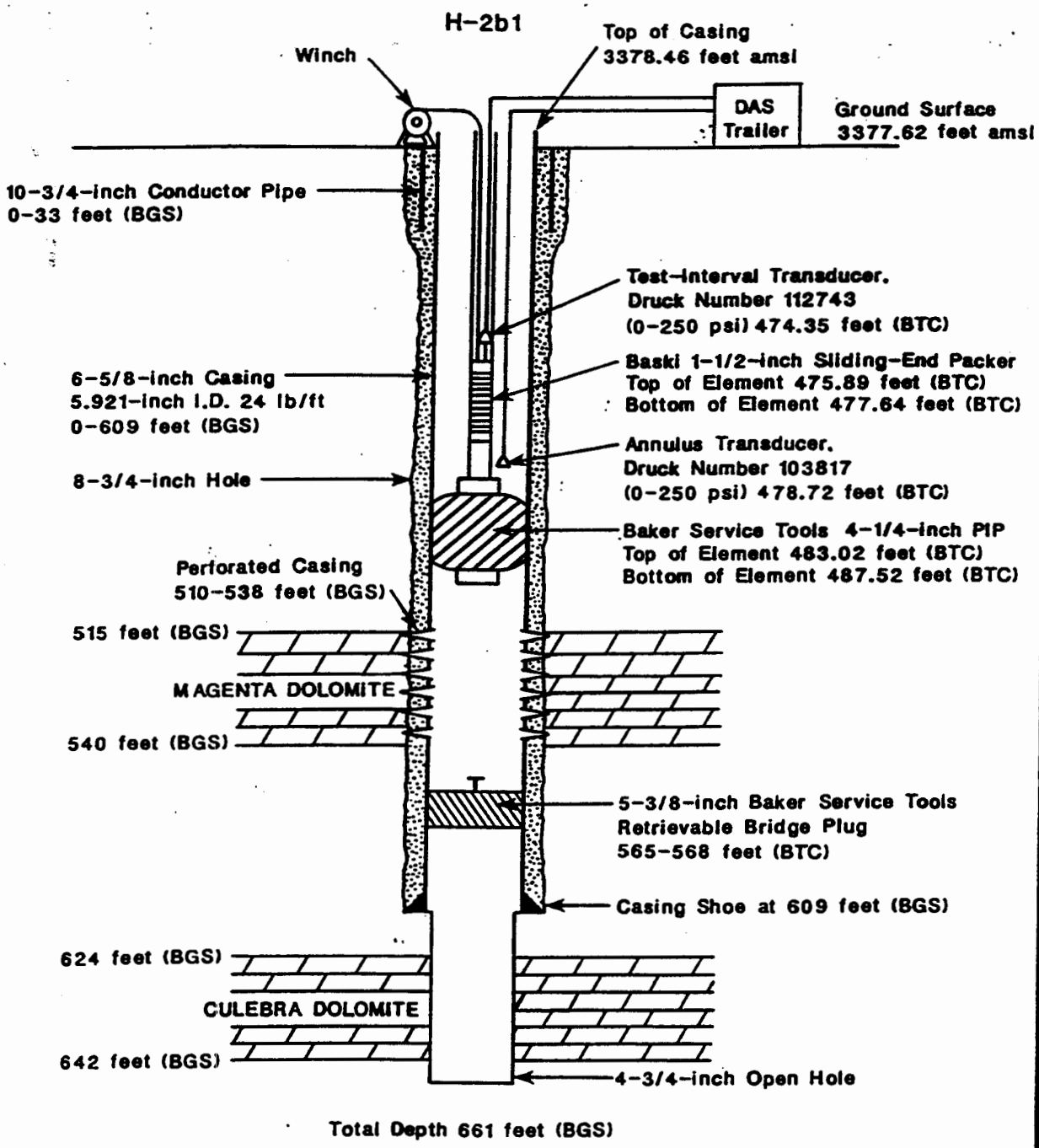
Drawn by ABW	Date 11/27/89	Locations of the H-2 and H-3 Hydropads Relative to the WIPP-Site Observation-Well Network
Checked by G.S.	Date 11/28/89	
Revisions	Date	
H09700R890D	11/28/89	
INTERA Technologies		Figure 1.1



Drawn by ABW	Date 4/19/89	Plan View of the Wells at the H-2 Hydropad
Checked by G.S.	Date 8/28/89	
Revisions	Date	
H09700R890D	8/28/89	
INTERA Technologies		Figure 1.2



Drawn by ABW	Date 8/25/89	Plan View of the Wells at the H-3 Hydropad
Checked by G.S.	Date 8/25/89	
Revisions	Date	
H09700R890D	8/25/89	
INTERA Technologies		Figure 1.3

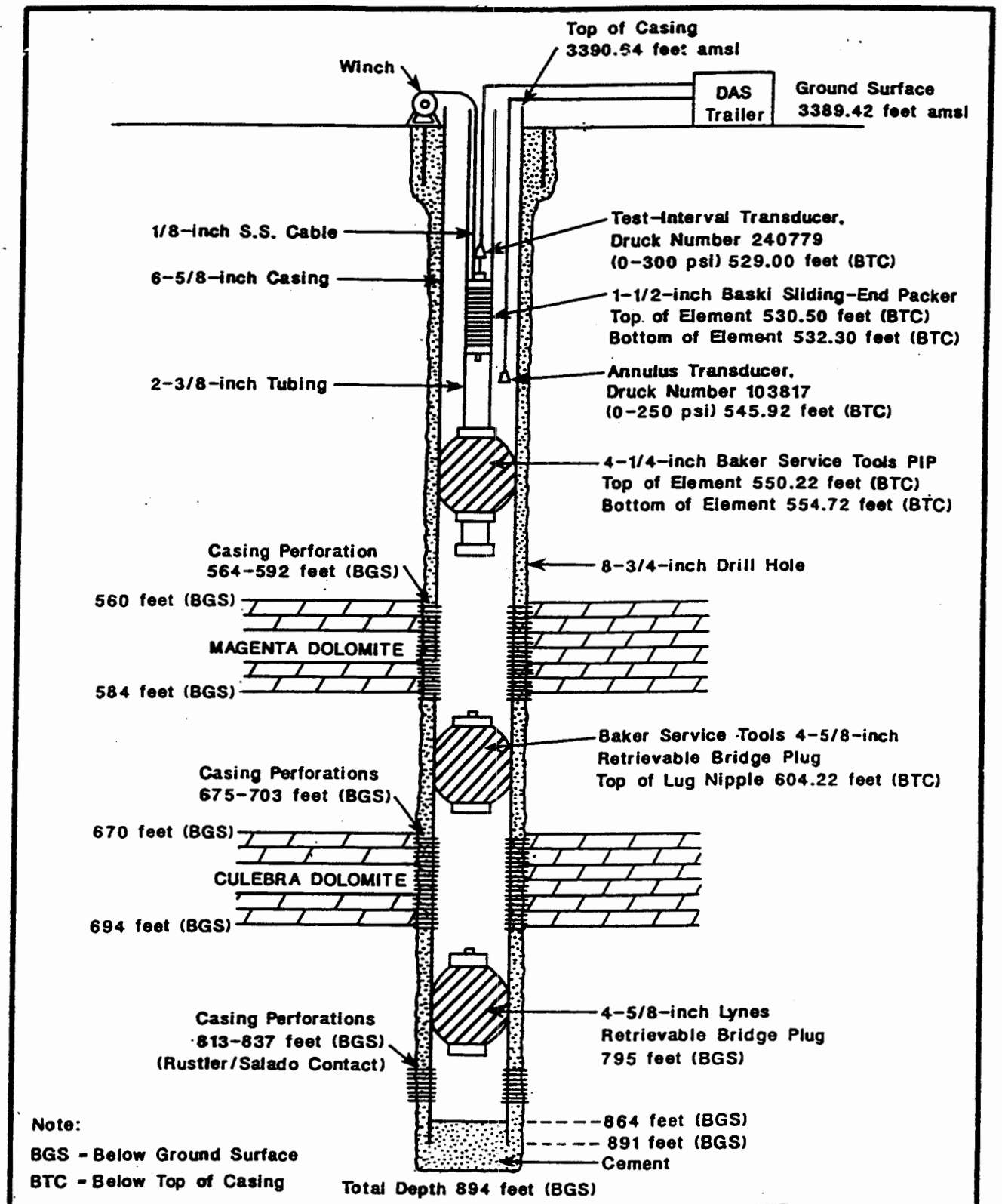


Note:

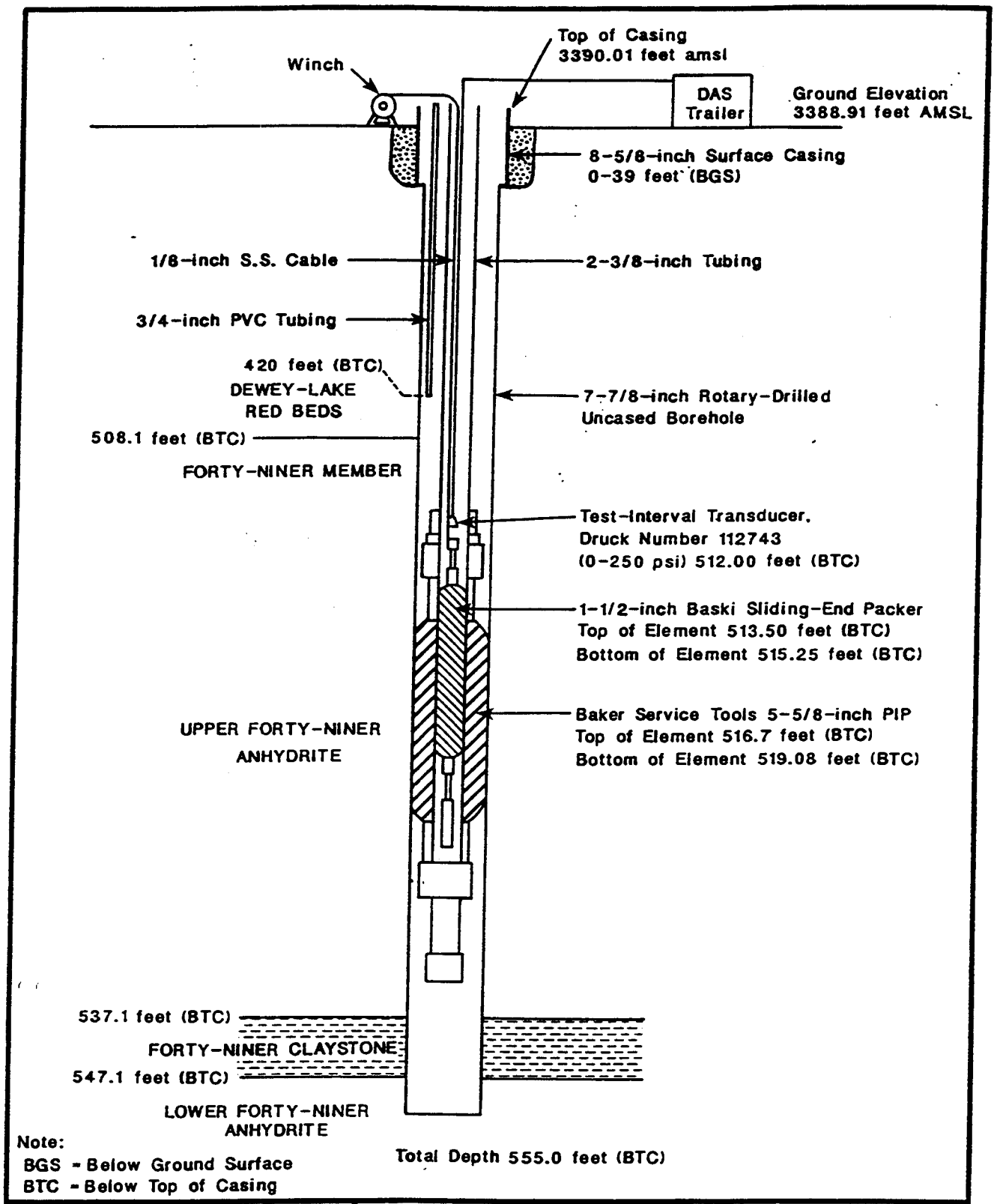
BGS - Below Ground Surface

BTC - Below Top of Casing

Drawn by	ABW	Date 8/25/89	Configuration of H-2b1 for Pulse and Slug Testing of the Magenta Dolomite
Checked by	G.S.	Date 8/25/89	
Revisions	G.S.	Date 10/24/89	
H09700R890D		8/25/89	
INTERA Technologies			Figure 3.1



Drawn by ABW	Date 8/25/89	Configuration of H-3b1 for Pulse and Slug Testing of the Magenta Dolomite
Checked by G.S.	Date 8/25/89	
Revisions G.S.	Date 10/24/89	
H09700R890D	8/25/89	
INTERA Technologies		Figure 3.2



Note:
BGS - Below Ground Surface
BTC - Below Top of Casing

Drawn by ABW	Date 8/25/89	Configuration of H-3d for Pulse and Slug Testing of the Forty-Niner
Checked by G.S.	Date 8/25/89	
Revisions G.S.	Date 10/24/89	
H09700R890D	8/25/89	

INTERA Technologies

Figure 3.3

Appendix B

Compiled Information for SWMU 001d (H-5/P-21)

Results for Hydrologic Tests and Water-Chemistry Analyses, Wells H-5a, H-5b, and H-5c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-19), pages 5-8 and Figure 18.

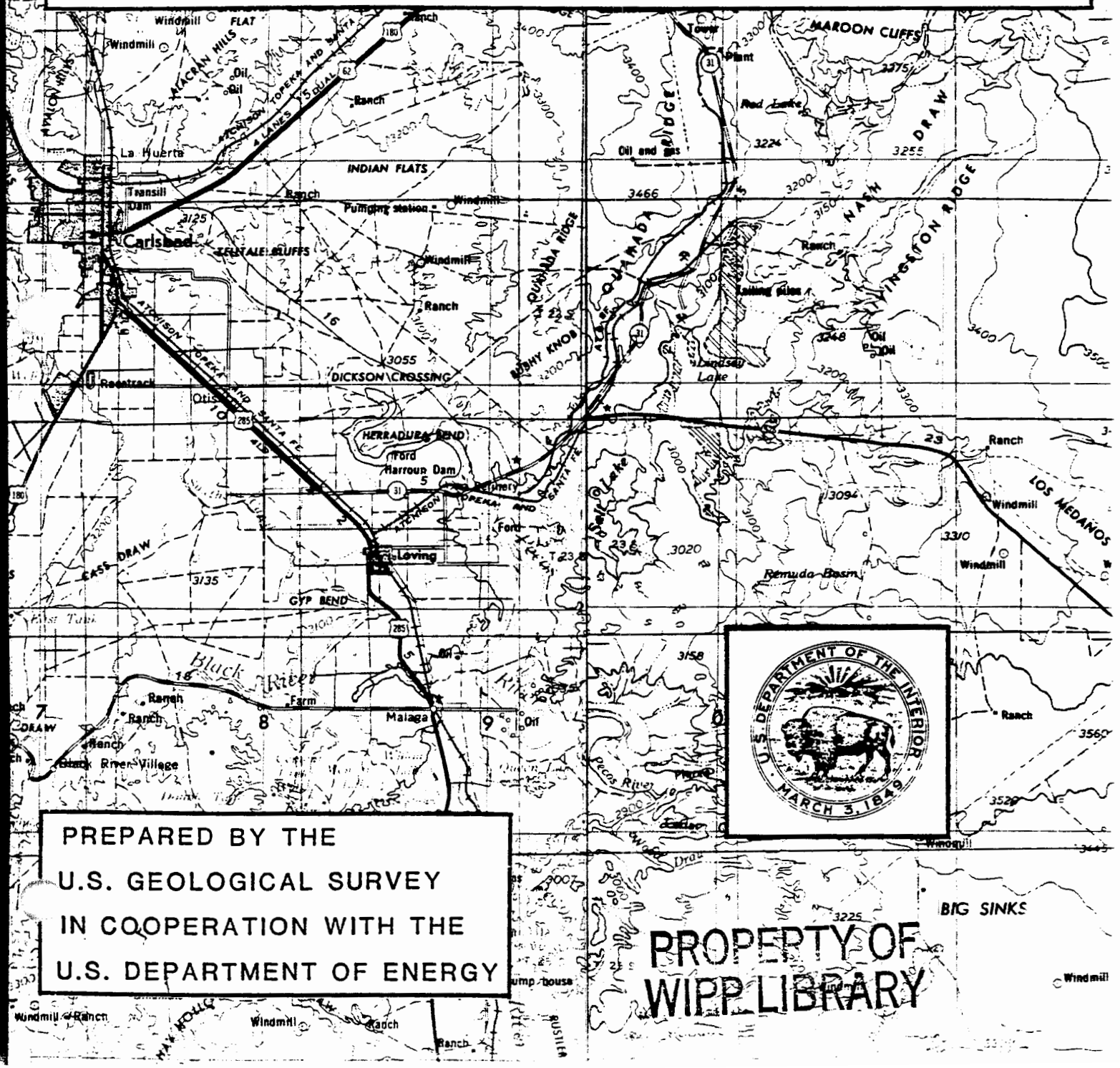
Hole History Data for Borehole P-21 (2 pages).

Results for Hydrologic Tests and Water-Chemistry Analyses, Wells H-5a, H-5b, and H-5c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-19), pages 5-8 and Figure 18.

WRI 82-19

WATER RESOURCES INVESTIGATIONS 82-19

RESULTS OF HYDROLOGIC TESTS AND WATER-CHEMISTRY ANALYSES, WELLS H-5A, H-5B, AND H-5C, AT THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO



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Acknowledgments

The authors wish to thank Robert Statler, Sandia National Laboratory, who was responsible for field operations, and Earl Cunningham, D. L. Bradley, Wayne Laney, and Matthew Wilson of Fenix & Scisson for scheduling and direction of support operation during drilling and testing.

We also wish to thank Paul Davis, who helped establish testing procedures and methods, and James Basler, who was responsible for test instrumentation development (both with the U.S. Geological Survey, Albuquerque office). We would like to express appreciation to R. K. Dewees, U.S. Geological Survey, Carlsbad Office, for collecting data during formation testing.

HYDROLOGIC TESTING

Shut-in tests and slug tests were used to determine transmissivities and estimates of storage coefficients for zones in which H-5A, H-5B, and H-5C are completed. The location of the wells is shown in figure 3. These tests were chosen because the test zones generally yield only small quantities of water to the wells, less than 0.6 gallon per minute. Both methods primarily are restricted to wells that are fully developed and fully penetrate a confined aquifer. In addition, the slug test is restricted to wells completed in aquifers of low transmissivity. In order to perform these tests and obtain optimum results, special testing procedures were devised.

Test procedures

Pretest activities

Special care was taken in the drilling program used to complete each test well. Air, air foam, and brine were used at one time or another as drilling and coring fluids (table 1). Drilling was done in such a way as to avoid contaminating or plugging the test zone, so that optimum test results would be possible.

In order to test the different zones above the repository level, three wells were drilled. Each was completed in a different test zone; Well H-5A in the Magenta Dolomite Member of the Rustler Formation, Well H-5B in the Culebra Dolomite Member of the Rustler Formation, and well H-5C in the Rustler Formation-Salado Formation contact zone. Each well was drilled to a point above the test zone, cased, and the casing cemented up to the land surface. The test zone was then cored.

Upon completion of a well, brine was used to flush the well and then compressed air was used to remove the brine from the well. This action was designed to develop the cored interval as well as guard against any plugging or contamination that might occur. Water levels were monitored until the hydrologic testing began to assure that equilibrium had been reached.

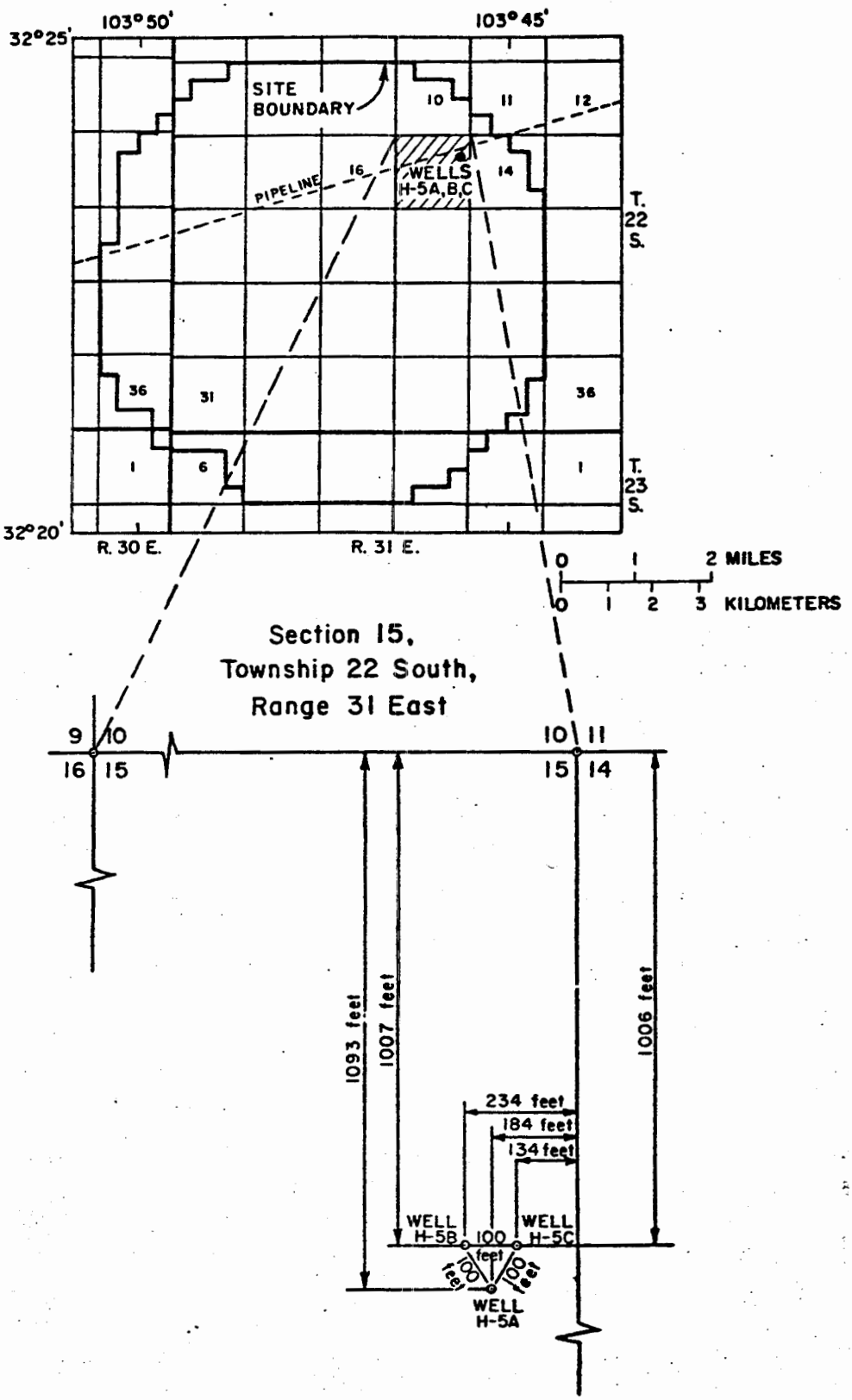


Figure 3.--Location of wells H-5A, H-5B, and H-5C within the proposed site boundary.

Table 1. Construction and testing chronologies of wells H-5A, H-5B, and H-5C

[All measurements adjusted to ground level in feet above National Geodetic Vertical Datum of 1929: H-5A, 3,506.2 feet; H-5B, 3,506.0 feet; H-5C, 3,506.4 feet.]

Well H-5A -- 1,093 feet from north line, 184 feet from east line

05-22-78	Set surface pipe.
06-13-78 to 06-17-78	Spudded and rotary drilled hole with air and air foam to 775 feet. Cleaned hole and set casing at 774 feet. Cemented casing.
06-19-78 to 06-20-78	Drilled out cement and plug, cleaned out to 775 feet. Cut core from 775 feet to a total depth of 824 feet, using brine. Flushed hole with brine and removed brine using compressed air. Hole completed.
06-21-78 to 12-09-78	Monitored water levels.
12-09-78 to 12-12-78	Conducted shut-in tests and slug test.
12-13-78 to present (1981)	Monitored water levels.

Well H-5B -- 1,007 feet from north line, 234 feet from east line

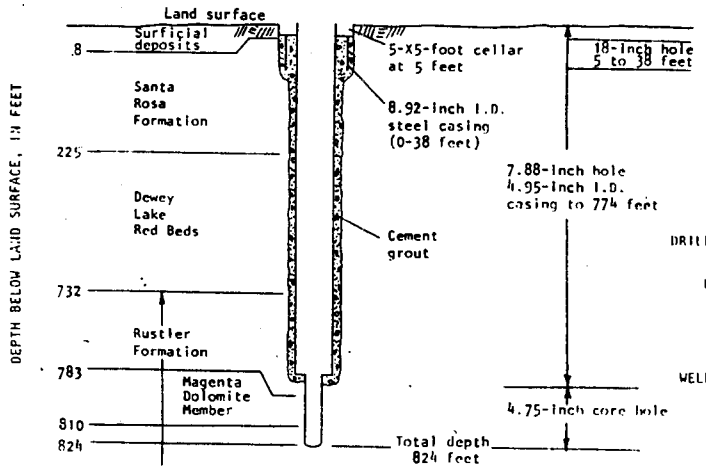
05-22-78	Set surface pipe.
06-05-78 to 06-09-78	Spudded and rotary drilled hole with air and air foam to 882 feet. Cleaned hole and set casing at 881 feet. Cemented casing.
06-12-78 to 06-13-78	Drilled out cement and plug, cleaned out to 882 feet. Cut core from 882 feet to a total depth of 925 feet, using brine. Flushed hole with brine and removed brine using compressed air. Hole completed.
06-14-78 to 12-12-78	Monitored water levels.
12-12-78 to 12-15-78	Conducted shut-in tests and slug test.
12-16-78 to present (1981)	Monitored water levels.

Table 1. Construction and testing chronologies of wells H-5A, H-5B, and H-5C - Concluded

Well H-5C -- 1,006 feet from north line, 134 feet from east line

05-22-78	Set surface pipe.
05-23-78 to 05-31-78	Spudded and rotary drilled hole with air, air foam, and brine to 1,025 feet. Obtained geophysical logs. Cleaned hole and set casing at 1,024 feet. Cemented casing.
06-02-78 to 06-03-78	Drilled out cement and plug, cleaned out to 1,026 feet. Cut core from 1,026 to a total depth of 1,076 feet using air and brine. Flushed hole with brine and removed brine using compressed air. Hole completed.
06-04-78 to 10-03-78	Monitored water levels.
10-03-78 to 11-07-78	Surface-water runoff accidentally drained into well.
12-15-78	Bailed hole dry to evacuate contaminated formation water.
12-16-78 to 05-16-79	Monitored water levels.
05-17-79 to 08-24-79	Added closely matched density water to well in order to set packer. Packer set and pressure recovery monitored until static pressure was reached.
08-24-79 to 06-10-80	Conducted slug (flow-in) test.
06-11-80 to present (1981)	Monitored water levels.

WELL H-5A



LOCATION: 1093 feet from north line, 184 feet from east line, section 15, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3506.2 feet

DEPTH DRILLED: 824 feet

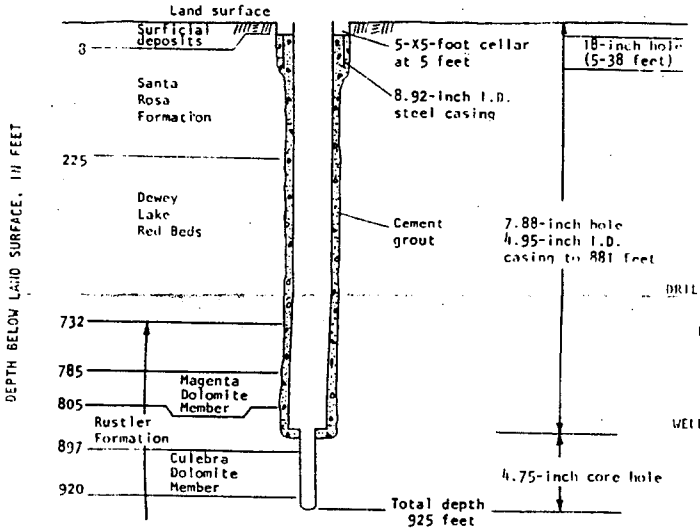
DATE COMPLETED: June 20, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air (38-109 feet), changed to air foam (109-775 feet). Cut 4.75-inch core using brine (775-824 feet).

WELL CASING RECORD: 8.92-inch inside diameter steel casing (0-38 feet). 4.95-inch inside diameter steel casing (0-774 feet).

WELL H-5B



LOCATION: 1007 feet from north line, 234 feet from east line, section 15, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3506.0 feet

DEPTH DRILLED: ~925 feet

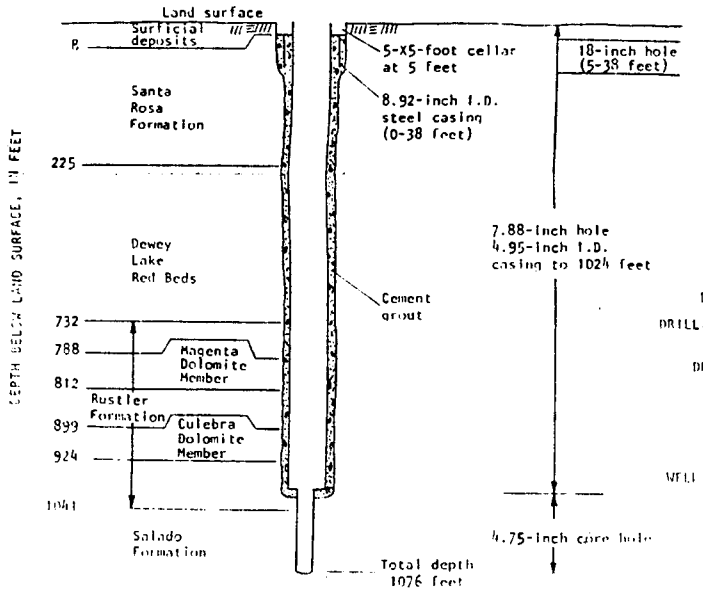
DATE COMPLETED: June 13, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air (38-148 feet), changed to air foam (148-882 feet). Cut 4.75-inch core using brine (882-925 feet).

WELL CASING RECORD: 8.92-inch inside diameter steel casing (0-38 feet). 4.95-inch inside diameter steel casing (0-881 feet).

WELL H-5C



LOCATION: 1006 feet from north line, 134 feet from east line, section 15, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3506.4 feet

DEPTH DRILLED: 1076 feet

DATE COMPLETED: June 3, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air (38-225 feet), changed to air foam (225-1025 feet). Cut 4.75-inch core using brine (1025-1048 feet), changed to air (1048-1076).

WELL CASING RECORD: 8.92-inch inside diameter steel casing (0-38 feet). 4.95-inch inside diameter steel casing (0-1024 feet).

Figure 18.--Construction detail of wells H-5A, H-5B, and H-5C.

Hole History Data for Borehole P-21 (2 pages).

FENIX & SCISSON, INC.

HOLE HISTORY DATA

E: 6-28-77 APPROVED:

HOLE No.:	ERDA P-21	W. O. No.:		I. D. No.:	
USER:	Sandia Lab	TYPE HOLE:	Exploratory/Potash Evaluation		
LOCATION:	New Mexico	COUNTY:	Eddy	AREA:	Los Medanos
SURFACE COORDINATES:	852' FNL, 150' FEL, Sec. 15, T22S, R31E			GROUND ELEVATION:	3510.2'
RIG ON LOCATION:		SPUDDED:	10-15-76	Plugged:	10-27-76
CIRCULATING MEDIA:	Air foam to 525', salt base mud to 1915'.				
No. of COMPRESSORS & SIZE:					

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CMT.
0'	23'	8-3/4"	6-5/8" (O.D.)			Used		0'	23'	None
23'	1105'	5-7/8"	4"			HW		0'	1105'	None
1105'	1510'	3-15/16"								
1510'	1915'	3-15/16"								

TOTAL DEPTH: 1915' MANDREL DEPTH PLUGS: Plugged to surface w/425 ft^3

JUNK:

LOGGING DATA: Page 1 SURVEYS PAGE: CORING PAGE:

TOM HOLE COORDINATES: @ REFERENCE:

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Move Rig up & down	____ days	Equipment Repair	0.16 days	Drilling Time	3.96 days
Secured w/o Crew	2.50 days	Caving	____ days	Trip Time	0.50 days
Bail & Run Mandrel	____ days	Lost Circ.	____ days	Single Shot Survey Time	____ days
Logging	0.29 days	Fishing	0.10 days		____ days
Survey	____ days	W.O. Equipment	____ days	Total	4.46 days
Casing Run & Pull	0.58 days	Haul & Mix Mud	0.25 days	Total Suspended Time	____ days
Cement	____ days	W.O. Loggers	0.17 days	Non-Operational Time	6.16 days
Coring	2.52 days		____ days	Operational Delay Time	1.19 days
Plug Back	0.27 days		____ days	Working Time	4.46 days
TOTAL	6.16 days	TOTAL	1.19 days	TOTAL ELAPSED TIME	11.81 days

REMARKS: Casing pulled.

Rig No.	Name	Type	
3625	Boyles Bros.	Failing 2000	11.81 days
			____ days
			____ days
			____ days
			____ days
			____ days

ERDA P-21

HOLE HISTORY

10-15-76 Moved in Boyles Bros. rig #3625 and rigged up. Drilled 8-3/4" hole from 0' to 23' with air foam. Set 6-5/8" O.D. used casing at 23', not cemented. Drilled 5-7/8" hole from 23' to 270'.

10-16-76 Drilled 5-7/8" hole from 270' to 450'.

10-17-76 Drilled 5-7/8" hole from 450' to 505' and stuck rods. Worked rods free and drilled from 505' to 525'. Surface casing dropped 6'. Pulled out of hole and secured rig at 1200 hours.

10-18-76 Rig secured to 0800 hours. Mixed up salt base mud. Drilled 5-7/8" hole from 525' to 750'.

10-19-76 Rig secured to 0800 hours. Drilled 5-7/8" hole from 750' to 855'. Pulled out of hole.

10-20-76 Changed out bit and ran in hole. Drilled 5-7/8" hole from 855' to 1105'. Pulled out of hole and started running casing.

10-21-76 Completed running 4½" O.D., HW casing and set at 1105', not cemented. Made up 3-15/16" drilling assembly and ran in hole. Drilled from 1105' to 1300'. Pulled surface casing.

10-22-76 Drilled 3-15/16" hole from 1300' to 1510'. Pulled out of hole and made up 3-15/16" coring assembly. Cored from 1510' to 1540'.

10-23-76 Cored from 1540' to 1720'.

10-24-76 Rig secured.

10-25-76 Rig secured to 0800 hours. Cored from 1720' to 1855'.

10-26-76 Cored from 1855' to 1915'. Pulled out of hole. Waited on logging unit. Ran USGS logs.

10-27-76 Completed logging. Pulled and recovered casing. Plugged back hole from 1915' using Halliburton with 500 gallons of mud flush ahead of 295 sacks (425 ft^3) of 50% Class "C" cement, 50% Pozmix "A", 2% gel and 19.4# per sack of salt. Circulated 20 sacks (29 ft^3) of slurry to surface. Set 1 joint of 3½" O.D. casing in the soft cement and cut off 1' above ground level for a hole marker. Hole plugged.

LOG INDEX

Type Log	Date	Run No.	Depth Driller	Depth Logger	Logged From	Logged To
USGS LOGS						
Gamma	10-26-76				2'	1918'
Gamma-Gamma	10-26-76				12'	1916'
Neutron	10-26-76				0'	1916'

Appendix C

Compiled Information for SWMU 001e (H-6/P-13)

Results for Hydrologic Tests and Water-Chemistry Analyses, Wells H-6a, H-6b, and H-6c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-8), pages 6-9 and Figure 13.

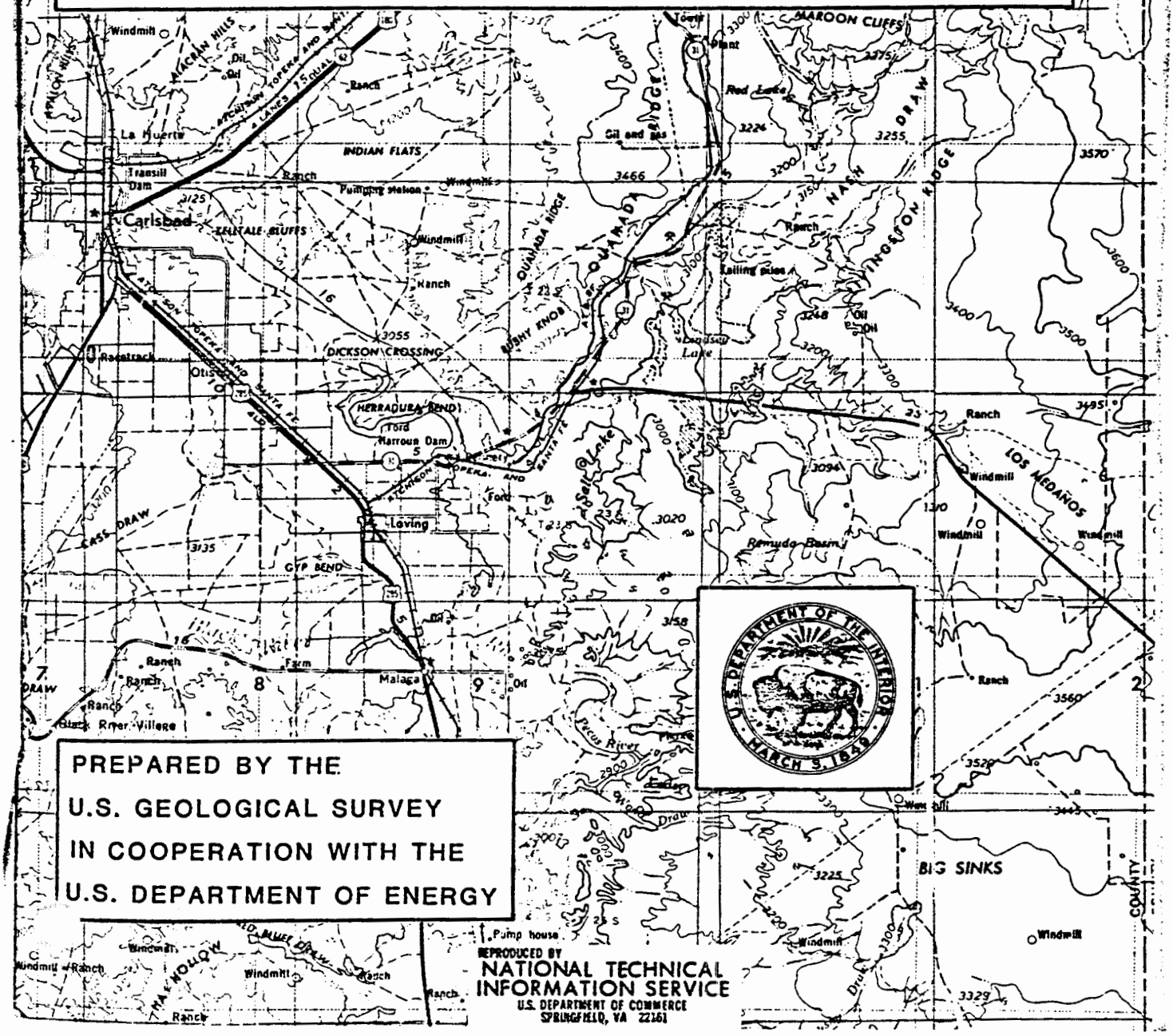
Hole History Data for Borehole P-13 (2 pages).

Results for Hydrologic Tests and Water-Chemistry Analyses, Wells H-6a, H-6b, and H-6c, at the Proposed Waste Isolation Pilot Plant Site, Southeastern New Mexico (USGS WRI 82-8), pages 6-9 and Figure 13.

PB83-104042

WATER-RESOURCES INVESTIGATIONS 82-8

RESULTS OF HYDROLOGIC TESTS AND WATER-CHEMISTRY ANALYSES, WELLS H-6A, H-6B, AND H-6C, AT THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO



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HYDROLOGIC TESTING

Shut-in tests and slug tests were used to determine transmissivities and estimates of storage coefficients of the zones in which wells H-6A and H-6C are completed. The locations of the wells are shown in figure 3. These tests were chosen because the test zones generally yield only small quantities of water to the wells (less than 0.5 gallon per minute). Both methods are primarily restricted to wells that are fully developed and fully penetrate a confined aquifer. In addition, the slug test is restricted to wells completed in aquifers of low transmissivity. In order to perform these tests and obtain optimum results, special testing procedures were devised.

Well H-6B, completed in the Culebra Dolomite Member of the Rustler Formation, produced sufficient quantities of water to render shut-in and slug tests ineffective in the determination of transmissivity and storage coefficient values. Therefore, Sandia National Laboratories contracted Geohydrology Associates, Inc., Albuquerque, New Mexico, to conduct conventional pumping and recovery tests on well H-6B and to ascertain a transmissivity value for the test zone. The results of the conventional pumping and recovery tests are given in this report.

Test procedures

Pretest activities

Special care was taken in the drilling program used to complete each test well. Air, air foam, and brine were used at one time or another as drilling and coring fluids (table 1). Drilling was done in such a way as to avoid contaminating or plugging the test zone, so that optimum test results would be possible.

In order to test the different zones above the repository level, three wells were drilled. Each well was completed in a different test zone: well H-6A in the Magenta Dolomite Member of the Rustler Formation, well H-6B in the Culebra Dolomite Member of the Rustler Formation, and well H-6C in the Rustler Formation-Salado Formation contact zone. Each well was drilled to a point above the test zone, cased, and the casing cemented up to the land surface. The test zone was then cored.

Upon completion of a well, brine was used to flush the well, and then compressed air was used to remove the brine from the well. This action was designed to develop the cored interval as well as guard against any plugging or contamination that might occur. Water levels were monitored until hydrologic testing began to assure that equilibrium had been reached.

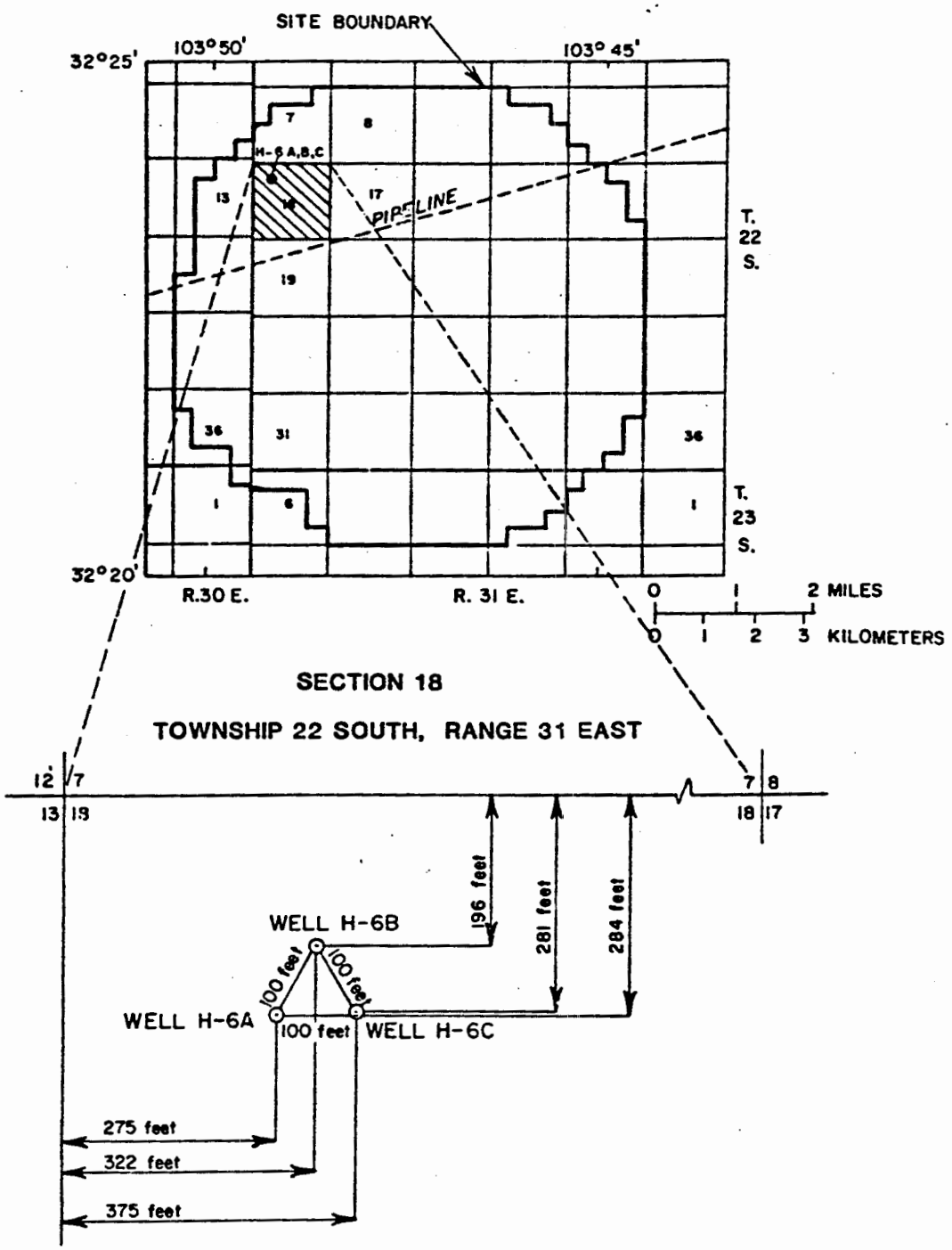


Figure 3.--Location of wells H-6A, H-6B, and H-6C within the proposed site boundary.

Table 1. Construction and testing chronologies of wells H-6A, H-6B, and H-6C (in section 18, Township 22 South, Range 31 East)

[All measurements adjusted to ground level in feet above National Geodetic Vertical Datum of 1929: H-6A, 3,347.3 feet; H-6B, 3,347.6 feet; H-6C, 3,347.9 feet.]

Well H-6A -- 284 feet from north section line, 275 feet from west section line

06-19-78	Set surface pipe.
07-06-78 to 07-07-78	Spudded and rotary drilled hole with air to 475 feet. Cleaned hole and set casing at 474.5 feet. Cemented casing.
07-10-78 to 07-11-78	Drilled out cement and plug, cleaned out to 475 feet using air foam. Cut core from 475 feet to a total depth of 525 feet using freshwater. Flushed hole with brine and removed brine using compressed air. Hole completed.
07-12-78 to 12-15-78	Monitored water levels.
12-16-78 to 12-18-78	Conducted shut-in and slug tests.
12-19-78 to present (1982)	Monitored water levels.

Well H-6B -- 196 feet from north section line, 322 feet from west section line

06-19-78	Set surface pipe.
06-27-78 to 06-29-78	Spudded and rotary drilled hole with air and air foam to 592 feet. Cleaned hole and set casing at 590 feet. Cemented casing.
07-01-78	Drilled out cement and plug, cleaned out to 592 feet using air foam.
07-05-78	Cut core from 592 feet to a total depth of 640 feet using freshwater. Flushed hole with brine and removed brine using compressed air. Hole completed.
07-06-78 to 12-18-78	Monitored water levels.

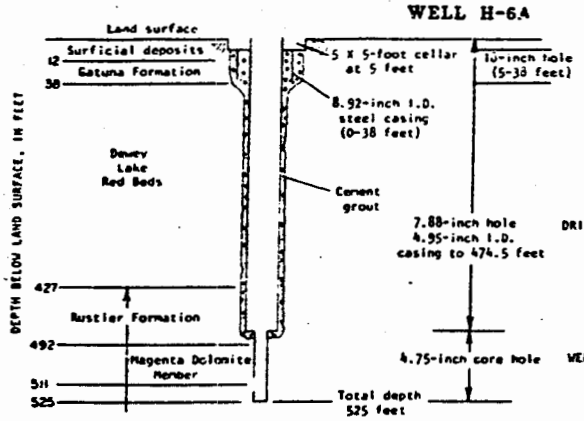
Table 1. Construction and testing chronologies of wells H-6A, H-6B, and H-6C - Concluded

12-19-78	Attempted to conduct shut-in and slug tests; test results insufficient.
12-20-78 to 09-17-79	Monitored water levels.
09-18-79 to 09-25-79	Pumping and recovery tests conducted by Geohydrology Associates, Inc.
09-26-79 to present (1982)	Monitored water levels.

Well H-6C -- 281 feet from north section line, 375 feet from west section line

06-19-78	Set surface pipe.
06-20-78 to 06-23-78	Spudded and rotary drilled hole with air and air foam to 700 feet. Cleaned hole and obtained geophysical logs. Set casing at 699 feet and cemented in place.
06-26-78	Drilled out cement and plug to 699 feet and cleaned out to 700 feet using air foam. Cut core from 700 feet to a total depth of 741 feet using brine. Flushed hole with brine and removed brine using compressed air. Hole completed.
06-27-78 to 03-20-79	Monitored water levels.
03-21-79 to 04-09-79	Conducted shut-in and slug tests.
04-10-79 to present (1982)	Monitored water levels.

WELL H-6A



LOCATION: 284 feet from north line, 275 feet from west line, section 18, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3347.3 feet

TOTAL DEPTH: 525 feet

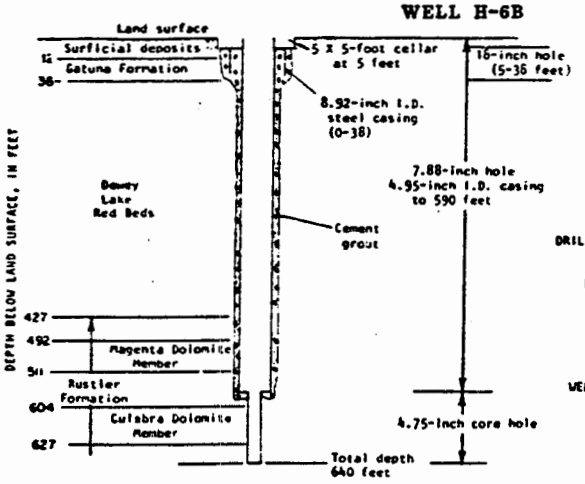
DATE COMPLETED: July 11, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air to 475 feet. Cut 4.75-inch core using freshwater (475 to 525 feet)

WELL-CASING RECORD: 8.92-inch I.D. steel casing (0-38 feet). 4.95-inch I.D. steel casing (0-474.5 feet.

WELL H-6B



LOCATION: 196 feet from north line, 322 feet from west line, section 18, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3347.6 feet

TOTAL DEPTH: 640 feet

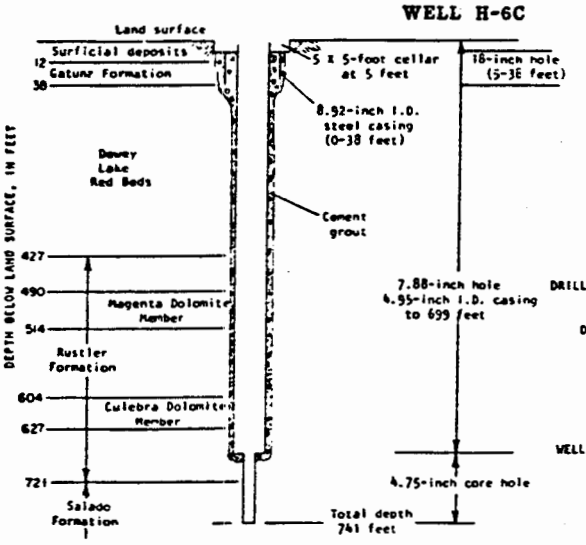
DATE COMPLETED: July 5, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air (38-492 feet), changed to air foam (492-592 feet) Cut 4.75-inch core using freshwater (592-640 feet)

WELL-CASING RECORD: 8.92-inch I.D. steel casing (0-38 feet). 4.95-inch I.D. steel casing (0-590)

WELL H-6C



LOCATION: 281 feet from north line, 375 feet from west line, section 18, Township 22 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3347.9 feet

TOTAL DEPTH: 741 feet

DATE COMPLETED: June 26, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-38 feet). Rotary drilled 7.88-inch hole with air (38-508 feet), changed to air foam (508-700 feet). Cut 4.75-inch core using brine (700-721 feet), changed to air foam (721-741 feet)

WELL-CASING RECORD: 8.92-inch I.D. steel casing (0-38 feet). 4.95-inch I.D. steel casing (0-699 feet)

Figure 13.--Construction detail of wells H-6A, H-6B, and H-6C.

Hole History Data for Borehole P-13 (2 pages).

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 6-30-77 APPROVED:

HOLE No.:	ERDA P-13	W. O. No.:		I. D. No.:	
USER:	Sandia Lab	TYPE HOLE:	Exploratory/Potash Evaluation		
LOCATION:	New Mexico	COUNTY:	Eddy	AREA:	Los Medanos
SURFACE COORDINATES:	125' FNL, 116' FWL, Sec. 18, T22S, R31E			GROUND ELEVATION:	3345.4'
RIG ON LOCATION:		SPUDDED:	9-17-76	Plugged:	9-24-76

CIRCULATING MEDIA: Mud to 18', air foam to 785', brine to 1220', salt base mud to 1576'.

No. of COMPRESSORS & SIZE:

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CMT.
0'	18'	8-3/4"	6-5/8" (O.D.)			Used		0'	18'	None
18'	785'	5-7/8"	4"			HW		0'	785'	None
785'	1220'	3-15/16"								
1220'	1576'	3-15/16"								

TOTAL DEPTH: 1576' MANDREL DEPTH PLUGS: Plugged to surface w/338 ft^3

JUNK:

LOGGING DATA: Page 1 SURVEYS PAGE: CORING PAGE:

TOM HOLE COORDINATES: @ REFERENCE:

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Move Rig up & down	____ days	Equipment Repair	0.83 days	Drilling Time	1.71 days
Secured w/o Crew	0.33 days	Caving	____ days	Trip Time	0.33 days
Bail & Run Mandrel	____ days	Lost Circ.	____ days	Single Shot Survey Time	____ days
Logging	0.21 days	Fishing	____ days		____ days
Survey	____ days	W.O. Equipment	0.04 days	Total	2.04 days
Casing Run & Pull	0.42 days	Haul & Mix Mud	0.33 days	Total Suspended Time	____ days
Cement	____ days	W.O. Loggers	0.06 days	Non-Operational Time	3.23 days
Coring	2.04 days	W.O. Cementers	0.25 days	Operational Delay Time	1.51 days
Plug Back	0.23 days		____ days	Working Time	2.04 days
TOTAL	3.23 days	TOTAL	1.51 days	TOTAL ELAPSED TIME	6.78 days

REMARKS: Casing pulled.

Rig No.	Name	Type	
3526	Boyles Bros.	Failing 2000	6.78 days
			____ days
			____ days
			____ days
			____ days
			____ days

ERDA P-13

HOLE HISTORY

9-17-76	Moved in Boyles Bros. rig #3526 and rigged up. Drilled 8-3/4" hole from 0' to 18' with mud. Set 6-5/8" O.D. used casing at 18', not cemented.
9-18-76	Rig secured to 0800 hours. Repaired rig. Drilled 5-7/8" hole from 18' to 440' with air foam.
9-19-76	Drilled 5-7/8" hole from 440' to 785'. Hit water at 630'. Mixed mud to set casing and displaced air foam. Pulled out of hole. Set 4½" O.D., HW casing at 785'.
9-20-76	Made up 3-15/16" drilling assembly and ran in hole. Drilled from 785' to 1135' using brine water.
9-21-76	Drilled 3-15/16" hole from 1135' to 1220'. Mixed up salt base mud. Made up 3-15/16" x 2¼" coring assembly and cored from 1220' to 1320'.
9-22-76	Cored from 1320' to 1440'.
9-23-76	Cored from 1440' to 1576'. Pulled out of hole and ran USGS logs.
9-24-76	Completed logging. Pulled and recovered casing. Plugged back hole to surface in stages using Halliburton with 500 gallons of mud flush ahead of 235 sacks (338 ft^3) of 50% Class "C" cement, 50% Pozmix "A", 2% gel and 19.4# per sack of salt. Set 1 joint of 3½" O.D. casing in the soft cement and cut off 1' above ground level for a hole marker. Hole plugged.

LOG INDEX

Type Log	Date	Run No.	Depth Driller	Depth Logger	Logged From	Logged To
USGS LOGS						
Gamma	9-23-76		1576'		3'	1573'
Gamma-Gamma	9-23-76		1576'		3'	1573'
Neutron	9-23-76		1576'	1575'	3'	1573'

NOTE: Logs furnished by Sandia.

Appendix D

Compiled Information for SWMUs 001r and 001ac (D-123 and DSP-207)

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Lithology Log (sample page), and Drilling Summary for D-123 (5 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Lithology Log (sample page), and Drilling Summary for D-207 (5 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Lithology Log (sample page), and Drilling Summary for D-123 (5 pages total).

Form 9-331 a
(Feb. 1951)

Budget Bureau 42-R358.2.
Approval expires 12-31-52.

Land Office Las Cruces
Lease No. P.P.P. LC 066112
Unit

(SUBMIT IN TRIPLICATE)

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JUL 17 1953
U. S. Geological Survey
Carlsbad, N. M.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

July 16, 19 53

Well No. 123 is located approximately 2600' S, 200' W of NE Cor. ~~ft. from {N/S} line and ft. from {E/W} line~~ of sec. 34

NE¼ Sec. 34 (¼ Sec. and Sec. No.) T 22S (Twp.) R 31E (Range) N.M.P.M. (Meridian)

(Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is ..... ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

This hole will be drilled with a 6¼" rock bit through the overburden and to the top of the Salado Halite. Upon encountering the Salado, a string of 4" casing will be set. NaCl-KCl brine will then be substituted for a mud as a drilling fluid. The Salado will then be cored with a diamond bit and core barrel to a depth sufficient to explore the salado for commercial deposits of soluble potash salts.

Upon completion, the hole will be plugged with cement from the top of the Salado to the bottom of the hole. A solid cement plug will also be run through and between all aquifers. The remainder of the hole will be filled with cuttings, a four-foot marker post cemented over the top and abandoned.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company DUVAL SULPHUR & POTASH COMPANY
Address P. O. Box 510, Carlsbad, New Mexico

By: B. G. Messer
Title: Chief Engineer

APPROVED: JUL 25 1953
U. S. Geological Survey

By R. S. Fulton
for Title REGIONAL MINING SUPERVISOR U.S.G.S.

Copy mailed to Washington

Form 9-331a
(Feb. 1951)

Budget Bureau 42-R358.2.
Approval expires 12-31-53.

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AUG 12 1953
U. S. Geological Survey
Carlsbad, N. M.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office Las Cruces
PPP
No. LC 066112
Unit

34

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

August 10, 1953

2614' N, 277' W of the SE cor.

Well No. 123 is located ft. from {N/S} line and ft. from {E/W} line of sec. 34

NE¼ SE¼ Sec. 34 (¼ Sec. and Sec. No.) T22S (Twp.) R31E (Range) NMPM (Meridian)

(Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3432 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Date Started: 7-19-53
Date Completed: 8-7-53
Top of Salado: 988'
Bottom of 124 Bed: 1788'
Total Depth: 1880'

Shot casing at 910' & 850'. Pulled 692' leaving 242' in hole. The following cement plugs were run:

(1) 73 sacks of cement mixed with 3% $CaCl_2$ and brine at bottom of hole.

(2) 45 sacks of cement mixed with fresh water bottomed at 880'.

The remainder of the hole was filled with cuttings, a four-foot marker post set, and the hole abandoned.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company Duval Sulphur & Potash Company
P.O. Box 510
Address Carlsbad, New Mexico

By: B. F. McGuire
B. F. McGuire
Title: Asst. Chief Engineer

APPROVED: AUG 12 1953
U. S. Geological Survey

By R. H. Dillard

Title REGIONAL MINING SUPERVISOR U.S.G.S.

Copy mailed to Washington 11/14

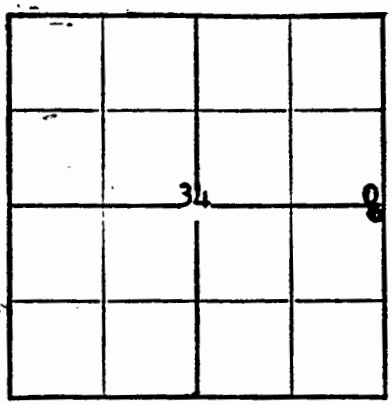
Budget Bureau No. 42-R352.2
Approval expires Dec. 31, 1954

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office Las Cruces
Serial Number LC 066 112
Date effective April 14, 1953

LOG OF PROSPECT BORE HOLE

Logs of prospect bore holes are to be transmitted in duplicate to the regional mining supervisor immediately upon completion of hole or shaft, or when work has been suspended indefinitely.



Locate hole correctly, giving distance in feet from N. or S. and E. or W. line of section; when hole is not vertical, give direction and angle.

Lessee or permittee Duval Sulphur & Potash Company
Address 17th Floor, Mellie Esperson Bldg., Houston 2, Texas
Driller Weaver Drilling Company, Carlsbad, New Mexico
Commenced drilling 7-19-53 Finished 8-7-53
Hole No. 123 Sec. 34 T. 22S R. 31E M. Prin. State N. Mex
Method of drilling Rotary Logged by D.D. Reese

The information given herewith is a complete and correct record of the bore hole and all work done thereon, so far as can be determined from all available records.

(Signed) B. F. McGuire for B. G. Messer
(Title) Chief Engineer

Date 10-2-53

Section 35(A) of the United States Criminal Code, 18 U. S. C. 80, makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

RECEIVED
NOV 12 1953
U. S. Geological Survey
Carlsbad, N. M.

Elevation of top of hole relative to sea level 3432'

FORMATION RECORD

Depth From (Feet)	Depth To (Feet)	Thickness of stratum (Feet)	Geologic formations; character of rock; oil, gas and water horizons; coal and other mineral occurrences
0	10	10	Blow Sand, light gray and caliche.
10	30	20	Blow sand, buff; caliche increasing downward.
30	70	40	Sandstone, red & fine red blow sand; some caliche.
70	100	30	Siltstone, red & clay; some caliche & occasional qtz. pebbl
100	220	120	Siltstone, red; little gray clay & caliche.
220	230	10	Shale red.
230	260	30	Siltstone, red; little gray clay & caliche.
260	270	10	Clay, red, silty.
270	470	200	Siltstone, maroon; little gray clay & caliche.
470	480	10	Fine-grained, red, sand & clay.
480	490	10	Siltstone, maroon; little gray clay, & caliche.
490	510	20	Sand, fine-grained, red & clay.
510	550	40	Sand, med. grained & red clay.
550	580	30	Shale, maroon & med. sand; little caliche.

Form 3
1M Sheets 7-52

DUVAL SULPHUR & POTASH COMPANY
POTASH DIVISION
CARLSBAD, NEW MEXICO

RECEIVED
NOV 1 2 1953
U. S. Geological Survey
Carlsbad, N. M.

CORE LITHOLOGY

WELL NO. 123

DEPTH (Feet) From	DEPTH (Feet) To	INTERVAL Feet	Shale ESTIM. %	P %	DESCRIPTION
					Abbreviations: H, Halite; P, Polyhalite;
					A, Anhydrite; S, Sylvite; L,
					Langbeinite; Le, Leonite; K,
					Kainite; Ke, Kieserite; C, Carnallite.
	932.0				Started Coring
932.0	941.6	9.6			Red silty sandstone.
941.6	947.5	5.9	3		Gray silty sandstone; little gray shaley in
					lower part.
947.5	951.4	3.9	2		Red, silty sandstone; little gray clay; very
					occasional thin strings of H.
951.4	986.1	34.7	10		Gray, silty, sandstone; some gray clay dissemin-
					ated irregularily throughout the sandstone.
986.1	988.3	2.2	20		Red, silty sandstone; very shaley in lower 0.7';
					few small H crystals.
988.3	991.1	2.8		2	H med.; few small pink P blebs & stringers
991.1	993.4	2.3	6		H med.; some med. to large red shale inclusions
					decreasing down; occasional small pink P bleb
993.4	995.6	2.2	5	5	H clear, med.; some pink P blebs & stringers &
					red shale inclusions.
995.6	998.1	2.5		2	H clear, med. to coarse; few small pink P blebs
					& occasional red shale inclusion.

DRILLING SUMMARY ON DSP #123

Date Started:	7-19-53	Started to Core:	932'
Date Completed:	8-7-53	Total Depth:	1880'
Top of Salado:	988'	Cored Interval:	948'

Drilled By: Weaver Drilling Co., Carlsbad, New Mexico

Type Equipment: Sullivan 200-A Core Drill, pulling 31 ft. of drill rods and coring with a 22 ft. core barrel and 3 -13/16 inch diamond bit.

Started drilling overburden with a 6¼" rotary rock bit. Stuck and unstuck drill pipe at 877 ft.

The 4 in. casing was set at 930.5 ft. The drilling fluid was replaced by a saturated NaCl-KCl brine solution and the rotary rock bit replaced by a diamond core bit and core barrel.

At 967 ft., 11.5 ft. of core was lost. Recovered same at 988 ft.

Hung up casing at 1061 ft. comming out of hole but got pipe loose.

The core barrel plugged at 1106 ft., but was easily unplugged.

Burned out a bit 1174 ft.

An air pocket was encountered at 1185 ft., breaking the pipe seat loose. Spudded pipe & regained seat.

Dropped core barrel in hole. Fished for and recovered same at 1433 ft.

Shot 4 in casing at 910 ft. & 850 ft. Pulled 692 ft. leaving 242 ft. in hole.

The following cement plugs were run:

(1) 73 sacks of cement mixed with 3% $CaCl_2$ and brine at bottom of hole.

(2) 45 sacks of cement mixed with fresh water bottomed at 880 ft.

The remainder of the hole was filled with cuttings, a 4-foot marker post set and the hole abandoned.

for B. F. McGinnis

B. G. Messer, ~~Chief Engineer~~

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Lithology Log (sample page), and Drilling Summary for D-207 (5 pages total).

Copy Mailed to Washington MAY 1 6 1958

Budget Bureau 42-R358.2.
Approval expires 12-31-55.

Form 9-331a
(Feb. 1961)

(SUBMIT IN TRIPLICATE)

Land Office Santa Fe

Lease No. NM 08285

Unit

RECEIVED
MAY 15 1958
U. S. Geological Survey
Carlsbad, N. M.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
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NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

May 15, 19 58

Well No. DSP 207 is located approximately 1000' N, 1500' E of SW Cor. ~~ft. from~~ {N/S} ~~line and~~ ~~ft. from~~ {E/W} ~~line of sec.~~ 19

SW¼ Sec. 19 (¼ Sec. and Sec. No.) T 22 S (Twp.) R 31 E (Range) NMPM (Meridian)

(Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is --- ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

This hole will be drilled with a 6¼ in. rock bit through the overburden and to the top of the Salado Halite. Upon encountering the Salado, a string of 4 in. casing will be set. NaCl-KCl brine will then be substituted for the mud as a drilling fluid. The Salado will then be cored with a diamond bit and core barrel to a depth sufficient to explore the Salado for commercial deposits of soluble potash salts.

Upon completion, the hole will be plugged with cement from the top of the Salado to the bottom of the hole. A solid cement plug will also be run through and between all aquifers. The remainder of the hole will be filled with cuttings, a four-foot marker post cemented over the top and the location left in good order.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company DUVAL SULPHUR & POTASH COMPANY

APPROVED: MAY 1 6 1958
U. S. Geological Survey

Address P. O. Box 510, Carlsbad, N. Mex.

Res. Mgr. R. N. Fay

By R. A. Fulton

Ch. Eng. B. F. McGuire

Title REGIONAL MINING SUPERVISOR U.S.G.S.

U. S. GOVERNMENT PRINTING OFFICE 16—84374-5

Copy Mailed to Washington

JUL 1 3 1958

Form 9-331 a
(Feb. 1961)

Budget Bureau 42-R358.4.
Approval expires 12-31-60.

(SUBMIT IN TRIPLICATE)

Land Office Santa Fe

Lease No. NM 08285

Unit

19

D

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JUL 1 4 1958

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
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NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

July 10, 19 58

Well No. 207 is located 1480' N and 1330' E of SW Cor. ft. from {N/S} line and ft. from {E/W} line of sec. 19

(¼ Sec. and Sec. No.) T 22 S (Twp.) R 31 E (Range) NMPM (Meridian)

(Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3406 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

DATE STARTED: 6-16-58
DATE COMPLETED: 7-3-58
TOP OF SALADO: 811'
BOTTOM OF 124 BED: 1519.8'
TOTAL DEPTH: 1613.0'

All casing was pulled and the following cement plugs were run:

(1) 66 sacks of cement mixed with 3% $CaCl_2$ and brine at bottom of hole.
(2) 25 sacks of cement mixed with fresh water bottomed at 560'.

The remainder of the hole was filled with cuttings and soil, a four-foot marker post set and the location left in good order.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company DUVAL SULPHUR & POTASH COMPANY
Address P.O. Box 510, Carlsbad, New Mexico

By: B. F. McGuire
Chief Engineer

APPROVED: 1 3 1958
U. S. Geological Survey

By R. S. Fulton

Title REGIONAL MINING SUPERVISOR U.S.G.S.

9-1147

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Budget Bureau No. 42-R352.2
Approval expires Dec. 31, 1954

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U.S. Land Office Santa Fe
Serial Number NM 08285
Date effective

1480' N		SW Cor.
1330' E	of	Sec. 19
T 22 S		R 31 E
	19	
	o	

Locate hole correctly, giving distance in feet from N. or S. and E. or W. line of section; when hole is not vertical, give direction and angle.

LOG OF PROSPECT BORE HOLE

Logs of prospect bore holes are to be transmitted in duplicate to the regional mining supervisor immediately upon completion of hole or shaft, or when work has been suspended indefinitely.

Lessee or permittee DUVAL SULPHUR & POTASH COMPANY
Address P.O. Box 510, Carlsbad, New Mexico
Driller Joy Drilling Company, Carlsbad, New Mexico
Commenced drilling 6-16-58 Finished 7-3-58
Hole No. 207 Sec. 19 T. 22S R. 31E M. NMPM State N.M.
Method of drilling Rotary Logged by D. D. Reese

The information given herewith is a complete and correct record of the bore hole and all work done thereon, so far as can be determined from all available records.

RECEIVED
SEP 12 1953
U. S. Geological Survey
Carlsbad, N. M.

(Signed) D D Reese For B. F. McGuire

Date 8-26-58 (Title) Chief Engineer

Section 35(A) of the United States Criminal Code, 18 U. S. C. 80, makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

Elevation of top of hole relative to sea level 3406'

FORMATION RECORD

DEPTH From— Feet	DEPTH To— Feet	Thickness of stratum Feet	Geologic formations; character of rock; oil, gas and water horizons; coal and other mineral occurrences
0	10	10	Sandstone, silty, maroon; some caliche.
10	20	10	Clay, silty, brown & maroon.
20	50	30	Clay, silty, brown.
50	70	20	Clay, silty, brown & brown sandstone.
70	80	10	Clay, silty, brown.
80	320	240	Clay, silty, brown; some brown fine grained sandstone.
320	330	10	Clay, brown, silty & Anhydrite.
330	460	130	Clay, brown, silty & Anhydrite, clay increasing in basel 30'.
460	470	10	Anhydrite, white; some silty brown clay.
470	490	20	Anhydrite, white; occasional brown silty clay.
490	520	30	Anhydrite, white; some brown clay & dolomitic limestone, gray.
520	550	30	Dolomitic limestone, gray.
550	560	10	Dolomitic limestone, gray & Anhydrite/Gypsum, white.
560	620	60	A/G white; little gray clay.

GPO-83-39570

Copy Mailed to Washington— 9-1-58

Form 3
2M Sheets 5-54

DUVAL SULPHUR & POTASH COMPANY
POTASH DIVISION
CARLSBAD, NEW MEXICO

RECEIVED

SEP 12 1958

U. S. Geological Survey
Carlsbad, N. M.

CORE LITHOLOGY

WELL NO. 207

DEPTH (Feet) From	DEPTH (Feet) To	INTERVAL Feet	ESTIM. % Shale	ESTIM. % P	DESCRIPTION
					Abbreviations: H - Halite P - Polyhalite
					A - Anhydrite Le - Leonite
					L - Langbeinite Ke - Kieserite
					K - Kainite S - Sylvite
					C - Carnallite
	811.0				Started Coring.
811.0	812.7	1.7	4	2	H clear, med; some small brown clay incl. & few pink P blebs & stringers.
812.7	817.2	4.5	3	1	H clear to very clear, med. to coarse; few med. to large brown clay incl. & small A/P white bleb stringers.
817.2	820.7	3.5	-	2	H clear, white, coarse; few small A/P blebs & stringers.
820.7	821.3	0.6	2	20	H clear, med; many med. A/P blebs; few small gray clay incl.
821.3	822.9	1.6	-	2	H clear, white, med; few small A/P blebs & stringers
822.9	826.2	3.3	6	2	H med; some med. brown clay incl; occ. gray at top; few small pink P blebs.
826.2	827.3	1.1	1	3	H clear, med; few small pink P blebs & brown clay in
827.3	830.1	2.8	3	-	H clear, med; few med. brown clay incl; occ. pink P bleb.
830.1	832.9	2.8	1	4	H clear, med; some med. irreg. pink P blebs & stringers; few brown clay incl. in upper part.
832.9	833.1	0.2	10	25	H clear, med; many med. A/P blebs; some med. gray clay incl.
833.1	835.9	2.8	1	3	H clear, med; few med. A/P blebs & stringers & small gray clay incl.
835.9	836.3	0.4	-	40	H clear, med; many med. pink P blebs in upper & lower part.

DRILLING SUMMARY ON DSP #207

Date Started: 6-16-58
Date Completed: 7-3-58
Top of Salado: 811'

Started to Core: 811'
Total Depth: 1613.0'
Cored Interval: 802'

Drilled by: Joy Drilling Company, Carlsbad, New Mexico
Type Equipment: Joy #250 Core Drill pulling 41 foot drill rods and coring with a 21 foot core barrel and a 3-13/16 inch diamond core bit.

Started hole with a 6-1/4 inch rotary rock bit. Drilled to top of salt and ran 4 inch casing.

At this depth, substituted brine for the drilling mud and exchanged the rotary rock bit for a diamond core bit and barrel. Coring then began.

Drilled to total depth without mishap and ran the following cement plugs:

(1) 66 sacks of cement mixed with 3% $CaCl_2$ and brine at bottom of hole.

(2) 25 sacks of cement mixed with fresh water bottomed at 560 feet.

Filled remainder of hole with cuttings and soil, set a four-foot marker post and left the location in good order.

B. F. McGuire

B. F. McGuire

Appendix E

Compiled Information for SWMUs 001u, 001v, 001w, 001ad, and 001ae (IMC-376, IMC-456, IMC-457, IMC-375, and IMC-377)

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Driller Shift Reports, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-376 (25 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Log of Prospect Well (sample page), and Recapitulation for IMC-456 (5 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Log of Prospect Well (sample page), and Recapitulation for IMC-457 (5 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Driller Shift Reports, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-375 (48 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-377 (6 pages total).

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Driller Shift Reports, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-376 (25 pages total).

APR 21 1965

Copy Mailed to Washington

Form 9-331 a
(Feb. 1961)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

376	
	20

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office Santa Fe, N. M.
Per mit NM 0384583
Unit

RECEIVED
APR 21 1965
U. S. Geological Survey
Carlsbad, N. M.

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

April 20, 1965

Well No. 376 is located 400 ft. ~~from~~ [N/S] ~~line and~~ ft. ~~from~~ [E/W] ~~line of~~ S 75° E from NW Corner of Sec. 20

NW 1/4 Sec. 20 (¼ Sec. and Sec. No.) T 22 S (Twp.) R 31 E (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy County (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3410 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Test well to be drilled for potash exploration. A rotary drill will be used from top to bottom.

Saturated potassium chloride brine, and/or air will be used while coring. Four inch casing will be set in top of the salt. All casing will be recovered.

Well will be plugged and marked to comply with past U.S.G.S. requirements.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chem. Corp.
Address P.O. Box 71, Carlsbad, New Mexico

K. O. Linn
K. O. Linn
Geologist

APPROVED: APR 21 1965
U. S. Geological Survey

By R. S. Fulton

Title REGIONAL MINING SUPERVISOR U.S.G.S.

U.S. GOVERNMENT PRINTING OFFICE : 1956—O-393560

Cc Mailed to Washington JUL 21 1965

Form 9-331 a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

376 | 20

(SUBMIT IN TRIPLICATE)

Land Office Santa Fe
Permit NM 0384583
Unit

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

RECEIVED
JUL 21 1965
S. Geological Survey
Carlsbad, N. M.

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

July 20, 19 65

S 75° E from NW Corner

Well No. 376 is located 400 ft. ~~from~~ {N/S} ~~line and~~ ~~ft. from~~ {E/W} ~~line~~ of sec. 20

NW 1/4 Sec. 20 (¼ Sec. and Sec. No.) T.22 S. (Twp.) R.31 E. (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy County (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3410 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Plugging Schedule

From	To	Int.	Material
1702	800	902	Cement
800	720	80	Mud
720	660	60	Cement
660	540	120	Mud
540	480	60	Cement
480	30	450	Mud
30	0	30	Cement

Work Schedule

Date Started:	6/15/65
Date Completed:	6/23/65
Top of Salt:	840'
Base USGS 124:	1591'
Base USGS 126:	1700'
Total Depth:	1702'

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp.
P.O. Box 71
Address Carlsbad, New Mexico

S. S. Adams
S. S. Adams
Geologist

APPROVED: JUL 21 1965
U. S. Geological Survey

By R. L. Fulton

Title REGIONAL MINING SUPERVISOR U. S. G. S.

GPO 862040

Drilling Instructions - IMC 376

1. Drill with rock bit to top of salt (approx. 870')
2. Set casing in salt.
3. Drill with rock bit from top of salt to 1330' using brine
4. Core from 1330 to Total depth (approx. 1754') using brine.

Samuel S. Adams
6/15/65

IMC
376

)YLES BROS. DRILLING COM NY

SHIFT REPORT

JOB [illegible] LOC. [illegible] DATE [illegible]

SHIFT DAY 8 SWING _____ NITE _____ HOLE NO. 376-3

RODS, END OF SHIFT _____ MUD _____

STICKUP, END OF SHIFT _____ TYPE _____

DEPTH, END OF SHIFT _____ CAL-SEAL _____

DEPTH, START OF SHIFT _____ LUMNITE _____

DRILLED _____ PORTLAND _____

CORE RECOVERED _____ ADDITIVES _____

TYPE OF ROCK _____ WATER _____

NUMBER OF RUNS _____

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

Moving ~~DRILLING~~ 8 HRS.

REAMING _____ EQUIP. REPAIR _____

CASING _____ STAND-BY OR SURVEY _____

SET-UP, TEAR DOWN _____ WATER DELAY _____

MIXING MUD _____ WASHING OR CLEANING _____

CEMENTING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]ing Rods. To new Setup.

DRILLER _____ HELPER _____

MACHINE NO. [illegible] FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB _____ LOC. _____ DATE _____

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 3P6

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND 74
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____
REAMING _____
CASING 2
SET-UP, TEAR DOWN 3
MIXING MUD _____

CEMENTING 3
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Finished drilling
casing, cemented hole with
7 sk 1/2 sk portland

DRILLER Leon Reed HELPER Gene Jones

MACHINE NO. 841 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC Eme Carlsbad DATE 6-23-6

SHIFT DAY ____ SWING — NITE ____ HOLE NO. 376

RODS, END OF SHIFT ____ MUD ____
STICKUP, END OF SHIFT ____ TYPE ____
DEPTH, END OF SHIFT ____ CAL-SEAL ____
DEPTH, START OF SHIFT ____ LUMNITE ____
DRILLED ____ PORTLAND ____
CORE RECOVERED ____ ADDITIVES ____
TYPE OF ROCK ____ WATER ____
NUMBER OF RUNS ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING ____ CEMENTING ____
~~REAMING~~ Pulling wire line Rods 3 hrs EQUIP. REPAIR ____
CASING 5 hrs STAND-BY OR SURVEY ____
SET-UP, TEAR DOWN ____ WATER DELAY ____
MIXING MUD ____ WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Pulled 1300' wire line Rods pulled 651' casing

DRILLER Wagnon HELPER Caldwell
MACHINE NO. 8 FOREMAN ____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Meeteetse DATE 6-23-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 56

RODS, END OF SHIFT 1709
STICKUP, END OF SHIFT 7
DEPTH, END OF SHIFT 1712
DEPTH, START OF SHIFT 1697
DRILLED 15
CORE RECOVERED 15
TYPE OF ROCK Salt.
NUMBER OF RUNS 1

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Had gt trouble, breaking wire line rods 800' pulled

DRILLER Tom Pleune HELPER Joe Hanna

MACHINE NO. 541 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. [illegible] DATE [illegible]
SHIFT DAY _____ SWING _____ NITE 8 HOLE NO. 376

RODS, END OF SHIFT		MUD	
STICKUP, END OF SHIFT		TYPE	
DEPTH, END OF SHIFT	1687	CAL-SEAL	
DEPTH, START OF SHIFT	1612	LUMNITE	
DRILLED	75	PORTLAND	
CORE RECOVERED	75	ADDITIVES	
TYPE OF ROCK	salt	WATER	
NUMBER OF RUNS	6		

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 hrs.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____
BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER K. Conway HELPER Tom Mitchell
MACHINE NO. 2611 FOREMAN _____

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-65 LOC Imc Bat DATE 6-22-

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 372

RODS, END OF SHIFT	1607	MUD	
STICKUP, END OF SHIFT	5	TYPE	
DEPTH, END OF SHIFT	1612	CAL-SEAL	
DEPTH, START OF SHIFT	1537	LUMNITE	
DRILLED	75	PORTLAND	
CORE RECOVERED	70	ADDITIVES	
TYPE OF ROCK	Salt & Gyp	WATER	
NUMBER OF RUNS	5		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Warren HELPER Carl C

MACHINE NO. 841 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. IMC Carlsbad DATE 6-22-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 376

RODS, END OF SHIFT 1544
STICKUP, END OF SHIFT 7
DEPTH, END OF SHIFT 1537
DEPTH, START OF SHIFT 1462
DRILLED 75
CORE RECOVERED 75
TYPE OF ROCK _____
NUMBER OF RUNS 5

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
~~WATER~~ Brine/load.

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Tom Reeve HELPER Gene Jones

MACHINE NO. 841 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 2-63 LOC. [illegible] DATE [illegible]

SHIFT DAY _____ SWING _____ ~~NITE~~ D HOLE NO. 37[illegible]

RODS, END OF SHIFT	1184	MUD	
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	1162	CAL-SEAL	
DEPTH, START OF SHIFT	1102	LUMNITE	
DRILLED	60	PORTLAND	
CORE RECOVERED	60	ADDITIVES	
TYPE OF ROCK	Sh	~~WATER~~	Brine
NUMBER OF RUNS	1		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	9 HRS.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING	1 hr.	STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER E. Conway HELPER Tom Mitchell

MACHINE NO. 211 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC Inc Carlsbad DATE 6-21-65

SHIFT DAY ____ SWING S ____ NITE ____ HOLE NO. 376

RODS, END OF SHIFT 1432
STICKUP, END OF SHIFT 20
DEPTH, END OF SHIFT 1402
DEPTH, START OF SHIFT 1357
DRILLED 45
CORE RECOVERED 45
TYPE OF ROCK Salt
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER Warman HELPER Caldwell

MACHINE NO. 841 FOREMAN ____

7

DYLES BROS. DRILLING COMPANY

SHIFT REPORT

JOB 5-63 LOC. INC Contract DATE 6-21-67

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 376

RODS, END OF SHIFT 1384
STICKUP, END OF SHIFT 27
DEPTH, END OF SHIFT 1357
DEPTH, START OF SHIFT 1328
DRILLED 29
CORE RECOVERED 29
TYPE OF ROCK Salt.
NUMBER OF RUNS 2

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER 1

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Had trouble
Sawing wire line Fast together

DRILLER Leon Reed HELPER Gene Jones

MACHINE NO. 241 FOREMAN _____

7

OYLES BROS. DRILLING CO ANY
SHIFT REPORT

JOB 5-63 LOC. Carlsbad DATE 6-20-6-

SHIFT DAY ____ SWING ____ ~~NITE~~ 6 HOLE NO. 376

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 328
DEPTH, START OF SHIFT 305
DRILLED 23
CORE RECOVERED ____
TYPE OF ROCK Rock Bit
NUMBER OF RUNS Salt.

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 6 hrs.
REAMING ____
CASING ____
~~SET-UP, TEAR DOWN~~ Moving 2 hrs.
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) move w/ Rods
picked up 690' of rods

DRILLER K. Conway HELPER Tom Mitchel
MACHINE NO. Yell FOREMAN ____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Eric Carlsbad DATE 6-20-63

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 376

RODS, END OF SHIFT 1317
STICKUP, END OF SHIFT 12
DEPTH, END OF SHIFT 1305
DEPTH, START OF SHIFT 1136
DRILLED 169
CORE RECOVERED _____
TYPE OF ROCK Salt + Gyp
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Warren HELPER Caldwell

MACHINE NO. 841 FOREMAN _____

7

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Carlsbad DATE 6-20-65

SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 376

RODS, END OF SHIFT 1144
STICKUP, END OF SHIFT 18
DEPTH, END OF SHIFT 1176
DEPTH, START OF SHIFT 882
DRILLED 294
CORE RECOVERED (W.B.)
TYPE OF ROCK Salt
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER Leon Reeve HELPER Gene Jones
MACHINE NO. 841 FOREMAN ____
7

OYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Carlsbad DATE 6-13-65
SHIFT DAY ____ SWING 2 NITE ____ HOLE NO. 326

RODS, END OF SHIFT	86	MUD	
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	77	CAL-SEAL	
DEPTH, START OF SHIFT	0	LUMNITE	
DRILLED	77	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK		WATER	
NUMBER OF RUNS			

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING	1½	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN	6½	WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____
SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Moving + Set Up

DRILLER [illegible] HELPER [illegible]

OYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Carlsbad DATE 6-13
SHIFT DAY ____ SWING ____ NITE 8 HOLE NO. 3

RODS, END OF SHIFT		MUD	1 sack
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	191	CAL-SEAL	
DEPTH, START OF SHIFT	71	LUMNITE	
DRILLED	120	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Rock bit	WATER	
NUMBER OF RUNS	Rock		

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING	8 hrs.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____
SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER [illegible] HELPER [illegible]

JOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC McCartbad DATE 6-16-65
SHIFT DAY ✓ SWING ✓ NITE ____ HOLE NO. 376

RODS, END OF SHIFT 401
STICKUP, END OF SHIFT 10
DEPTH, END OF SHIFT 391
DEPTH, START OF SHIFT 321
DRILLED 71
CORE RECOVERED ____
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____
SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) 2 hrs Cleaning Cement Rocks out of pump

DRILLER Harrison HELPER Caldwell

JOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC McCartbad DATE 6-16-65
SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 376

RODS, END OF SHIFT 333
STICKUP, END OF SHIFT 12
DEPTH, END OF SHIFT 321
DEPTH, START OF SHIFT 191
DRILLED 130
CORE RECOVERED Rotl.
TYPE OF ROCK Limestone
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER 2

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____
SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER Leon Reece HELPER Jesse Garza

LOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Carlsbad DATE 6-17-63
SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 326

RODS, END OF SHIFT	328	MUD	
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	326	CAL-SEAL	
DEPTH, START OF SHIFT	211	LUMNITE	
DRILLED	115	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Roc + Bit	WATER	
NUMBER OF RUNS	Roc		

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING	8 hrs	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER T. Conway HELPER Tim Mitchell

LOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. IMC Carlsbad DATE 6-17-63
SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 326

RODS, END OF SHIFT		MUD	
STICKUP, END OF SHIFT		TYPE	
DEPTH, END OF SHIFT		CAL-SEAL	
DEPTH, START OF SHIFT		LUMNITE	
DRILLED		PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK		WATER	
NUMBER OF RUNS			

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING	fishing 8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) 8 hrs. fishing rod out of hole

DRILLER Ron Reave HELPER [illegible]

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-13 LOC. Carlsbad DATE 6-11-65
SHIFT DAY ____ SWING ____ NITE 8 HOLE NO. 3-16

RODS, END OF SHIFT 633
STICKUP, END OF SHIFT 15
DEPTH, END OF SHIFT 611
DEPTH, START OF SHIFT 26ut
DRILLED 47
CORE RECOVERED ____
TYPE OF ROCK Hoch. B.
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8 hrs.
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Twisted Rods

DRILLER [illegible] HELPER [illegible]

OYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB [illegible] LOC. [illegible] DATE 6-17-[illegible]
SHIFT DAY ____ SWING ____ NITE ____ HOLE NO. 3-16

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT [illegible]
DEPTH, START OF SHIFT 566
DRILLED 56
CORE RECOVERED ____
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER ____ HELPER ____

FAX NO. 1 505 887 7812

MAY-15-96 WED 13:59 THAYER

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. 1 mi Carlsbad DATE 6-18-65

SHIFT DAY ___ SWING ✓ NITE ___ HOLE NO. 326

RODS, END OF SHIFT	716	MUD	
STICKUP, END OF SHIFT	~~704~~ 8	TYPE	
DEPTH, END OF SHIFT	1446 708	CAL-SEAL	
DEPTH, START OF SHIFT	1446	LUMNITE	
DRILLED	62	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Lime	WATER	Load
NUMBER OF RUNS			

FEET CASED ___ FROM ___ TO ___ SIZE ___

FEET REAMED ___ FROM ___ TO ___ SIZE ___

CEMENT DRILLED ___ FROM ___ TO ___

TIME CHARGES

DRILLING	8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ___ SIZE & TYPE ___ OVERSIZE ___ ON ___ OFF ___

SHELL NO. ___ TYPE ___ ON ___ OFF ___

BIT CONDITION ___ REASON FOR RETIRING ___

REMARKS (Explain delays and hole condition) ___

DRILLER Warren HELPER Caldwell

OYLES BROS. DRILLING CO[illegible]NY
SHIFT REPORT

JOB 5-63 LOC. 1 mi DATE 6-18-[illegible]

SHIFT DAY ✓ SWING ___ NITE ___ HOLE NO. 326

RODS, END OF SHIFT	663	MUD	
STICKUP, END OF SHIFT	17	TYPE	
DEPTH, END OF SHIFT	646	CAL-SEAL	
DEPTH, START OF SHIFT	644	LUMNITE	
DRILLED	2	PORTLAND	
CORE RECOVERED	Rotate	ADDITIVES	
TYPE OF ROCK	Lime	WATER	L
NUMBER OF RUNS			

FEET CASED ___ FROM ___ TO ___ SIZE ___

FEET REAMED ___ FROM ___ TO ___ SIZE ___

CEMENT DRILLED ___ FROM ___ TO ___

TIME CHARGES

DRILLING	8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ___ SIZE & TYPE ___ OVERSIZE ___ ON ___ OFF ___

SHELL NO. ___ TYPE ___ ON ___ OFF ___

BIT CONDITION ___ REASON FOR RETIRING ___

REMARKS (Explain delays and hole condition) Had to pull [illegible] continued [illegible]

DRILLER [illegible] HELPER [illegible]

FAX NO. 1 505 887 7812

MAY-15-96 WED 14:00 THAYER

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 3-63 LOC. Mc Carlsbad DATE 6-1-[illegible]
SHIFT DAY ____ SWING 5 NITE ____ HOLE NO. 276

RODS, END OF SHIFT ____ MUD 2 sk gel
STICKUP, END OF SHIFT ____ TYPE ____
DEPTH, END OF SHIFT ____ CAL-SEAL ____
DEPTH, START OF SHIFT 840 LUMNITE ____
DRILLED ____ PORTLAND ____
CORE RECOVERED ____ ADDITIVES Oil
TYPE OF ROCK ____ WATER ____
NUMBER OF RUNS ____

FEET CASED 840 FROM 0 TO 840 SIZE 4"
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING ____ CEMENTING ____
REAMING ____ EQUIP. REPAIR 2 hrs
CASING 5 hrs STAND-BY OR SURVEY ____
SET-UP, TEAR DOWN ____ WATER DELAY ____
MIXING MUD ____ WASHING OR CLEANING 1

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) 2 hrs on failing [illegible] repair [illegible] unloading of [illegible] [illegible]

DRILLER [illegible] HELPER [illegible]

BOYLES BROS. DRILLING CO. PANY
SHIFT REPORT

JOB 3-63 LOC. [illegible] DATE [illegible]
SHIFT DAY ____ SWING ____ NITE 8 HOLE NO. 276

RODS, END OF SHIFT ____ MUD 1 sk gel
STICKUP, END OF SHIFT ____ TYPE ____
DEPTH, END OF SHIFT 882 CAL-SEAL ____
DEPTH, START OF SHIFT 840 LUMNITE ____
DRILLED 42 PORTLAND ____
CORE RECOVERED ____ ADDITIVES ____
TYPE OF ROCK Rock Salt WATER ____
NUMBER OF RUNS ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 6 hrs CEMENTING ____
REAMING ____ EQUIP. REPAIR ____
CASING 2 hrs STAND-BY OR SURVEY ____
SET-UP, TEAR DOWN ____ WATER DELAY ____
MIXING MUD ____ WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

AGRICULTURAL CHEMICALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

P. O. BOX 71, CARLSBAD, NEW MEXICO

Page No. 1

Test No. 376

LOG OF PROSPECT WELL

DEPTH FROM	DEPTH TO	INTERVAL	OVERBURDEN DESCRIPTION
0	10	10	80% brown sand, 20% white caliche
10	20	10	95% brown sand, 5% white caliche
20	140	120	Brown siltstone and shale
140	150	10	Red-brown clay and silt
150	170	20	Brown siltstone and shale
170	220	50	Red-brown clay, 5% white gypsum
220	260	40	Brown shale, 2% white gypsum
260	290	30	Brown shale and siltstone, 5% gray clay
290	330	40	Brown shale and siltstone, 5% white caliche
330	370	40	Red brown shale, 5% white caliche
370	390	20	Brown clay, 5% white caliche
390	460	70	Brown shale, 2% white caliche
460	490	30	Red brown shale and siltstone
490	500	10	Red brown siltstone and shale, 5% white gypsum and [illegible]

RECEIVED
SEP 22 1965
U. S. Geological Survey
Carlsbad, N. M.

PLUGGING
SHEET

IMC No. 376

From	To	Int.	Material	Size	Ft. /Sack	Sacks
1202	840	862	cement	3 7/8"	18.1	48
840	800	40	cement	6 1/4	7.3	6
800	720	80	mud	6 1/4	7.3	11
720	660	60	cement	6 1/4	7.3	8
660	540	120	mud	6 1/4	7.3	18
540	480	60	cement	6 1/4	7.3	8
480	30	450	mud	6 1/4	7.3	60
30	0	30	cement	6 1/4	7.3	4

TOTAL SACKS cement 74
mud 89

Set casing 4' above surface

Set Marker Plate Number _____

8-61

Copy Mailed to Washington 9-22-65

RECAPITULATION

TEST WELL IMC 376

Permittee:	R. G. Haworth
Operator:	International Minerals & Chemical Corp.
Permit No.	NM-0384583
Location:	400' S75°E from NW Corner of Sec. 20, T.22S., R.31E.
Surface Elevation:	3410'
Total Depth:	1702'
Type of Well:	Potash Core Test
Drilling Contractor:	Boyles Bros. Drilling Co.
Drilling Record:	Date Started: 6/15/65 Date Completed: 6/23/65 6-1/4 Rockbit: 0 - 840' 3-7/8 Rockbit: 840 - 1328' 3-7/8 Corebit: 1328 - 1702'
Casing Record:	4" Casing: 0 - 840' All Recovered
Water Horizons:	Unknown
Rustler Formation:	500 - 840'
Top of Salt:	840'
Top of USGS 124 Bed:	1581'
Mineralized Beds:	None 5th - 2.0' - 10.9%/L

RECEIVED
SEP 22 1965
U. S. Geological Survey
Carlsbad, N. M.

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Log of Prospect Well (sample page), and Recapitulation for IMC-456 (5 pages total).

Form 9-331a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

	22
	X

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office .....
Lease No. NM 0384584
Unit .....

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JUN 14 1976
U. S. Geological Survey
Carlsbad, N. M.

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

6/14/76, 19

Well No. 456 is located 300 ft. from [S] line and 2650 ft. from [E] line of sec. 22

SW 1/4 SEC 22 (¼ Sec. and Sec. No.) T 22S (Twp.) R31E (Range) NMPM (Meridian)

Potash (Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3520 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Test to be drilled for potash exploration. A rotary drill will be used from top to bottom.

Saturated potassium chloride brine will be used while coring. Four inch casing will be set in top of the salt. All casing will be removed.

Well will be plugged and marked to comply with past USGS requirements.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp.

APPROVED: 6/15/76
U. S. Geological Survey

Address P. O. Box 71

Carlsbad, New Mexico 88220

By L. E. Gordon
for REGIONAL MINING SUPERVISOR U. S. G. S.

W. T. Dow
W. T. Dow
Chief Mining Engineer

Title

U. S. GOVERNMENT PRINTING OFFICE 1956 -O-393560

copy to BLM 6/15/76

Form 9-331 a
(Feb. 1961)

Form Approved
Budget Bureau No. 42-R0358

Land Office .....
Lease No. NM 0384584
Unit .....

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

RECEIVED
NOV 30 1976
U. S. Geological Survey
Carlsbad, N. M.

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

November 24, 1976

Well No. 456 is located 300 ft. from [S] line and 2650 ft. from [E] line of sec. 22

SW 1/4 Sec. 22 (¼ Sec. and Sec. No.) T22S (Twp.) R31E (Range) NMPM (Meridian)

Potash (Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3520 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Plugging Schedule

From	To	Interval	Material
1975	0	1975	Cement

Date Started	6/22/76
Date Stopped	7/7/76
Top of Salt	1080
Total Depth	1975

All casing recovered.
Set 4" pipe 4' above ground, marker plate se
Drill site cleaned and mud pit filled.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp. APPROVED: 2/4/77
P. O. Box 71 U. S. Geological Survey
Address Carlsbad, New Mexico 88220

W. T. Dow
W. T. Dow
Chief Mining Engineer

By L. E. Gordon
for AREA MINING SUPERVISOR U. S. G. S.
Title

copies to IMC, BLM, 2/4/77

GPO 88 3-757

9-1147

Budget Bureau No. 42-R352.4
Approval Expires 9-30-73

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U.S. Land Office .....
Serial Number .....
Date effective .....

LOG OF PROSPECT BORE HOLE

Logs of prospect bore holes are to be transmitted in duplicate to the Regional Mining Supervisor immediately upon completion of hole or shaft, or when work has been suspended indefinitely.

Locate hole correctly, giving distance in feet from N. or S. and E. or W. line of section; when hole is not vertical, give direction and angle.

Lessee or permittee International Minerals & Chemical Corp.
Address P.O. Box 71, Carlsbad, N.M. 88220
Driller Boyles Brothers
Commenced drilling 6/22/76 Finished 7/7/76
Hole No. 456 Sec. 22 T. 22S R. 31E M. NMPM State N.M.
Method of drilling Core Logged by Koenig

The information given herewith is a complete and correct record of the bore hole and all work done thereon, so far as can be determined from all available records.

(Signed) W. T. [illegible]

Date 11/19/76 (Title) Chief Mine Engineer

The United States Criminal Code, 18 U. S. C. 1001 makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

Elevation of top of hole relative to sea level .....

FORMATION RECORD

DEPTH From— Feet	Inches	To— Feet	Inches	Thickness of stratum Feet	Inches	Geologic formations; character of rock; oil, gas and water horizons; coal and other mineral occurrences
						RECEIVED
						NOV 22 1976
						U. S. Geological Survey
						Carlsbad, N.M.
						"FOR U. S. GOVERNMENT USE ONLY"

(Attach continuation sheets if necessary)

GPO 892-030

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION

P. O. BOX 71, CARLSBAD, NEW MEXICO

Page No. 1

Test No. 456

LOG OF PROSPECT WELL

DEPTH FROM	DEPTH TO	INTERVAL	OVERBURDEN DESCRIPTION
1	40	40	Surficial quartz sand and silt, with 3-5% reddish-brown clay; 30-40% caliche, white, @ 10-20.
40	740	700	Reddish-brown clay; 50-60% quartz silt @ 160-170 and 5-15% quartz silt @ 60-70, 90-110, and 120-130; traces light green clay @ 50-60.
740	760	20	Clean quartz silt.
760	790	30	Quartz silt with traces to 5% reddish-brown clay.
790	800	10	Anhydrite, light gray and satinspar gypsum, colorless, with 10-20% quartz silt and traces reddish-brown clay.
800	810	10	Anhydrite, light gray, with 15-20% limestone, gray; 3-5% reddish-brown clay.
810	830	20	Anhydrite, medium gray, with 5-10% quartz sand and traces reddish-brown clay.
830	880	50	Quartz silt; traces reddish-brown clay and with 5-10% anhydrite @ 830-840, and 15-25% @ anhydrite @ 860-880.
880	900	20	Quartz silt with 5-10% caliche, white, and traces reddish-brown clay.
900	930	30	Reddish-brown clay with halite lenses @ 910-920.
930	940	10	Quartz silt with 10-15% anhydrite, grayish-pink, and traces reddish-brown clay.
940	950	10	Anhydrite, medium gray with 2-3% reddish-brown clay.
950	980	30	Reddish-brown clay with 3-5% anhydrite and 15-20% halite, colorless.
980	1030	50	Halite, colorless, with 40-50% reddish-brown clay and traces orangish-red polyhalite.

"FOR U. S. GOVERNMENT USE ONLY"

RECAPITULATION

TEST WELL IMC 456

OPERATOR:	International Minerals & Chemical Corporation
LEASE NO.:	NM 0384584
LOCATION:	300 FSL-2650 FEL, Sec. 22, T22S-R31E
SURFACE ELEVATION:	3520
TOTAL DEPTH:	1975
TYPE OF WELL:	Potash Core Test
DRILLING CONTRACTOR:	Boyles Brothers

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U. S. Geological Survey
Carlsbad, N.M.

DRILLING RECORD:	Date Started:	6/22/76
	Date Completed:	7/7/76
	6-1/4" Rock Bit	0 - 940
	3-7/8" Rock Bit	940 - 1580
	3-7/8" Core Bit	1580 - 1975
CASING RECORD:	4" Casing	All Recovered
WATER HORIZON:	Unknown	
RUSTLER FORMATION:	Top of Salt	1080
	Top of USGS	124 bed 1852.8
		126 bed 1960.4

MINERALIZED BEDS:

10th Ore Zone	5.6'	2.6% K2O Sylvite (.93 L
		3.5% K2O Lang.
		.93
4th Ore Zone	Barren	4.43

"FOR U. S. GOVERNMENT USE ONLY"

5.6 - 4.4 / L

41.6

WTD:jvw

Notice of Intention to Drill, Subsequent Report of Abandonment, Borehole Log (sample page), Log of Prospect Well (sample page), and Recapitulation for IMC-457 (5 pages total).

Form 9-331 a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office .....
Lease No. NM 0384584
Unit .....

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JUN 23 1976
U. S. Geological Survey
Carlsbad, N. M.

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

June 21, 1976, 19

Well No. 457 is located 200 ft. from [S] line and 1200 ft. from [W] line of sec. 27

SW 1/4 SEC 27 T22S R31E NMPM
(¼ Sec. and Sec. No.) (Twp.) (Range) (Meridian)

Potash Eddy New Mexico
(Field) (County or Subdivision) (State or Territory)

The elevation of the derrick floor above sea level is 3460 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Test to be drilled for potash exploration. A rotary drill will be used from top to bottom.

Saturated potassium chloride brine will be used while coring. Four inch casing will be set in top of the salt. All casing will be removed.

Well will be plugged and marked to comply with past USGS requirements.

FOR U. S. GEOLOGICAL SURVEY USE ONLY

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp.

APPROVED: 6-29-76
U. S. Geological Survey

Address P. O. Box 71

Carlsbad, New Mexico 88220

By R. S. Fulton

W. T. Dow

Title REGIONAL MINING SUPERVISOR U. S. G. S.

Form 9-331 a
(Feb. 1961)

Form Approved
Budget Bureau No. 42-R0358

Land Office .....
Lease No. NM 0384584
Unit .....

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

RECEIVED
NOV 30 1976
U. S. Geological Survey
Carlsbad, N.M.

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

November 24, 1976

Well No. 457 is located 200 ft. from {S} line and 1200 ft. from {W} line of sec. 27

SW 1/4 Sec. 27 (¼ Sec. and Sec. No.) T22S (Twp.) R31E (Range) NMPM (Meridian)

Potash (Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3460 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Plugging Schedule

From	To	Interval	Material
1885	0	1885	Cement

Date Started	7/8/76
Date Stopped	7/22/76
Top of Salt	980
Total Depth	1885

All casing recovered.
Set 4" pipe 4' above ground, marker plate se
Drill site cleaned and mud pit filled.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp. APPROVED: 2/4/77
P. O. Box 71 U. S. Geological Survey
Address Carlsbad, New Mexico 88220

W. T. Dow
W. T. Dow
Chief Mining Engineer

By L. E. Gordon
Title for AREA MINING SUPERVISOR U. S. G. S.

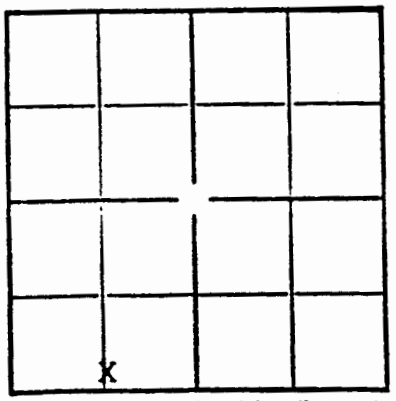
Copies to IMC 2/4/77

9-1147

Budget Bureau No. 42-R352.4
Approval Expires 9-30-73

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U.S. Land Office .....
Serial Number .....
Date effective .....



Locate hole correctly, giving distance in feet from N. or S. and E. or W. line of section; when hole is not vertical, give direction and angle.

LOG OF PROSPECT BORE HOLE

Logs of prospect bore holes are to be transmitted in duplicate to the Regional Mining Supervisor immediately upon completion of hole or shaft, or when work has been suspended indefinitely.

Lessee or permittee International Minerals & Chemical Corp
Address P. O. Box 71, Carlsbad, N. M. 88220
Driller Boyles Brothers
Commenced drilling 7/8/76 Finished 7/23/76
Hole No. 457 Sec. 27 T. 22S R. 31E M. NMPM State NM
Method of drilling Core Logged by Koenig

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U. S. Geological Survey
Carlsbad, N. M.

The information given herewith is a complete and correct record of the bore hole and all work done thereon, so far as can be determined from all available records.

(Signed) W. T. [illegible]
(Title) Chief Mine Engineer

Date 8/31/76

The United States Criminal Code, 18 U. S. C. 1001 makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

Elevation of top of hole relative to sea level .....

FORMATION RECORD

DEPTH From— Feet	Inches	To— Feet	Inches	Thickness of stratum Feet	Inches	Geologic formations; character of rock; oil, gas and water horizons; coal and other mineral occurrences
						OVERBURDEN
						"FOR U. S. GOVERNMENT USE ONLY"
0		10		10		Caliche, white and light brown, with silicious silt.
10		30		20		Silicious silt with 10-15% reddish-brown clay.
30		660		630		Claystone and clay, reddish-brown, with traces of caliche (possible contamination of sample) at 370-380, and with 0.1-0.2 mm spheres of gray claystone at 560-660.
660		720		60		Anhydrite, light gray and whitish, with reddish-brown clay, 10-20%
720		760		40		Anhydrite, gray, with white.
760		840		80		Gypsum, white, with traces reddish-brown clay.
840		880		40		Anhydrite, gray and whitish; contains 3-5% reddish-brown clay in lower 10 feet.
880		900		20		Missing samples.

(Attach continuation sheets if necessary)

GPO 892-030

AGRICULTURAL CHEMICALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

P. O. BOX 71, CARLSBAD, NEW MEXICO

Page No. 1

Test No. 4

LOG OF PROSPECT WELL

DEPTH FROM	DEPTH TO	INTERVAL	CORE DESCRIPTION
1480.0	1484.5	4.5	Halite rock interval. Halite, colorless, fine to medium grained. Polyhalite, pinkish-orange, 6-8% as minute to small blebs USGS MARKER BED 116
1484.5	1486.2	1.7	1.0' Polyhalite, reddish-pink, with brownish-gray anhydrite. 0.1' Halite rock. 0.6' Polyhalite, reddish-pink.
1486.2	1491.5	5.3	Halite rock interval. Halite, colorless, fine to medium grained. Polyhalite, reddish-orange to pinkish-orange, 3-4% as minute blebs. VACA TRISTE SANDSTONE MEMBER
1491.5	1507.2	15.7	Halite, colorless, fine to medium grained. Polyhalite, reddish-orange, traces to 1% as minute blebs. Clay, reddish-brown, 20-30% overall, variable from 5 to 70% as minute to extremely large clots and layered; layers at 1493.7-.9, 94.3-.4 and .7-.9, 95.3-.4 and .9-96.0, 98.1-99.1 and 1500.4-.5; partings at 1501.1 and 1502.2.
1507.2	1528.8	21.6	Halite rock interval with argillic zones. Halite, colorless, fine to medium grained. Polyhalite: reddish-pink, 10-12% as minute blebs and thin stringers at 1507.2-09.8, and layered at 1509.8-1510.0; reddish-orange, 8-10% as minute blebs and thin stringers at 1510.0-12.8, 3-4% as minute blebs at 12.8-14.2, traces as scattered minute blebs at 14.2-15.8 and 1525.8-28.8, and 5-6% as minute blebs at 1515.8-25.8. Clay, reddish-brown, minute to medium clots, 15-20% at 1515.3-.8 and 8-12% at 1525.8-28.8; partings at 1512.4, 26.8 and 28.1; partial partings at 1514.2 and 15.8.

RECAPITULATION

TEST WELL IMC 457

OPERATOR:	International Minerals & Chemical Corporation		
LEASE NO.:	NM 0384584		
LOCATION:	200 FSL-1200 FWL Sec. 27, T22S-R31E		
SURFACE ELEVATION:	3460		
TOTAL DEPTH:	1885		
TYPE OF WELL:	Potash Core Test		
DRILLING CONTRACTOR:	Boyles Brothers		
DRILLING RECORD:	Date Started:	7/8/76	
	Date Completed:	7/22/76	
	6-1/4" Rock Bit	0 - 940	
	3-7/8" Rock Bit	940 - 1480	
	3-7/8" Core Bit	1480 - 1885	
CASING RECORD:	4" Casing	980	All Recovered
WATER HORIZON:	Unknown		
RUSTLER FORMATION:	Top of Salt	980	
	Top of USGS	124 bed	1777.3
		126 bed	1880.1
MINERALIZED BEDS:			
	10th Ore Zone	5.4'	0.3% K2O Sylvite 8.5% K2O Lang.
	4th Ore Zone	2.1'	0 % K2O Sylvite 7.6% K2O Lang.

RECEIVED
NOV 22 1976
U. S. Geological Survey
Carlsbad, N. M.

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WTD:jvw

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Driller Shift Reports, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-375 (48 pages total).

Copy Mailed to Washington APR 12 1965

Form 9-331 a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

375

X			
	33		

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APR 12 1965

U. S. Geological Survey

Land Office Santa Fe, N.M.
Permit NM 0359161
Unit

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

April 8, 1965

Well No. 375 is located 150 ft. ~~from xxxxxx line and xxxxxx ft. from xxxxxx line of xxx~~ S 27°E from NW corner of Sec. 33

NW 1/4 Sec. 33 (¼ Sec. and Sec. No.) T 22 S (Twp.) R 31 E (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy County (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3390 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Test well to be drilled for potash exploration. A rotary drill will be used from top to bottom.

Saturated potassium chloride brine, and/or air will be used while coring. Four inch casing will be set in top of the salt. All casing will be recovered.

Well will be plugged and marked to comply with past U.S.G.S. requirements.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chem. Corp.
Address P.O. Box 71, Carlsbad, New Mexico

K. O. Linn
Geologist

APPROVED: APR 12 1965
U. S. Geological Survey

By R. A. Fulton

Title REGIONAL MINING SUPERVISOR U.S.G.S.

U.S. GOVERNMENT PRINTING OFFICE : 1956—O-393560

C / Mailed to Washington - 5-18-6

Form 9-331a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

375

*			
	33		

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MAY 18 1965
U. S. Geological Survey
Carlsbad, N. M.

(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Land Office Santa Fe
Permit Lease No. NM-0359161
Unit

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
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NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

May 17, 1965

Well No. 375 is located 144 ft. ~~from~~ {N/S} ~~line and~~ ~~ft. from~~ {E/W} ~~line~~ of sec. 33

S 24°E from NW Cor.

NW¼ Sec. 33 (¼ Sec. and Sec. No.) T22S (Twp.) R31E (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3390 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Plugging Schedule

From	To	Int.	Material
1746'	817'	929'	Cement
817'	510'	307'	Cement
510'	20'	490'	Mud
20'	0'	20'	Cement

Work Schedule

Date Started: 4/28/65
Date Completed: 5/13/65
Top of Salt: 790'
Base USGS 124: 1612'
Base USGS 126: 1739'
Total Depth: 1746'

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp.
Address P. O. Box 71, Carlsbad, New Mexico

K. O. Linn
K. O. Linn
Geologist

APPROVED: 5-18-65
U. S. Geological Survey

By Chas. M. McConnell
Title REGIONAL MINING SUPERVISOR U. S. G. S.

GPO 862040

Collar 3390
TS 2525
865

Collar 3390
VT 2030
1360

3390
Bitt 1750
1640

1645

3390
1880
1760
1705

Drilling Instructions for IMC 375

(1.) Drill with rock bit to top of salt (approx. 865')

(2.) Set casing

(3.) Drill with rock bit to 1300 feet, using brine

(4.) Core from 1300 feet to total depth, using brine

Total depth approx. 1750 feet.

Kurt O. Lima
4/29/65

375

B /LES BROS. DRILLING COMF. NY

SHIFT REPORT

JOB 5-63 LOC. 7 mi.-Carlsbad DATE 4-28-6

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 375

RODS, END OF SHIFT	115	MUD	3 sacks.
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	93	CAL-SEAL	
DEPTH, START OF SHIFT	0	LUMNITE	
DRILLED	93	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Rock Bit	~~WATER~~	2 Loads.
NUMBER OF RUNS			

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	7 hrs.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, ~~TEAR DOWN~~	1 hr.	WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER K. Conway HELPER Jim Mitchell

MACHINE NO. 222 FOREMAN _____

7

B ILES BROS. DRILLING COMP. IY

SHIFT REPORT

JOB 5-63 LOC. IMC Carlsbad DATE 4-28-65

SHIFT DAY ____ SWING ____ NITE L HOLE NO. 375

RODS, END OF SHIFT 235
STICKUP, END OF SHIFT 17
DEPTH, END OF SHIFT 218
DEPTH, START OF SHIFT 93
DRILLED 125
CORE RECOVERED Rockbit
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD Brooks.
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER 5

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 6
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY 2
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) 2 hr. waiting on water for cementing at 143 ft. got circulation back at 157 ft. Cont. drilling

DRILLER Leon Reeve HELPER Gene Pallock

MACHINE NO. 822 FOREMAN ____

7

B /LES BROS. DRILLING COMP. NY

SHIFT REPORT

JOB 5-63 LOC. [illegible] DATE [illegible]

SHIFT DAY 8 SWING _____ NITE _____ HOLE NO. 37[illegible]

RODS, END OF SHIFT _____

STICKUP, END OF SHIFT _____

DEPTH, END OF SHIFT 230

DEPTH, START OF SHIFT 218

DRILLED 12

CORE RECOVERED 12 12

TYPE OF ROCK _____

NUMBER OF RUNS _____

MUD _____

TYPE _____

CAL-SEAL _____

LUMNITE _____

PORTLAND _____

ADDITIVES _____

WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 2

REAMING _____

CASING _____

SET-UP, TEAR DOWN _____

MIXING MUD _____

CEMENTING _____

EQUIP. REPAIR 2

STAND-BY OR SURVEY 4

WATER DELAY _____

WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Last Inclination at 230

DRILLER [illegible] HELPER _____

MACHINE NO. _____ FOREMAN _____

7

B /LES BROS. DRILLING COMP. IY
SHIFT REPORT

JOB [illegible] LOC. [illegible] DATE [illegible]

SHIFT DAY ____ SWING [illegible] NITE ____ HOLE NO. [illegible]

RODS, END OF SHIFT [illegible]
STICKUP, END OF SHIFT [illegible]
DEPTH, END OF SHIFT 388
DEPTH, START OF SHIFT 330
DRILLED 58
CORE RECOVERED ____
TYPE OF ROCK Rubble
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER [illegible]

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8 hrs.
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Found top with Rods 1 sack of flake. & 3 Cements. to regain Circulation

DRILLER L. Conway HELPER Tim Mitchell
MACHINE NO. 822 FOREMAN ____

7

B ;LES BROS. DRILLING COMP. IY

SHIFT REPORT

JOB [illegible] LOC. [illegible] DATE [illegible]

SHIFT DAY _____ SWING _____ NITE L HOLE NO. [illegible]

RODS, END OF SHIFT 345'
STICKUP, END OF SHIFT [illegible]
DEPTH, END OF SHIFT 348
DEPTH, START OF SHIFT 289
DRILLED [illegible]
CORE RECOVERED [illegible]
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER 2

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 7
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 1
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. _____ FOREMAN _____

7

B ILES BROS. DRILLING COMP. IY

SHIFT REPORT

JOB 3-63 LOC. IMC DATE 4-30-63

SHIFT DAY 8 SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____	MUD _____
STICKUP, END OF SHIFT _____	TYPE _____
DEPTH, END OF SHIFT 360	CAL-SEAL _____
DEPTH, START OF SHIFT 348	LUMNITE _____
DRILLED 12	PORTLAND _____
CORE RECOVERED R.B.	ADDITIVES _____
TYPE OF ROCK _____	WATER _____
NUMBER OF RUNS _____	

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 6	CEMENTING _____
REAMING _____	EQUIP. REPAIR 2
CASING _____	STAND-BY OR SURVEY _____
SET-UP, TEAR DOWN _____	WATER DELAY _____
MIXING MUD _____	WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER Mercer HELPER _____

MACHINE NO. 822 FOREMAN _____

7

B ILES BROS. DRILLING COMP. IY

SHIFT REPORT

JOB 5-63 LOC. Inc-Cordova DATE 4-30-6

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 375

RODS, END OF SHIFT	415	MUD	
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	393	CAL-SEAL	
DEPTH, START OF SHIFT	360	LUMNITE	
DRILLED	33	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Rock Bit.	WATER	
NUMBER OF RUNS			

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	4 HRS.	CEMENTING	
REAMING		EQUIP. REPAIR	4 HRS.
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) put Bearing + grease seal in transfer casing

DRILLER K. Conway HELPER Tim mitchell

MACHINE NO. 822 FOREMAN _____

7

B 'LES BROS. DRILLING COMP. IY
SHIFT REPORT

JOB 5-63 LOC. McCoolod DATE 4-30-65

SHIFT DAY ____ SWING ____ NITE ✓ HOLE NO. 375

RODS, END OF SHIFT 475
STICKUP, END OF SHIFT 13
DEPTH, END OF SHIFT 462
DEPTH, START OF SHIFT 393
DRILLED 59
CORE RECOVERED R.B.
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER 2

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 5
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR 3
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) 3 hr. replacing
mud out of gear end of pump
trying to [illegible] pump for [illegible]
5 hr. drilling

DRILLER Leon Reese HELPER Gene Pollock

MACHINE NO. 822 FOREMAN ____

7

B(LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 5-63 LOC. 1 Mc Cobb DATE 5-1-65

SHIFT DAY ____ SWING ____ NITE ____ HOLE NO. 375

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 471
DEPTH, START OF SHIFT 462
DRILLED 9
CORE RECOVERED R.B.
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 9
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR 6
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION dull REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Broke machine hitting rock 6 hours trying to get it [illegible] Bit dull.

DRILLER Murray HELPER Caldwell

MACHINE NO. ____ FOREMAN ____

7

Inc
375

DYLES BROS. DRILLING COMPANY

SHIFT REPORT

JOB 5-65 LOC. [illegible] DATE 5-1-65

SHIFT DAY _____ SWING 4 NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 4
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. 622 FOREMAN _____

7

DOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC/MC Carlsbad DATE 5-3-65

SHIFT DAY L SWING _____ NITE _____ HOLE NO. 335

RODS, END OF SHIFT 515
STICKUP, END OF SHIFT 12
DEPTH, END OF SHIFT 513
DEPTH, START OF SHIFT 472
DRILLED 31
CORE RECOVERED R. Fit
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER 2

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 6
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 2
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) 1 hr. repairing Hyd. System (in drilling)

DRILLER Leon Reeve HELPER Gene Pollock

MACHINE NO. 922 FOREMAN _____

DYLES BROS. DRILLING COMPANY

SHIFT REPORT

JOB 5-63 LOC. IMC [illegible] DATE 5-3-65

SHIFT DAY _____ SWING E NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____	MUD _____
STICKUP, END OF SHIFT _____	TYPE _____
DEPTH, END OF SHIFT 320	CAL-SEAL _____
DEPTH, START OF SHIFT 303	LUMNITE _____
DRILLED 17	PORTLAND _____
CORE RECOVERED _____	ADDITIVES _____
TYPE OF ROCK _____	WATER _____
NUMBER OF RUNS _____	

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 7	CEMENTING _____
REAMING _____	EQUIP. REPAIR 1
CASING _____	STAND-BY OR SURVEY _____
SET-UP, TEAR DOWN _____	WATER DELAY _____
MIXING MUD _____	WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Stuck pipe in drill + been pumping. Broke it loose from bottom. Not no [illegible]

DRILLER Murray HELPER [illegible]

MACHINE NO. 1 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB [illegible]-3-63 LOC. Carlsbad DATE 5-3-65

SHIFT DAY _____ SWING _____ NITE 8 HOLE NO. 375

RODS, END OF SHIFT	5	MUD	
STICKUP, END OF SHIFT	15	TYPE	
DEPTH, END OF SHIFT	527	CAL-SEAL	
DEPTH, START OF SHIFT	520	LUMNITE	
DRILLED	7	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Porkp T.	WATER	
NUMBER OF RUNS			

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 hrs.	CEMENTING	
& Fishing ~~REAMING~~		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) fishing for Rods twisting off

DRILLER K. Carnal HELPER Tom Mitchel

MACHINE NO. 822 FOREMAN _____

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC/AIC Carlsbad DATE 5-4-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 375-

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING Fishing 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) 3 hrs. fishing for rods & drill collars & bit.

DRILLER Leon Reese HELPER Gene Pollock

MACHINE NO. 822 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY

SHIFT REPORT

JOB 5-63 LOC [illegible] DATE 5-4-65

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____	MUD _____
STICKUP, END OF SHIFT _____	TYPE _____
DEPTH, END OF SHIFT 559	CAL-SEAL _____
DEPTH, START OF SHIFT 527	LUMNITE _____
DRILLED 32	PORTLAND _____
CORE RECOVERED 12.3	ADDITIVES _____
TYPE OF ROCK _____	WATER _____
NUMBER OF RUNS _____	

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8	CEMENTING _____
REAMING _____	EQUIP. REPAIR _____
CASING _____	STAND-BY OR SURVEY _____
SET-UP, TEAR DOWN _____	WATER DELAY _____
MIXING MUD _____	WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Fourhours spent fishing rods out of hole

DRILLER Mercurey HELPER Stillwell

MACHINE NO. _____ FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Inc. Rockbed DATE 5-4-63

SHIFT DAY _____ SWING _____ ~~NITE~~ 8 HOLE NO. 375

RODS, END OF SHIFT		MUD	
STICKUP, END OF SHIFT		TYPE	
DEPTH, END OF SHIFT	592	CAL-SEAL	
DEPTH, START OF SHIFT	559	LUMNITE	
DRILLED	33	PORTLAND	
CORE RECOVERED		ADDITIVES	
TYPE OF ROCK	Rock	WATER	
NUMBER OF RUNS	1-core		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 HRS.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER F. Conway HELPER Tim Mitchell

MACHINE NO. 522 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY

SHIFT REPORT

JOB 5-63 LOC. McCoolstown DATE 5-5-65

SHIFT DAY — SWING _____ NITE _____ HOLE NO. 335

RODS, END OF SHIFT 64 64
STICKUP, END OF SHIFT 20
DEPTH, END OF SHIFT 624
DEPTH, START OF SHIFT 592
DRILLED 32
CORE RECOVERED 100%
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER 2

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 6
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 2
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) In hr. fighting
last piece of Nathan table
after driller pulled out put
rod back on!

DRILLER Leon Reese HELPER Gene Pettit

MACHINE NO. S22 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. 1 mc DATE 5-5-65

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 325

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT 665
DEPTH, START OF SHIFT 65-
DRILLED 2
CORE RECOVERED 15-R
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 7
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____
BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER [illegible] HELPER [illegible]
MACHINE NO. _____ FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 4 63 LOC. [illegible] DATE 5- [illegible]

SHIFT DAY ____ SWING ____ NITE ✓ HOLE NO. [illegible]

RODS, END OF SHIFT 704
STICKUP, END OF SHIFT 10
DEPTH, END OF SHIFT 687
DEPTH, START OF SHIFT 646
DRILLED 41
CORE RECOVERED ____
TYPE OF ROCK Limestone
NUMBER OF RUNS [illegible]

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8 1.25
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Hard Lime St.

DRILLER K. Conway HELPER Tom Mitchell

MACHINE NO. 322 FOREMAN ____

DYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Emc DATE 5-6-65

SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 375

RODS, END OF SHIFT ____ MUD ____

STICKUP, END OF SHIFT ____ TYPE ____

DEPTH, END OF SHIFT 707 CAL-SEAL ____

DEPTH, START OF SHIFT 687 LUMNITE ____

DRILLED 20 PORTLAND ____

CORE RECOVERED R.B. ADDITIVES ____

TYPE OF ROCK ____ WATER ____

NUMBER OF RUNS ____

FEET CASED ____ FROM ____ TO ____ SIZE ____

FEET REAMED ____ FROM ____ TO ____ SIZE ____

CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 8 CEMENTING ____

REAMING ____ EQUIP. REPAIR ____

CASING ____ STAND-BY OR SURVEY ____

SET-UP, TEAR DOWN ____ WATER DELAY ____

MIXING MUD ____ WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER J D Conners HELPER Gene Pollock

MACHINE NO. 822 FOREMAN ____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. TM 2 DATE 5-5-63

SHIFT DAY ____ SWING 8 NITE ____ HOLE NO. 375

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 877
DEPTH, START OF SHIFT 870
DRILLED 7
CORE RECOVERED R 8
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED 710 FROM 0 TO 710 SIZE 4 in
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 2
REAMING ____
CASING 6
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____
BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) Casing [illegible] hard

DRILLER Murray HELPER [illegible]
MACHINE NO. 8321 FOREMAN ____

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Inc-[illegible] DATE 5-6-65

SHIFT DAY _____ SWING _____ NITE 8 HOLE NO. 373

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER 3 Loads.

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 2 hrs.
REAMING _____
CASING 2 hrs.
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 4 hrs
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____
BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Finishing setting casing TRP to put rugs on pump.

DRILLER K. Conway HELPER Tom Hatcher
MACHINE NO. 222 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. Inc Eastwood DATE 5-7-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT 938
STICKUP, END OF SHIFT 18
DEPTH, END OF SHIFT 920
DEPTH, START OF SHIFT 817
DRILLED 103
CORE RECOVERED K. bit
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER Clear

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 6
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 2
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS, (Explain delays and hole condition) Pulled [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

DRILLER Leon Reeves HELPER Gene Pollock

MACHINE NO. 522 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. 1A9 C DATE 3-7-63

SHIFT DAY ____ SWING 4 NITE ____ HOLE NO. 375

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 982
DEPTH, START OF SHIFT 920
DRILLED 62
CORE RECOVERED R.B
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 3
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR 1
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. [illegible] FOREMAN [illegible]

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 4-63 LOC. [illegible] DATE 5-8-63

SHIFT DAY 6 SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT 1133
STICKUP, END OF SHIFT 22
DEPTH, END OF SHIFT 1111
DEPTH, START OF SHIFT 992
DRILLED 119
CORE RECOVERED [illegible]
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 5
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR 3
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]
[illegible]
[illegible]

DRILLER Leon Reene HELPER _____
MACHINE NO. 822 FOREMAN _____

7

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB 5-63 LOC. [illegible] DATE [illegible]

SHIFT DAY ____ SWING 5 NITE ____ HOLE NO. [illegible]

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 1236
DEPTH, START OF SHIFT 11[illegible]
DRILLED 125
CORE RECOVERED [illegible]
TYPE OF ROCK ____
NUMBER OF RUNS ____

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER [illegible]

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 6
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR ____
STAND-BY OR SURVEY ____
WATER DELAY 2
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. ____ FOREMAN ____

BOYLES BROS. DRILLING COMPANY
SHIFT REPORT

JOB [illegible] LOC. [illegible] DATE [illegible]

SHIFT DAY _____ SWING _____ NITE [illegible] HOLE NO. [illegible]

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT [illegible]
DEPTH, START OF SHIFT [illegible]
DRILLED [illegible]
CORE RECOVERED _____
TYPE OF ROCK [illegible]
NUMBER OF RUNS [illegible]

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING [illegible]
REAMING _____
Pouring CASING [illegible]
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]
Rods Haul [illegible]
Rods started putting cable on [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. [illegible] FOREMAN _____

B. LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 5-13 LOC. [illegible] DATE 5-10-6[illegible]

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT	1323	MUD	
STICKUP, END OF SHIFT	7	TYPE	
DEPTH, END OF SHIFT	1316	CAL-SEAL	
DEPTH, START OF SHIFT	1298	LUMNITE	
DRILLED	18	PORTLAND	
CORE RECOVERED	18	ADDITIVES	
TYPE OF ROCK	Salt	WATER	
NUMBER OF RUNS			

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	6	CEMENTING	
REAMING		EQUIP. REPAIR	2
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. 822 FOREMAN _____

BC LES BROS. DRILLING COMP, .Y
SHIFT REPORT

JOB 5-63 LOC. MC DATE 5-1-63

SHIFT DAY ____ SWING ✓ NITE ____ HOLE NO. 275

RODS, END OF SHIFT ____
STICKUP, END OF SHIFT ____
DEPTH, END OF SHIFT 1336
DEPTH, START OF SHIFT 1316
DRILLED 20
CORE RECOVERED 20
TYPE OF ROCK ____
NUMBER OF RUNS 2

MUD ____
TYPE ____
CAL-SEAL ____
LUMNITE ____
PORTLAND ____
ADDITIVES ____
WATER ____

FEET CASED ____ FROM ____ TO ____ SIZE ____
FEET REAMED ____ FROM ____ TO ____ SIZE ____
CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING 3
REAMING ____
CASING ____
SET-UP, TEAR DOWN ____
MIXING MUD ____

CEMENTING ____
EQUIP. REPAIR 5
STAND-BY OR SURVEY ____
WATER DELAY ____
WASHING OR CLEANING ____

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. 7 FOREMAN ____

BC LES BROS. DRILLING COMP, .Y
SHIFT REPORT

JOB 5-63 LOC. [illegible] DATE [illegible]

SHIFT DAY _____ SWING _____ NITE 8 HOLE NO. [illegible]

RODS, END OF SHIFT	[illegible]	MUD	
STICKUP, END OF SHIFT	10	TYPE	
DEPTH, END OF SHIFT	[illegible]	CAL-SEAL	
DEPTH, START OF SHIFT	356	LUMNITE	
DRILLED	70	PORTLAND	
CORE RECOVERED	70	ADDITIVES	
TYPE OF ROCK	salt	WATER	1 load
NUMBER OF RUNS	7		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 HRS.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER [illegible] HELPER Tom [illegible]

MACHINE NO. 822 FOREMAN _____

7

BC LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 5-63 LOC Mccorkle DATE 5-11-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 3?4-

RODS, END OF SHIFT	1483	MUD	
STICKUP, END OF SHIFT	7	TYPE	
DEPTH, END OF SHIFT	1476	CAL-SEAL	
DEPTH, START OF SHIFT	1406	LUMNITE	
DRILLED	70	PORTLAND	
CORE RECOVERED	70	ADDITIVES	
TYPE OF ROCK	Salt.	WATER	
NUMBER OF RUNS	7		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Leon Reave HELPER Wesley Riley

MACHINE NO. 822 FOREMAN _____

7

BC LES BROS. DRILLING COMPA Y

SHIFT REPORT

JOB 3-43 LOC. LMC DATE 5-11-61

SHIFT DAY _____ SWING ✓ NITE _____ HOLE NO. 37

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT ✓
DEPTH, END OF SHIFT [illegible]
DEPTH, START OF SHIFT [illegible]
DRILLED [illegible]
CORE RECOVERED [illegible]
TYPE OF ROCK ✓
NUMBER OF RUNS [illegible]

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING ✓
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Murray HELPER [illegible]

MACHINE NO. _____ FOREMAN _____

B(LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 3-63 LOC. [illegible] DATE 5-11-63

SHIFT DAY _____ SWING _____ NITE 8 HOLE NO. 375

RODS, END OF SHIFT	663	MUD	
STICKUP, END OF SHIFT	11	TYPE	
DEPTH, END OF SHIFT	595	CAL-SEAL	
DEPTH, START OF SHIFT	525	LUMNITE	
DRILLED	70	PORTLAND	
CORE RECOVERED	70	ADDITIVES	
TYPE OF ROCK	Salt	WATER	Brine
NUMBER OF RUNS	7		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 hrs.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

K Conway HELPER Jm Mitchell

822 FOREMAN _____

BC .LES BROS. DRILLING COMPA. .Y

SHIFT REPORT

JOB 5-63 LOC. Mc Cutchlock DATE 5-12-65

SHIFT DAY ✓ SWING ____ NITE ____ HOLE NO. 375

RODS, END OF SHIFT	1663	MUD	
STICKUP, END OF SHIFT	1	TYPE	
DEPTH, END OF SHIFT	1664	CAL-SEAL	
DEPTH, START OF SHIFT	1594	LUMNITE	
DRILLED	61	PORTLAND	
CORE RECOVERED	61	ADDITIVES	
TYPE OF ROCK	Salt	WATER	Load from
NUMBER OF RUNS	7		

FEET CASED ____ FROM ____ TO ____ SIZE ____

FEET REAMED ____ FROM ____ TO ____ SIZE ____

CEMENT DRILLED ____ FROM ____ TO ____

TIME CHARGES

DRILLING	8	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. ____ SIZE & TYPE ____ OVERSIZE ____ ON ____ OFF ____

SHELL NO. ____ TYPE ____ ON ____ OFF ____

BIT CONDITION ____ REASON FOR RETIRING ____

REMARKS (Explain delays and hole condition) ____

DRILLER Leon Reeve HELPER Aurtor Riley

MACHINE NO. 422 FOREMAN ____

B[illegible] .LES BROS. DRILLING COMP[illegible] .Y

SHIFT REPORT

JOB [illegible]-63 LOC. [illegible] DATE [illegible]

SHIFT DAY _____ SWING [illegible] NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT [illegible]
DEPTH, START OF SHIFT [illegible]
DRILLED [illegible]
CORE RECOVERED [illegible]
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 8
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. [illegible] FOREMAN _____

7

BC .LES BROS. DRILLING COMPA. .Y
SHIFT REPORT

JOB 5-63 LOC. Inc-Carlsbad DATE 5-12-6[illegible]

SHIFT DAY _____ SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT	1753	MUD	
STICKUP, END OF SHIFT	0	TYPE	
DEPTH, END OF SHIFT	1746	CAL-SEAL	
DEPTH, START OF SHIFT	1696	LUMNITE	
DRILLED	50	PORTLAND	
CORE RECOVERED	50	ADDITIVES	
TYPE OF ROCK	Lm. H.	WATER	Brine
NUMBER OF RUNS	5		

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING	8 hrs.	CEMENTING	
REAMING		EQUIP. REPAIR	
CASING		STAND-BY OR SURVEY	
SET-UP, TEAR DOWN		WATER DELAY	
MIXING MUD		WASHING OR CLEANING	

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE NC. OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Pipe stopped Breaking out Rods.

DRILLER K. Conway HELPER T. Mitchell

MACHINE NO. 622 FOREMAN _____

7

BC . LES BROS. DRILLING COMPA. .Y

SHIFT REPORT

JOB 5-63 LOC/ McCorkle DATE 5-13-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING 5
REAMING _____
CASING 3
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Broke [illegible] line rods 3 hr. pulling [illegible] & casing

DRILLER Leon Reeve HELPER Vester Riley

MACHINE NO. S22 FOREMAN _____

7

B(LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 3-63 LOC. IMC DATE 5-13-63

SHIFT DAY _____ SWING ✓ NITE _____ HOLE NO. [illegible]

RODS, END OF SHIFT _____	MUD _____
STICKUP, END OF SHIFT _____	TYPE _____
DEPTH, END OF SHIFT _____	CAL-SEAL _____
DEPTH, START OF SHIFT _____	LUMNITE _____
DRILLED _____	PORTLAND _____
CORE RECOVERED _____	ADDITIVES _____
TYPE OF ROCK _____	WATER _____
NUMBER OF RUNS _____	

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____	CEMENTING _____
REAMING _____	EQUIP. REPAIR _____
CASING 8	STAND-BY OR SURVEY _____
SET-UP, TEAR DOWN _____	WATER DELAY _____
MIXING MUD _____	WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) [illegible]

DRILLER [illegible] HELPER [illegible]

MACHINE NO. _____ FOREMAN _____

7

BC LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 5-63 LOC. McCarthed DATE 5-14-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 325

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND _____
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____
REAMING _____
CASING 8
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING _____
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS: (Explain delays and hole condition) Set cemented 8 to pull and back off to Ro Stuck.

DRILLER Leon Reeve HELPER Vester Riley

MACHINE NO. 822 FOREMAN _____

7

B(LES BROS. DRILLING COMP, .Y

SHIFT REPORT

JOB 5-63 LOC. 1MC DATE 5-14-65

SHIFT DAY _____ SWING 8 NITE _____ HOLE NO. 3 25

RODS,- END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND 35 sacks
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____
REAMING _____
CASING _____
SET-UP, TEAR DOWN _____
MIXING MUD _____

CEMENTING 8
EQUIP. REPAIR _____
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Cut down [illegible] 35 sacks [illegible] [illegible]

DRILLER Mooney HELPER [illegible]

MACHINE NO. 1 FOREMAN _____

7

B\ LES BROS. DRILLING COMP. .Y
SHIFT REPORT

JOB 563 LOC. Imc-Carlsbad DATE 5-18-65

SHIFT DAY _____ SWING _____ NITE 8 hr HOLE NO. 375

RODS, END OF SHIFT _____ MUD _____

STICKUP, END OF SHIFT _____ TYPE _____

DEPTH, END OF SHIFT _____ CAL-SEAL _____

DEPTH, START OF SHIFT _____ LUMNITE _____

DRILLED _____ PORTLAND _____

CORE RECOVERED _____ ADDITIVES _____

TYPE OF ROCK _____ WATER _____

NUMBER OF RUNS _____

FEET CASED _____ FROM _____ TO _____ SIZE _____

FEET REAMED _____ FROM _____ TO _____ SIZE _____

CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

~~DRILLING~~ Fishing 8 hrs. CEMENTING _____

REAMING _____ EQUIP. REPAIR _____

CASING _____ STAND-BY OR SURVEY _____

SET-UP, TEAR DOWN _____ WATER DELAY _____

MIXING MUD _____ WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) Fishing for Corkscrewed Rods.

DRILLER K. Conway HELPER Jim mitchell

MACHINE NO. 822 FOREMAN _____

7

B .'LES BROS. DRILLING COMP. ;Y

SHIFT REPORT

JOB 5-63 LOC. Meeteetse DATE 5-15-65

SHIFT DAY ✓ SWING _____ NITE _____ HOLE NO. 375

RODS, END OF SHIFT _____
STICKUP, END OF SHIFT _____
DEPTH, END OF SHIFT _____
DEPTH, START OF SHIFT _____
DRILLED _____
CORE RECOVERED _____
TYPE OF ROCK _____
NUMBER OF RUNS _____

MUD _____
TYPE _____
CAL-SEAL _____
LUMNITE _____
PORTLAND 63 sacks
ADDITIVES _____
WATER _____

FEET CASED _____ FROM _____ TO _____ SIZE _____
FEET REAMED _____ FROM _____ TO _____ SIZE _____
CEMENT DRILLED _____ FROM _____ TO _____

TIME CHARGES

DRILLING _____
REAMING _____
CASING _____
SET-UP, TEAR DOWN 2
MIXING MUD _____

CEMENTING 3
EQUIP. REPAIR 3
STAND-BY OR SURVEY _____
WATER DELAY _____
WASHING OR CLEANING _____

BITS AND SHELLS

BIT NO. _____ SIZE & TYPE _____ OVERSIZE _____ ON _____ OFF _____

SHELL NO. _____ TYPE _____ ON _____ OFF _____

BIT CONDITION _____ REASON FOR RETIRING _____

REMARKS (Explain delays and hole condition) _____

DRILLER Leon Reeve HELPER Vester Riley

MACHINE NO. 822. FOREMAN _____

7

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION

P. O. BOX 71, CARLSBAD, NEW MEXICO

Page No. —

Test No. 285

LOG OF PROSPECT WELL

RECEIVED
SEP 27 1965
U. S. Geological Survey
Carlsbad, N. M.

DEPTH FROM	DEPTH TO	INTERVAL	DESCRIPTION
			OVERBURDEN
0	30	30	Sand - red w/25-35% tan caliche
30	50	20	Clay-Sand - red w/10-15% tan gray caliche
50	200	150	Clay - Shale - red-brown w/traces of tan gray caliche
200	230	30	Clay-Shale - w/10-15% tan-gray caliche
230	270	40	Sand - red-brown, fine grained
270	280	10	Clay - red-brown, coarse grained
280	340	60	Clay-Shale - red w/20-50% gray gypsum
			Cavities in gypsum resulting in lost circulation
340	380	40	Clay-Shale - red-brown, w/15-20% gray gypsum
380	440	60	Clay-Shale - red-brown, w/30-50% gypsum in cavities
			(Lost circulation)
440	470	30	Clay-Shale - red-brown, w/traces of gypsum
470	520	50	Anhydrite - gray-tan, flinty - cherty - hard cutting
520	530	10	Clay-Shale - red-brown, fine grained w/traces of [illegible]
530	550	20	Anhydrite - gray to slate color w/traces of red shale
			Very hard cutting
550	560	10	Anhydrite - blue-slate color - very hard cutting

470-520 50 Anhydrite
520-530 Clay
530-680 Ls & Anhydrite
680-700 Gyp
700-810 Brown clay
810- Top of Salt

800

510

817
929
1746

PLUGGING SHEET

IMC No. 375

From	To	Int.	Material	Size	Ft. /Sack	Sacks
1746'	817'	929'	Cement	3 7/8"	18	52
817	510	307	Cement	6 1/4"	7.3	42
510	20	490'	Mud	6 3/4"		
20	0	20'	Cement	6 3/4"	6.0	4
		1746				

TOTAL SACKS 98

Set casing 4' above surface

Set Marker Plate Number 375

Kurt O. Lim
5/13/65

8-61

236

to Washington 9/27/65

RECAPITULATION

TEST WELL IMC 375

RECEIVED
SEP 22 1965
U. S. Geological Survey
Carlsbad, N. M.

Permittee:	R. G. Haworth
Operator:	International Minerals & Chemical Corp.
Permit No.	NM-0359161
Location:	144' S24°E from NW Corner of Sec. 33, T.22S., R.31E.
Surface Elevation:	3390'
Total Depth:	1746'
Type of Well:	Potash Core Test
Drilling Contractor:	Boyles Bros. Drilling Co.
Drilling Record:	Date Started: 4/28/65 Date Completed: 5/13/65 6-1/4 Rockbit: 0 - 520' 3-7/8 Rockbit; 520 - 1300' 3-7/8 Corebit: 1300 - 1746'
Casing Record:	4" Casing: 0 - 817' Recovered 129'
Water Horizons:	Unknown
Rustler Formation:	470 - 790'
Top of Salt:	790'
Top of USGS 124 Bed:	1602'
Mineralized Beds:	None

Notice of Intention to Drill, Subsequent Report of Abandonment, IMC Drilling Instructions, Log of Prospect Well (sample page), Plugging Sheet, and Recapitulation for IMC-377 (6 pages total).

APR 21 1965

Copy Mailed to Washington

Form 9-331a
(Feb. 1961)

377

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(SUBMIT IN TRIPLICATE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

Land Office Santa Fe, N. M.
Permit
Lease No. NM 0384584
Unit

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL	X	SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

April 20, 1965

S 45° E from NW Corner

Well No. 377 is located 100 ft. ~~from~~ {N/S} ~~line and~~ ~~ft. from~~ {E/W} ~~line of~~ sec. 22

NW 1/4 Sec. 22 (¼ Sec. and Sec. No.) T 22 S (Twp.) R 31 E (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy County (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3490 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Test well to be drilled for potash exploration. A rotary drill will be used from top to bottom.

Saturated potassium chloride brine, and/or air will be used while coring. Four inch casing will be set in top of the salt. All casing will be recovered.

Well will be plugged and marked to comply with past U.S.G.S. requirements.

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chem. Corp.
Address P.O. Box 71, Carlsbad, New Mexico

K. O. Linn
K. O. Linn
Geologist

APPROVED: APR 21 1965
U. S. Geological Survey

By R. S. Fulton

Title REGIONAL MINING SUPERVISOR U.S.G.S.

U.S. GOVERNMENT PRINTING OFFICE : 1956—O-303560

Cc Mailed to Washington JL 1 1965

Form 9-331a
(Feb. 1951)

Budget Bureau No. 42-R358.4.
Approval expires 12-31-60.

377

22

(SUBMIT IN TRIPLICATE)

Land Office Santa Fe
Permit NM 0384584
Unit

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

RECEIVED
JUL 21 1965
U.S. Geological Survey
Carlsbad, N. Mex.

SUNDRY NOTICES AND REPORTS ON WELLS

NOTICE OF INTENTION TO DRILL		SUBSEQUENT REPORT OF WATER SHUT-OFF	
NOTICE OF INTENTION TO CHANGE PLANS		SUBSEQUENT REPORT OF SHOOTING OR ACIDIZING	
NOTICE OF INTENTION TO TEST WATER SHUT-OFF		SUBSEQUENT REPORT OF ALTERING CASING	
NOTICE OF INTENTION TO RE-DRILL OR REPAIR WELL		SUBSEQUENT REPORT OF RE-DRILLING OR REPAIR	
NOTICE OF INTENTION TO SHOOT OR ACIDIZE		SUBSEQUENT REPORT OF ABANDONMENT	X
NOTICE OF INTENTION TO PULL OR ALTER CASING		SUPPLEMENTARY WELL HISTORY	
NOTICE OF INTENTION TO ABANDON WELL			

(INDICATE ABOVE BY CHECK MARK NATURE OF REPORT, NOTICE, OR OTHER DATA)

July 20, 19 65

Well No. 377 is located 105 ft. ~~from~~ {N/S} ~~line and~~ ~~ft. from~~ {E/W} ~~line~~ of sec. 22
S 48° E of NW Corner

NW 1/4 Sec. 22 (¼ Sec. and Sec. No.) T.22 S. (Twp.) R.31 E. (Range) N.M.P.M. (Meridian)

Potash (Field) Eddy County (County or Subdivision) New Mexico (State or Territory)

The elevation of the derrick floor above sea level is 3490 ft.

DETAILS OF WORK

(State names of and expected depths to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other important proposed work)

Plugging Schedule

From	To	Int.	Material
1876	996	880	Cement
996	925	71	Mud
925	885	40	Cement
885	730	155	Mud
730	700	30	Cement
700	10	690	Mud
10	0	10	Cement

Work Schedule

Date Started:	6/26/65
Date Completed:	7/16/65
Top of Salt:	1014'
Base USGS 124:	1777.8'
Base USGS 126:	1864.9'
Total Depth:	1876'

I understand that this plan of work must receive approval in writing by the Geological Survey before operations may be commenced.

Company International Minerals & Chemical Corp.
Address P.O. Box 71, Carlsbad, New Mexico

APPROVED: JUL 21 1965
U. S. Geological Survey

S. S. Adams
S. S. Adams
Geologist

By R. S. Fulton
Title REGIONAL MINING SUPERVISOR U. S. G. S.

GPO 862040

Drilling Instructions - IMC 377

1. Drill with rock bit to top of salt (approx. 1020')
2. Set casing
3. Drill with rock bit to 1570 feet, using brine
4. Core from 1570 to total depth (approx. 1990') using brine.

Copy Mailed to Washington - 10-19-65

AGRICULTURAL CHEMICALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

P. O. BOX 71, CARLSBAD, NEW MEXICO

Page No. 1

Test No. 37

LOG OF PROSPECT WELL

RECEIVED
OCT 19 1965
U. S. Geological Survey
Roswell, N. M.

DEPTH FROM	DEPTH TO	INTERVAL	DESCRIPTION
0	10	10	OVERBURDEN Brown sand, 45% white caliche
10	20	10	Red brown clay, 5% white caliche
20	40	20	Brown sand, 20% maroon siltstone, 5% white caliche
40	60	20	Brown sand, 10% maroon siltstone, 1% white caliche
60	70	10	Brown sand, 25% maroon mudstone
70	100	30	Brown sand, 5% maroon mudstone
100	110	10	White and brown sand, 2% gray clay balls, 20% white caliche, 15% maroon mudstone
110	160	50	Red-brown sand and silt, 40% red-brown shale
160	170	10	Brown sand and silt, 25% brown mudstone
170	180	10	Brown sand, 5% brown mudstone
180	190	10	Brown sand
190	200	10	Brown silt and sand, 25% brown mudstone
200	250	50	Brown sand and silt, 2% white caliche
250	260	10	Red-brown shale, 2% white caliche

PLUGGING
SHEET

IMC No. 377

From	To	Int.	Material	Size	Ft. /Sack	Sacks
1876	996	880	Cement	3 7/8"	18.1	49
996	925	71	Mud	6 1/4	7.3	10
925	885	40	Cement	6 1/4	7.3	5
885	730	155	Mud	6 1/4	7.3	21
730	700	30	Cement	6 1/4	7.3	4
700	10	690	Mud	6 1/4	7.3	95
10	0	10	Cement	6 1/4	7.3	1

TOTAL SACKS _____

cement 59
mud 126

Set casing 4' above surface

Set Marker Plate Number _____

8-61

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RECEIVED
OCT 19 1965
U. S. Geological Survey
Carlsbad, N. M.

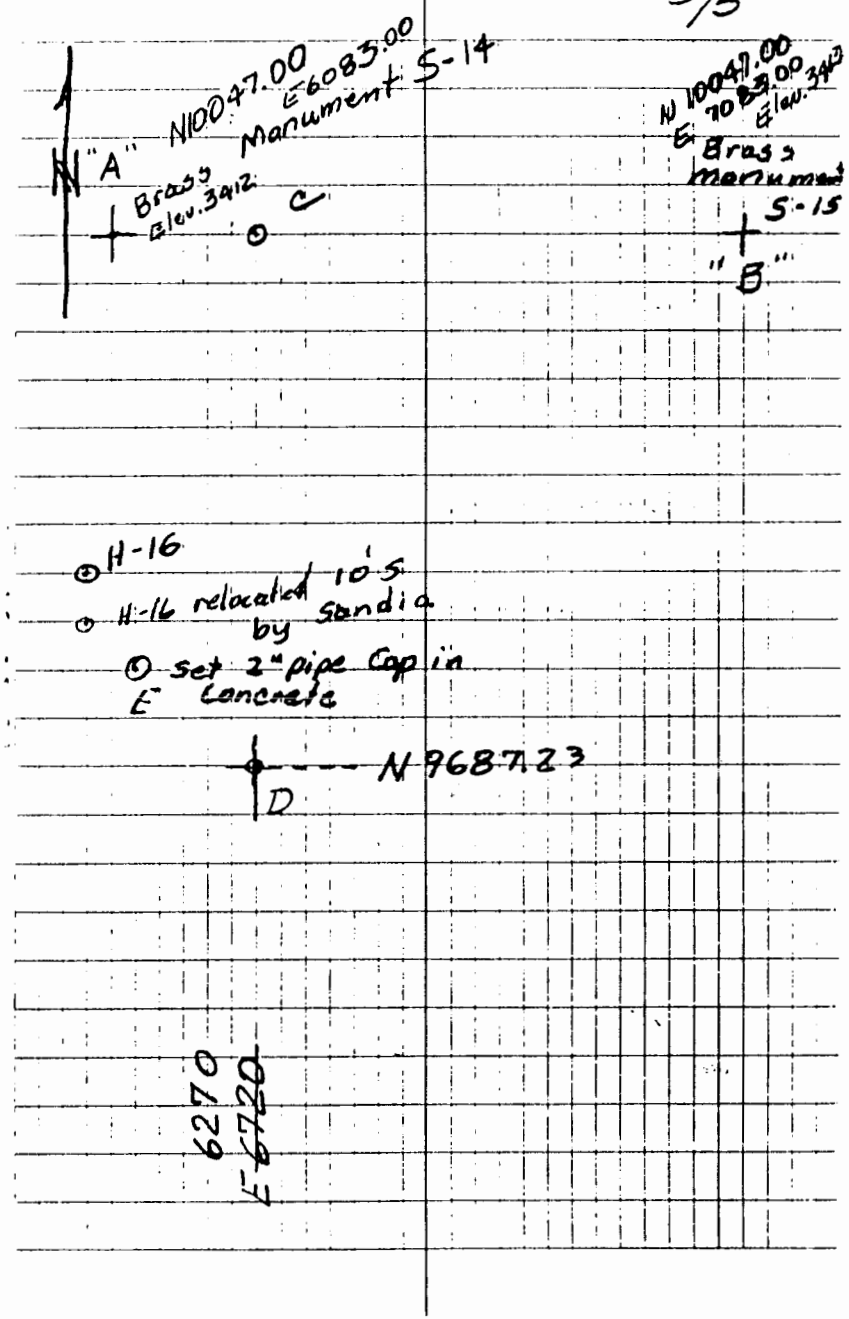
RECAPITULATION

TEST WELL IMC 377

Permittee:	R. G. Haworth
Operator:	International Minerals & Chemical Corp.
Permit No.	NM-0384584
Location:	105' S48°E from NW Corner of Sec. 22, T.22S., R.31E.
Surface Elevation:	3490'
Total Depth:	1876'
Drilling Contractor:	Boyles Bros. Drilling Co.
Drilling Record:	Date Started: 6/26/65 Date Completed: 7/16/65 6-1/4 Rockbit: 0 - 996' 3-7/8 Rockbit: 996 - 1530'
Casing Record:	4" Casing: 0 - 996' All Recovered
Water Horizons:	Unknown
Rustler Formation:	700 - 1014'
Top of Salt:	1014'
Top of USGS 124 Bed:	1770'

Mineralized Beds:	10th Ore Zone	1616.8 - 1622.6'	5.8' @ 8.2% K_2O Sylv.
	4th Ore Zone	1788.2 - 1792.3'	4.1' @ 11.6% K_2O Lang.
	3rd Ore Zone	Barren	
	2nd Ore Zone	Barren	
	1st Ore Zone	Barren	

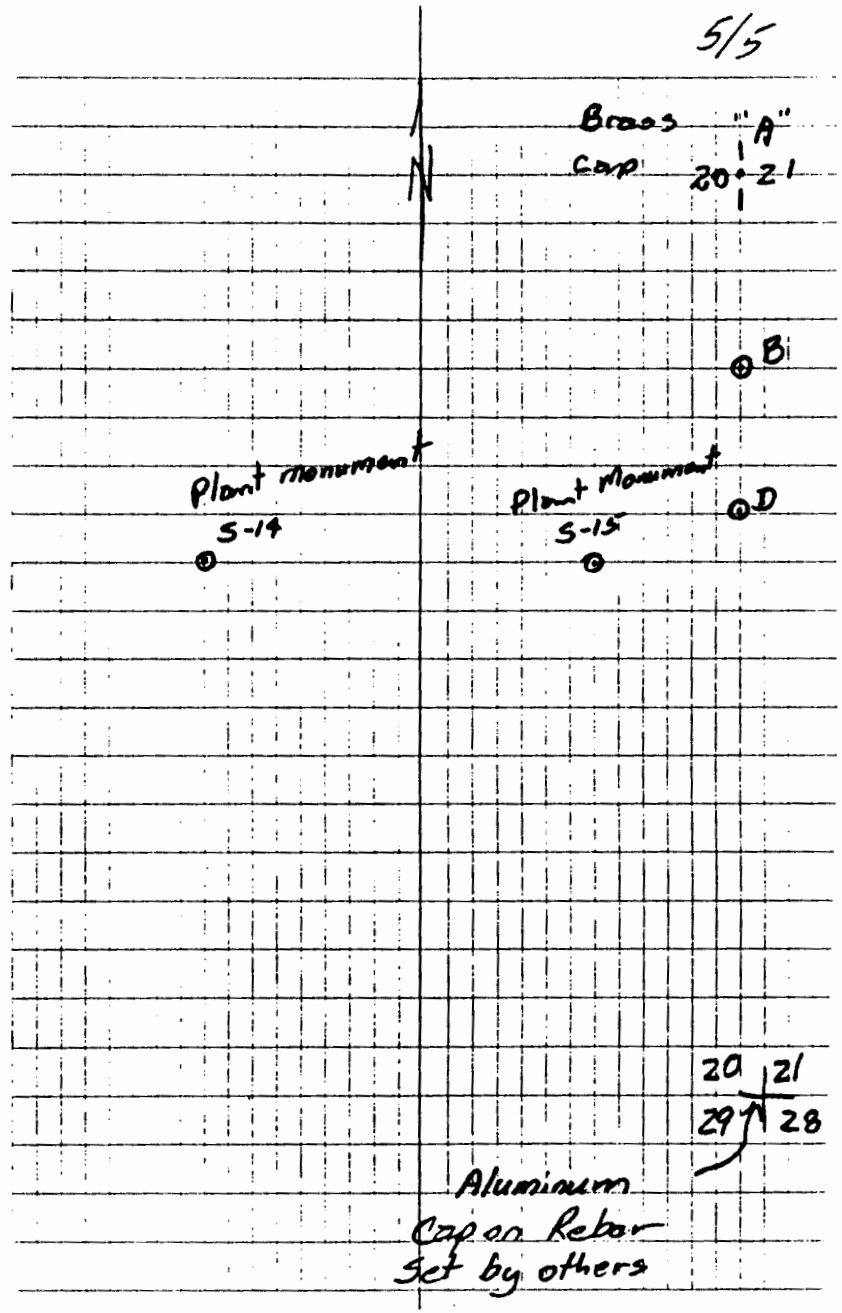
3/5



4/5

Sta	Slope Dist.	Horiz Angle	Vert Angle	Horiz Dist	
BC	2299.90'		90°32'45"	2299.80	
BD	840.74'		91°00'57"	840.61	
CBS-15		24°01'42"			
BS-15	952.90'		91°07'06"	952.72	
DS-15	389.12	calculated			
S-14) (S-15) D		~~195°21'03"~~ 135°21'35"			~~disregard~~
S15 – D	389.04'		Measured	389.04	
S14 – S15	1000.02'		90°00'00"		

5/5


N
Brass Cap
"A"
20
21
B
Plant monument
S-14
Plant Monument
S-15
D
20
21
29
28
Aluminum Cap on Rebar Set by others

APPENDIX C

PERMITS AND MISCELLANEOUS RECORDS

Sandia National Laboratories
Albuquerque, New Mexico 87185

June 23, 1987

State of New Mexico
State Engineers Office
Attn: Mr. Art Mason
P. O. Box 1717
Roswell, New Mexico 88201

Dear Mr. Mason:

Subject: Notice of Intention to Drill Hydrologic Exploratory Hole H-16

Enclosed in triplicate is the notice of intention to drill exploratory hole H-16. This hole is one of a series of hydrologic test holes to evaluate the hydraulic properties of the Rustler and Dewey Lake Formations at the WIPP site.

As you are aware, this hole is being drilled on behalf of the Department of Energy by Sandia National Laboratories in conjunction with the WIPP site.

If you have any questions, please feel free to contact me at 505-846-8275.

Sincerely,

Jerry W. Mercer

Jerry W. Mercer
Engineering Projects Div
7133

JWM:7133:jm

Enc

STATE OF NEW MEXICO

STATE ENGINEER OFFICE

ROSWELL

S. E. REYNOLDS
STATE ENGINEER

DISTRICT II
909 E. 2ND STREET
P.O BOX 1717
ROSWELL, NEW MEXICO 88201

July 1, 1987

FILE: 0-08-1471

Jerry W. Mercer
Sandia National Laboratories
PO Box 5800, Division 7133
Albuquerque, New Mexico 87185

Dear Mr. Mercer:

Enclosed is your copy of the above numbered Notice of Intention to Drill Exploratory Hole in the SE¼SE¼ of Section 20, Township 22 South, Range 31 East.

Yours truly,

Art Mason
Field Engineering Unit

AM/tmg
Encl.
cc Santa Fe

May 1972

IMPORTANT – READ INSTRUCTIONS ON BACK BEFORE FILLING OUT THIS FORM

NOTICE OF INTENTION TO DRILL EXPLORATORY HOLE

Eddy County
County

Date Received June 26, 1987 File No. 0-08-1471

1. Name Sandia National Laboratories

   Mailing Address P. O. Box 5800, Div 7133

   City and State Albuquerque, New Mexico 87185

2. Hole is to be drilled under contract for U. S. Department of Energy (self or company)

   and is to be known as the H-16.

3. The hole is to located _____ feet from the _____ Line and _____ feet from the _____ Line

   of Section _____ Township _____ Range _____ N.M.P.M., on land owned

   by _____ of _____.

4. Drilling will commence on or about July 10, 1987.

5. Description of Hole: Depth to be drilled 850 feet. It is our intention to:

   a. ☐ complete this hole as follows without cementing casing and to plug this hole immediately after completion of drilling in accordance with the rules and regulations of all appropriate regulatory agencies.

   b. ☒ cement casing and retain hole completed as follows:

Diameter of hole	Casing						Mud or Cement	
	Size	New/Used	API Grade	Wt/Foot	Interval From	Interval To	Type	Sacks
18	10-3/4	New	J-55	40.5	0	40	Batch	To Surf
9-5/8	7	New	J-55	23	40	500	70-30 poz Salt Resist	To Surf
6-1/8	Open Hole				500	850		

6. Location of hole is confidential _____ ; not confidential _____.

7. Logs of hole are confidential _____ ; not confidential _____.

8. Additional statements or explanations: The hole will be completed in the Rustler Formation; monitoring 5 separate zones isolated with packers. Hole will be used for long-term monitoring of the hydrologic characteristics of the Rustler Formation.

I, Jerry W. Mercer, depose and say that I have carefully read the foregoing statement and each and all of the items contained therein, and that the same are true to the best of my knowledge and belief.

Jerry W. Mercer
Jerry W. Mercer
Engineering Projects Div 7133

The above proposed casing, cementing, and plugging program has been reviewed by me, in my capacity as a duly appointed representative of the New Mexico State Engineer, and to the best of my knowledge and belief will be adequate to insure that waters and other minerals will be permanently confined to the zones in which they are encountered. (See reverse side of form for specific State Engineer regulations regarding the drilling of this hole).

Date 6/30/87

1. Drilling of hole shall be subject to compliance with the New Mexico Statutes and all rules and regulations of the State Engineer.

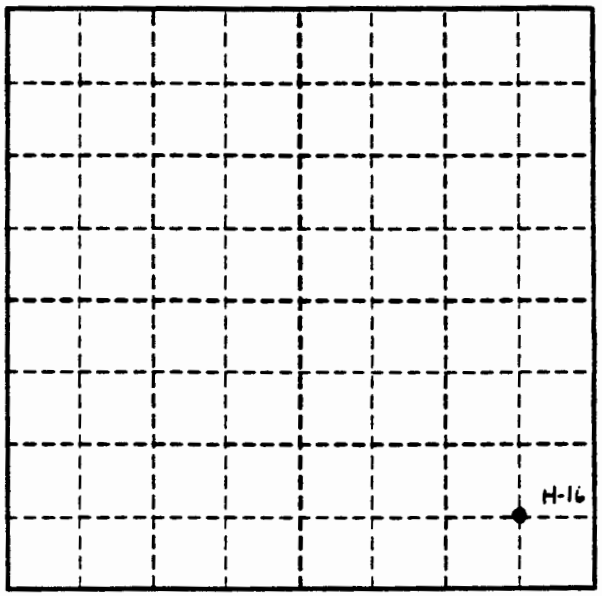
2. Casing shall not be installed or cemented without prior notification of the State Engineer office.

3. Hole shall not be plugged without prior notification of the State Engineer office.

4. Log of hole and plugging record shall be filed with the State Engineer office as soon as hole is completed.

LOCATE HOLE AS ACCURATELY AS POSSIBLE ON FOLLOWING PLAT:

Section(s) SE 1/4, SE 1/4 Sec 20, Township 22 S., Range 31 E. N.M.P.M.
Elevation approx 3410 ft.



INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate.
Each of the triplicate copies must be properly signed.

A separate notice must be filed for each hole drilled.

Sections 1-4 – Fill out all blanks fully and accurately.
Section 7 – Estimate time reasonably required to commence drilling. Drilling shall not commence until the Engineer is notified.

Forms should be filed with the Field Engineer, Box 1717, Roswell, New Mexico 88201

Sandia National Laboratories

Albuquerque, New Mexico 87185

Date: July 13, 1987

To: Record

From: Jerry W. Mercer, 7133

Subject: Technical and Safety Meeting at Hydrologic Test Hole H-16

A safety and technical information meeting was held at the H-16 drill site on July 13, 1987 at 1600 hours, prior to breaking tower on H-16. The purpose of the meeting was to discuss the technical objectives of the test hole and to outline safety procedures. Jerry Mercer gave an overview of the purpose of the test hole emphasizing the scientific importance. The test hole will be used as a monitoring hole for the fourth (air-intake) shaft. The hole will be completed in the Rustler Formation and will contain a five packer test system that will isolate selected horizons for monitoring effects of the shaft construction. Again it was emphazied that the objective was quality of drilling and coring not "how much hole can you make".

The safety part of the meeting stressed three major points:

1. WIPP site safety requirements

2. Availability of medical facilities at the WIPP site

3. Drilling Safety Plan adopted by Pennsylvania Drilling

The WIPP site safety requirements were reviewed included discussion of occupational safety equipment such as hard hats, safety shoes, and safety glasses. The use of safety glasses was stressed because under Penn Drillings safety plan safety glasses are not required except when "chipping" or mixing chemicals. The WIPP site requires use of Safety glasses at all times. Because we're drilling in the parking lot of the site, drilling crews must be exceptionally safety conscious ("drilling in a fish bowl").

The availability of medical facilities at the site were discussed. The contractor was informed that 24-hour medical help is available at the site and includes avalibility of ambulance etc.. In case of an accident, necessary treatment should be given to the injured person and then site security and the Sandia Field Test Director should be notified as soon as possible.

The Pennsylvania Drilling safety procedures were reviewed and discussed. Penn will use the Recommended Safe Operating Procedures as outlined by the International Association of Drilling Contractors (IADC). A copy of these procedures will be kept in the Sandia Field office trailer. Compliance with the WIFF site safety procedures will be required. Where there are conflicts between standards, the standard providing the greatest protection will be required. The driller will hold periodic safety meetings.

Copy to:
Ray Nations, DOE
6331 Al Lappin
6331 Rick Beauheim
Penn Drilling
File

SANDIA NATIONAL LABORATORY
INSTRUCTIONS TO LOGGING COMPANY

Date 7/16/87 Logging Company DRESSER-ATLAS

Prepared By J. W. MERCER Logging Engineer VAUGHN

Witnessed By Jerry W Mercer

Log Headings:

Company U.S. DEPARTMENT OF ENERGY

Well Number H-16

Field WIPP

County EDDY State NEW MEXICO

Location NW 1/4 SE 1/4 (PROVISIONAL)

Section 20 Township 22-S. Range 31-E.

Permanent Datum: ground level (G.L.) Elevations: G.L. 3409.6

drill floor (D.F.) D.F. —

kelley bushing (K.B.) K.B. —

Hole Status

	SIZE	FROM	TO		SIZE	FROM	TO
Casings	10-3/4"	0	36.5 ft.	Borehole	18"	0	36.5 ft.
					7-7/8"	36.5 ft	470 ft.

Fluid Status

Type Fluid in Borehole SAT BRINE Fluid Level FULL Fluid Loss —

Density — pH — Viscosity —

Purpose of Logging Program, Zones of Special Interest, Critical Hole Conditions, Remarks, Etc.

To obtain stratigraphic and hydrologic data for correlation and hydrologic analyses

"All logs" minimum 200 ft repeat, record all logs on same depth.

Number of Prints: Field 6 Final 13

Send to : Sandia National Laboratories
P. O. Box 5800, Division 7133 Attn. Jerry W. Mercer
Albuquerque, New Mexico 87185

NOTE:

Log Number * 1 GAMMA-RAY — COMPENSATED NEUTRON

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales Dresser-Standard
(c.) Logging Speed Desired ~ 30 feet/min
(d.) Interval to be Logged Total hole
(e.) Zones of Special Interest Total hole

(f.) Special Instructions Gamma 0 – 150 API
Caliper 6" – 16"
Neutron -15 to 45% on limestone
Drill crew will insure hole is full of fluid during logging operations

---

Log Number * 2 COMPENSATED DENSILOG w/ GAMMA RAY

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales Density 2.0 – 3.0 with 1.0 – 2.0 BKUP
(c.) Logging Speed Desired ~ 30 feet/min
(d.) Interval to be Logged Total hole
(e.) Zones of Special Interest Total hole

(f.) Special Instructions Gamma 0 – 150 API
caliper 6" – 16"
Density 2.0 - 3.0 with 1.0 - 2.0 BKUP
Drill crew will insure hole is full of fluid during all logging operations

---

Log Number * 3 DUAL LATEROLOG WITH GAMMA RAY

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales Dresser Standard
(c.) Logging Speed Desired ~ 30 feet/min
(d.) Interval to be Logged total depth to surface casing 36 ft
(e.) Zones of Special Interest total hole

(f.) Special Instructions Gamma 0 – 150 API
Resistivity 0.2 – 2000 OHM/M
Drill crew will insure hole is full of fluid during all logging operations

---

* Logs do not need to be run in this sequence

Log Number * BHC - ACOUSTILOG WITH GAMMA RAY

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales 40 - 140 us/foot with 140 - 240 BKUP
(c.) Logging Speed Desired ≈ 40 feet/min
(d.) Interval to be Logged Total depth to surface casing
(e.) Zones of Special Interest Total hole

(f.) Special Instructions Acoustic 40 - 140 us/foot
with 140 - 240 BKUP
Gamma 0 - 150 API

Drill crew will insure hole remains full of fluid during all logging operations

- LAST LOG -

Log Number *

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales
(c.) Logging Speed Desired
(d.) Interval to be Logged
(e.) Zones of Special Interest

(f.) Special Instructions

Log Number *

(a.) Vertical Depth Scales 2-inches/100 feet and 5-inches/100feet
(b.) Horizontal Logging Scales
(c.) Logging Speed Desired
(d.) Interval to be Logged
(e.) Zones of Special Interest

(f.) Special Instructions

---

* Logs do not need to be run in this sequence

LOG QUALITY REPORT

Hole H-16 Log Date 7/16/87 Current Date 7/16/87

Log COMPENSATED NEUTRON GAMMA RAY Run # 1 Engr. Vaughn

Field Print ☑ Final Print ☐ Log Analyst J.W. Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Labelled	✓	
3. Scale Changes Labelled	NA	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

LOG QUALITY REPORT

Hole H-16 Log Date 7/16/87 Current Date 7/16/87

Log Z-DENSILOG Run # 1 Engr. Vaughn

Field Print ✓ Final Print ☐ Log Analyst F.W. Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Labelled	✓	
3. Scale Changes Labelled	NA	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

LOG QUALITY REPORT

Hole H-16 Log Date 7/16/87 Current Date 7/16/87

Log DUAL LATERO LOG Gammmit RAY Run # 1 Engr. Vaughn

Field Print ✓ Final Print ☐ Log Analyst J.W. Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Labelled	✓	
3. Scale Changes Labelled	NA	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

LOG QUALITY REPORT

Hole H - 16 Log Date 7/16/87 Current Date 7/16/87

Log BHC Acoustilog Run # 1 Engr. Vaughn

Field Print ✓ Final Print ☐ Log Analyst J. W. Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO	REMARKS
A. HEADING			
1. Correct Heading Used	✓		
2. Heading Data Properly Completed	✓		
3. Logging Data Section Completed	✓		
4. Equipment Data Section Completed	✓		
5. Scale Changes Noted on Heading	✓		
6. Are all abnormal conditions explained in the remarks section	✓		
B. CALIBRATIONS AND SCALES			
1. Scales Correct for Area	✓		
2. Scales Labelled	✓		
3. Scale Changes Labelled			NA
4. Zeroes Recorded	✓		
5. Before Log Calibrations	✓		
6. After Log Calibrations		✓	on magnetic tape will put on final
7. Repeat Section Recorded	✓		
8. Repeat Section Acceptable	✓		
C. VALIDITY OF LOG			
1. Curves Functioning Correctly	✓		
2. Do Log values fall within reasonable limits	✓		
3. Curves on Depth	✓		
4. Logging Speed Indicated	✓		
5. Logging Speed Correct	✓		
D. APPEARANCE			
1. Printing or Typing Neat	✓		
2. Printing or Typing Accurate	✓		
3. Grid and Pen Traces	✓		
4. Splices Straight and Clean	✓		
5. Film Correctly Processed	✓		
6. General Print Quality	✓		

LOG QUALITY REPORT

Hole H-16 Log Date 8/18/87 Current Date 8/18/87

Log COMPENSATED NEUTRON - GAMMA RAY Run # 2 Engr. Cain

Field Print ✓ Final Print ☐ Log Analyst Jerry W Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Labelled	✓	
3. Scale Changes Labelled	✓	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

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LOG QUALITY REPORT

Hole H-16 Log Date 8/18/87 Current Date 8/18/87

Log Z-DENSILOG GAMMA RAY Run # 2 Engr. Cain

Field Print ✓ Final Print ☐ Log Analyst Jerry W Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Labelled	✓	
3. Scale Changes Labelled	✓	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

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LOG QUALITY REPORT

Hole H-16 Log Date 8/18/87 Current Date 8/18/87

Log DUAL LATEROLOG GAMMA RAY Run # 2 Engr. Cain

Field Print ✓ Final Print ☐ Log Analyst Jerry W Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

	YES	NO	REMARKS
A. HEADING			
1. Correct Heading Used	✓		
2. Heading Data Properly Completed	✓		need to use new location on Final
3. Logging Data Section Completed	✓		
4. Equipment Data Section Completed	✓		
5. Scale Changes Noted on Heading	✓		
6. Are all abnormal conditions explained in the remarks section	✓		
B. CALIBRATIONS AND SCALES			
1. Scales Correct for Area	✓		
2. Scales Labelled	✓		
3. Scale Changes Labelled	✓		
4. Zeroes Recorded	✓		
5. Before Lag Calibrations	✓		
6. After Lag Calibrations	✓		
7. Repeat Section Recorded	✓		
8. Repeat Section Acceptable	✓		
C. VALIDITY OF LOG			
1. Curves Functioning Correctly	✓		
2. Do Log values fall within reasonable limits	✓		
3. Curves on Depth	✓		
4. Logging Speed Indicated	✓		
5. Logging Speed Correct	✓		
D. APPEARANCE			
1. Printing or Typing Neat	✓		
2. Printing or Typing Accurate	✓		
3. Grid and Pen Traces	✓		
4. Splices Straight and Clean	✓		
5. Film Correctly Processed	✓		
6. General Print Quality	✓		

LOG QUALITY REPORT

Hole H - 16 Log Date 8/18/87 Current Date 8/18/87

Log BHC ACOUSTILOG Run # 2 Engr. Cain

Field Print ✓ Final Print ☐ Log Analyst Jerry W Mercer

CHECK ALL BOXES – ACCEPTABLE YES OR UNACCEPTABLE NO
Sections not applicable to a particular service, Leave Blank.

	YES	NO
A. HEADING		
1. Correct Heading Used	✓	
2. Heading Data Properly Completed	✓	
3. Logging Data Section Completed	✓	
4. Equipment Data Section Completed	✓	
5. Scale Changes Noted on Heading	✓	
6. Are all abnormal conditions explained in the remarks section	✓	
B. CALIBRATIONS AND SCALES		
1. Scales Correct for Area	✓	
2. Scales Lobelled	✓	
3. Scale Changes Labelled	NA	
4. Zeroes Recorded	✓	
5. Before Log Calibrations	✓	
6. After Log Calibrations	✓	
7. Repeat Section Recorded	✓	
8. Repeat Section Acceptable	✓	
C. VALIDITY OF LOG		
1. Curves Functioning Correctly	✓	
2. Do Log values fall within reasonable limits	✓	
3. Curves on Depth	✓	
4. Logging Speed Indicated	✓	
5. Logging Speed Correct	✓	
D. APPEARANCE		
1. Printing or Typing Neat	✓	
2. Printing or Typing Accurate	✓	
3. Grid and Pen Traces	✓	
4. Splices Straight and Clean	✓	
5. Film Correctly Processed	✓	
6. General Print Quality	✓	

REMARKS: Code Remarks with the proper Section Number. For Example: Remarks concerning before log calibrations would be coded B-5.

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CEMENTING SERVICE REPORT

DS-496 PRINTED IN U.S.A.

DOWELL SCHLUMBERGER INCORPORATED

TREATMENT NUMBER	DATE 7/17/8
STAGE	DS DISTRICT Artesia New Mexico

WELL NAME AND NO.	LOCATION (LEGAL)
Test well H-16	Sec 20, T22S, R31E
FIELD-POOL	FORMATION
COUNTY/PARISH: Eddy	STATE: New Mexico — API. NO.

NAME Sandia National Laboratories

AND

ADDRESS

ZIP CODE

RIG NAME:

WELL DATA:		BOTTOM			TOP
BIT SIZE	CSG/Liner Size	7"			
TOTAL ~~470~~ 469'	WEIGHT	23#			
☒ ROT ☐ CABLE	FOOTAGE				
MUD TYPE	GRADE	K55			
☐ BHST ☐ BHCT	THREAD				
MUD DENSITY	LESS FOOTAGE SHOE JOINT(S)				TOTAL
MUD VISC.	Disp. Capacity				

NOTE: Include Footage From Ground Level To Head In Disp. Capacity

Float Shoe		Stage Tool	
TYPE		TYPE	
DEPTH		DEPTH	
TYPE	Flapper Float S	TYPE	
DEPTH	469'	DEPTH	

Head & Plugs	☐ TBG ☐ D.P.	SQUEEZE JOB	
☐ Double	SIZE	Tool TYPE	
☒ Single	☐ WEIGHT	DEPTH	
☐ Swage	☐ GRADE	TAIL PIPE: SIZE	DEPTH
☐ Knockoff	☐ THREAD	TUBING VOLUME	Bbls
TOP ☒ R ☐ W	☐ NEW ☐ USED	CASING VOL. BELOW TOOL	Bbls
BOT ☐ R ☐ W	DEPTH	TOTAL	Bbls
		ANNUAL VOLUME	Bbls

SPECIAL INSTRUCTIONS

Cement 470' feet of 7 inch casing using a Thixotropic lead slurry and an extended tail slurry

IS CASING/TUBING SECURED? ☒ YES ☐ NO

LIFT PRESSURE PSI — CASING WEIGHT - SURFACE AREA (Tons & Ft²)

PRESSURE LIMIT PSI — BUMP PLUG TO 500+disp PSI

ROTATE RPM — RECIPROCATE FT — No. of Centralizers 5

JOB SCHEDULED FOR TIME: DATE:

ARRIVE ON LOCATION TIME: 14:15 DATE: 7/17/8

LEFT LOCATION TIME: 1930 DATE: 7/17/8

TIME 0001 to 2400	PRESSURE TBG OR D.P.	PRESSURE CASING	VOLUME PUMPED BBL INCREMENT	VOLUME PUMPED BBL CUM	INJECT RATE	FLUID TYPE	FLUID DENSITY	SERVICE LOG DETAIL
								PREJOB SAFETY MEETING
1615	\	\			2.5	chem. wash		start chemical wash
1621	\	\		10	"	H2O		start H2O spacer
1625	\	\	10	20	"	Slurry		start lead slurry
1632	\	\	18	38	"	"		start tail-in cement
1638	\	\			4.5	"		circulating cement, Rate increase
1647	\	\	56	94	"	"		shut down, drop plug
1649	\	\			4.5	H2O		start displacement
1653	\	\			2	"		lower rate
1656	\	900	18.5		2	"		shut down, bumped plug, close head in.

REMARKS

SYSTEM CODE	NO. OF SACKS	YIELD CU. FT/SK	COMPOSITION OF CEMENTING SYSTEMS	SLURRY MIXED BBLS	SLURRY MIXED DENSITY
1.	65	1.54	RFC	17.9	14.6
2.	175	1.78	70:30 IDA:CPOZ + 2% D-20 + 20% D44 (BWOW)	55.6	13.5
3.					
4.					
5.					
6.					

BREAKDOWN FLUID TYPE — VOLUME — DENSITY

☐ HESITATION SQ. ☐ RUNNING SQ. — CIRCULATION LOST ☐ YES ☒ NO

BREAKDOWN PSI — FINAL PSI

Washed Thru Perfs ☐ YES ☐ NO — TO FT

DISPLACEMENT VOL. 15.5 Bbls

MEASURED DISPLACEMENT ☐ ☐ WIRELINE

PRESSURE MAX. MIN.

Cement Circulated To Surf. ☒ YES ☐ NO Bbl

TYPE OF WELL ☐ OIL ☐ GAS ☐ STORAGE ☐ INJECTION ☐ BRINE WATER ☒ WILDCAT

PERFORATIONS TO TO TO TO

CUSTOMER REPRESENTATIVE: Terry Mercer

DS SUPERVISOR: Jim Maggard

Appendix F

Compiled Information for SWMUs 001y, 001z, 001aa, and 001ab (WIPP-18, WIPP-19, WIPP-21 and WIPP-22)

Basic Data Report for Drillhole WIPP 18 (Waste Isolation Pilot Plant - WIPP) (SAND79-0275), Section 3.0 pages 6 through 10, and Appendix C pages C-1 through C-8.

Basic Data Report for Drillhole WIPP 19 (Waste Isolation Pilot Plant - WIPP) (SAND79-0276), Section 3.0 pages 6 through 14, and Appendix C pages C-1 through C-11.

Basic Data Report for Drillhole WIPP 21 (Waste Isolation Pilot Plant - WIPP) (SAND79-0277), Section 3.0 pages 6 through 10, and Appendix C pages C-1 through C-5.

Basic Data Report for Drillhole WIPP 22 (Waste Isolation Pilot Plant - WIPP) (SAND79-0275), Section 3.0 pages 6 through 12, and Appendix C pages C-1 through C-6.

WIPP Hydrology Program, Waste Isolation Pilot Plant, Southeastern New Mexico, Hydrologic Data Report #4 (SAND86-7166), Part C, Sections 1.0 through 5.0, Figure 1.1, Figure 1.2, and Figure 1.3 (21 pages total).

Basic Data Report for Drillhole WIPP 18 (Waste Isolation Pilot Plant - WIPP) (SAND79-0275), Section 3.0 pages 6 through 10, and Appendix C pages C-1 through C-8.

WIPP - Drillholes

SAND79-0275
Unlimited Release
UC-70

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MAY 16 1980

Basic Data Report for Drillhole WIPP 18 (Waste Isolation Pilot Plant - WIPP)

Sandia Laboratories
United States Geological Survey

Sandia National Laboratories

SF 2900-Q(3-80)

3.0 GEOLOGIC DATA

By

C. L. Jones[1] and J. L. Gonzales[2]

3.1 Abstract

Borehole WIPP 18 is an exploratory well drilled to 1060 feet in eastern Eddy County, New Mexico, to define the structure of near-surface rocks. The formations penetrated include (1) surficial deposits of Holocene age and the Mescalero caliche of Pleistocene age, (2) the Santa Rosa Sandstone of Triassic age, and (3) the Dewey Lake Red Beds, the Rustler Formation, and part of the Salado Formation, all of Permian age. The geologic section is normal with no missing units or anomalous unit thinning or thickening. Correlated geologic and geophysical logs of WIPP 18 stratigraphic, lithologic, and physical details of the near-surface formations are presented.

3.2 Introduction

Borehole WIPP 18 is one of a series of exploratory wells drilled near the center of the proposed site for WIPP (Waste Isolation Pilot Plant) in eastern Eddy County, New Mexico (Figure 3). The specific objective in the exploratory drilling was to determine the nature of the structure of near-surface formations along a 2800-foot segment of a seismic-reflection survey line. Ambiguous seismic records from this segment of the survey line have been interpreted as indicating a fault sharply cutting the near-surface rocks with a possible minimum of 100-150 feet of structural displacement at the top of the Salado Formation.

Geologic details of the rocks penetrated by WIPP 18 are tabulated herein. The tabulation includes stratigraphic details and correlated lithologic and geophysical logs. Figure 4 is an interpretation prepared from the descriptive sample log (Table 3) and the suite of wireline geophysical logs. Other aspects of the rocks will be reported elsewhere.

---

[1]U.S. Geological Survey, Denver, Colorado

[2]Fenix & Scisson, Inc., Carlsbad, New Mexico

All measurements related to WIPP 18 are reported in the inch-pound system. This system is used to facilitate the direct comparison of original measurements and observations made by surveyors in establishing the geographic coordinates of the borehole, by drillers in reporting sample depth and drilling conditions, and geophysical loggers in recording inhole variations in rock properties with depth. If the metric equivalent of the inch-pound system is desired, the following conversion factors are provided:

Multiply English unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
inch (in)	25.4	millimeter (mm)
inch (in)	2.54	centimeter (cm)
pounds (lb)	0.4536	kilogram (kg)
pounds per square inch	0.06895	megapascal (MPa)

3.3 Description of WIPP 18

Borehole WIPP 18 is located in eastern Eddy County, New Mexico, in section 20, T.22S., R.31E. (Figure 3; Table 1). The hole was drilled between March 14 and 30, 1978, to a depth of 1060 feet measured from a land-surface altitude of 3456.5 feet above MSL (mean sea level).

Conventional rotary drilling procedures and a salt-base mud containing starch and other additives were used to drill WIPP 18. Cuttings were collected at 10-foot intervals by the driller. The cuttings were washed and then examined through a binocular microscope. The results of the examination are interpreted and correlated with selected geophysical logs on Figure 4. Stratigraphic data concerning formation thickness and depth interval in WIPP 18 are summarized in Table 2. A descriptive log of the cuttings (Table 3) was prepared at the site; it shows the depth reported by the cuttings.

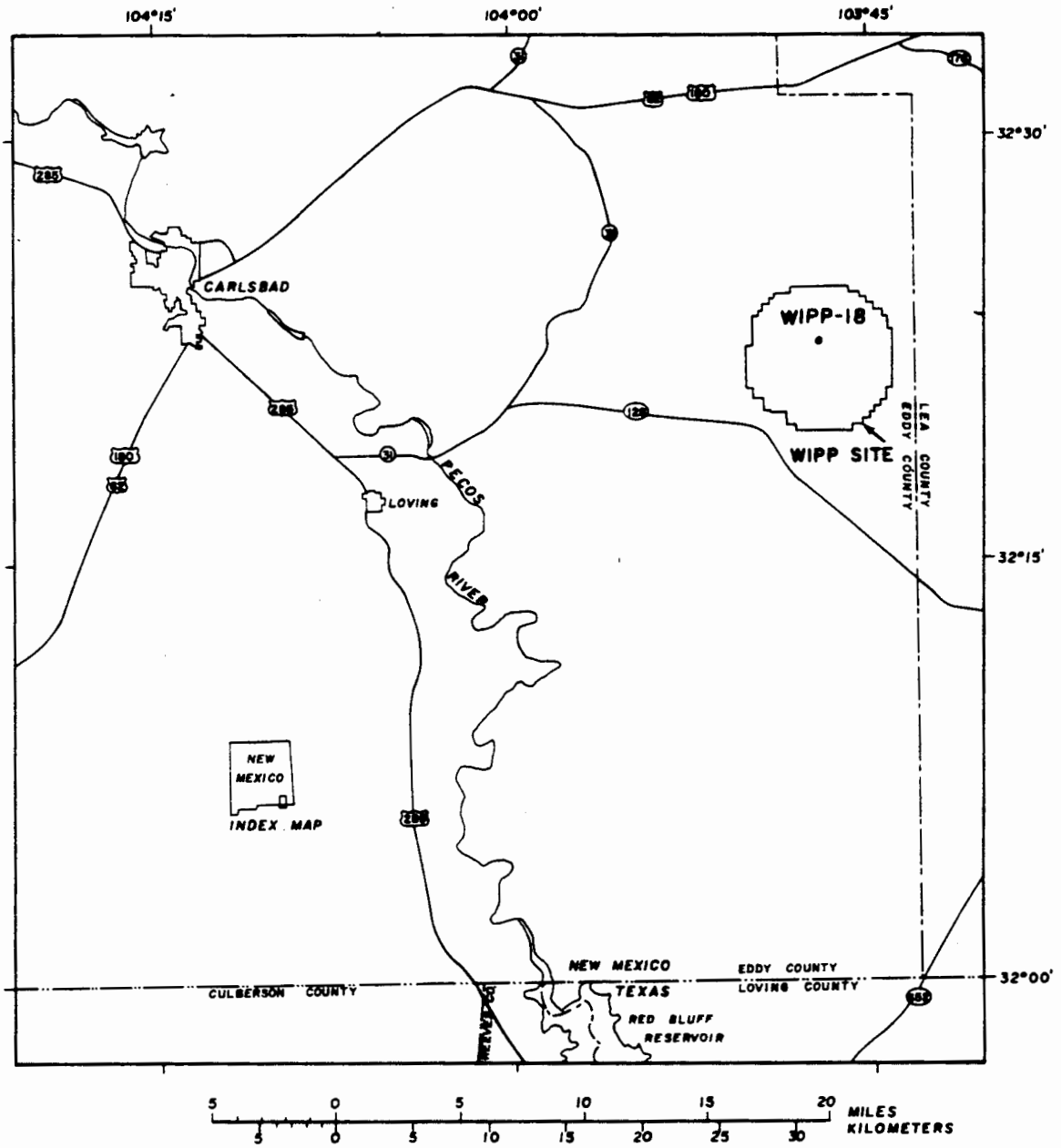


Figure 3. Index map showing location of borehole WIPP 18, Carlsbad, New Mexico.

After completion of the drilling, a suite of wireline geophysical logs was run the full length of WIPP 18 under open-hole, fluid-filled conditions. The suite includes (1) a gamma-ray curve that recorded variations in the distribution of radioactive elements, (2) a compensated-neutron porosity curve that recorded variations in the distribution of hydrogen, and (3) a compensated formation density-porosity curve that essentially recorded variations in rock density. The geophysical logging was done to (1) facilitate the recognition and correlation of rock units, (2) assure identification of major lithologies (dolomite, anhydrite, polyhalite, and other rocks), and (3) provide depth determinations independent of that provided by the driller.

The geologic section in WIPP 18 includes the surficial deposits of Holocene age, the Mescalero caliche of Pleistocene age, the Santa Rosa Sandstone of Triassic age, and the Dewey Lake Red Beds, the Rustler Formation, and the upper part of the Salado Formation, all of Permian age.

On the basis of comparison with geologic sections found by other earlier drilling in the WIPP area (Jones, 1978), the geologic section is normal with no missing units or anomalous unit thicknesses, and there is no indication of structural disruptions or discontinuities.

Table 1.--Abridged history of borehole WIPP-18

LOCATION: Sec. 20, T. 22 S., R. 31 E.
983.58 feet from north line
11.45 feet from east line

ALTITUDE: LS (land surface) 3,456.47 feet. Datum for depth measurements in drilling and logging operations.

DESCRIPTIVE LOG OF CUTTINGS PREPARED BY: J. L. Gonzales

DRILLING CONTRACTOR: Pennsylvania Drilling Co.

DRILLING RECORD: Commenced drilling on March 14, 1978, and completed on March 30, 1978, at 1,060 feet below LS.

Set 7-inch-OD conductor pipe in 8 3/4-inch hole at 16 feet; packed annulus with dirt.

Drilled 6 1/8-hole from 16 to 1,060 feet.

On completion of drilling and logging, borehole filled with salt-base mud and capped pending final decision on future work.

APPENDIX C

HOLE HISTORY

compiled by

R. D. Statler
Division 1133
and
P. D. Seward
Division 1135
Sandia Laboratories

INTRODUCTION TO APPENDIX C, HOLE HISTORY

The hole history is a document provided soon after completion of the borehole, and it summarizes the relevant information on the daily log kept by the contractor. The hole history is not edited to ensure conformance in every detail with later information developed for previous chapters. Further information may be obtained as necessary through examination of the original daily time logs.

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 10-16-78 (Rev. #1) 5-19-78

HOLE NO.: WIPP #18	W. O. NO.:	I. D. NO.:
USER: Sandia Lab.	TYPE HOLE: Exploratory	
LOCATION New Mexico	COUNTY: Eddy	AREA:
SURFACE COORDINATES: * 981.73' FNL, 13.70' FEL, Sec.20, T22S, R31E		
GROUND ELEVATION: *	PAD ELEVATION:	TOP CASING ELEVATION:
RIG ON LOCATION:	SPUDDED: 3-14-78	COMPLETED: 4-3-78
CIRCULATING MEDIA: Salt mud.		
MAIN RIG & CONTRACTOR		NO. OF COMPRESSORS & CAPACITY:

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	16'	8-3/4"	6.456"	20#				0'	16'	NONE
16'	1060'	6-1/8"								

TOTAL DEPTH: 1060'GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @
JUNK & PLUGS LEFT IN HOLE:		
SURVEYS PAGE:	CORING PAGE:	CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2		
BOTTOM HOLE COORDINATES: 989.33' FNL, 13.10' FEL @ 1060'		REFERENCE: Schlumberger

RIGS USED *(Site Prep Rigs *)*

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
1	Pennsylvania Drilling	Failing 2000		5.71	0.29	13.96	19.95
	Company						

REMARKS:

* Brass monument location: 985.85' FNL, 15.97' FEL, Sec.20, T22S, R31E. Elevation 3456.47'.

Horizontal displacement at 1060' was 7.6', S 4° 41' E

Sample Description Page 3

PREPARED BY: WDS/lkm

TIME BREAKDOWN ON NEXT PAGE

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 5-19-78

HOLE NO.: WIPP #18	W. O. NO.:		I. D. NO.:
USER: Sandia Lab	TYPE HOLE: Exploratory		
LOCATION New Mexico	COUNTY: Eddy	AREA:	
SURFACE COORDINATES: 4293.76' FSL, 12.49' FEL, Sec. 20, T22S, R31E			
GROUND ELEVATION: 3456.50'	PAD ELEVATION:	TOP CASING ELEVATION:	
RIG ON LOCATION:	SPUDDED: 3-14-78	COMPLETED: 4-3-78	
CIRCULATING MEDIA: Salt mud			
MAIN RIG & CONTRACTOR		NO. OF COMPRESSORS & CAPACITY:	

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	16'	8-3/4"	6.456"	20#				0'	16'	NONE
16'	1060'	6-1/8"								

TOTAL DEPTH: 1060' GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @
JUNK & PLUGS LEFT IN HOLE:		
SURVEYS PAGE:	CORING PAGE:	CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2		
BOTTOM HOLE COORDINATES: 4286.16' FSL, 11.89' FEL @ 1060'		REFERENCE: Schlumberger

RIGS USED *(Site Prep Rigs *)*

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
1	Pennsylvania Drilling	Failing 2000		5.71	0.29	13.96	19.95
	Company						

REMARKS: * *Site Prep Items*

Horizontal displacement at 1060' was 7.6', S 4° 41' E

Sample Description Page 3

PREPARED BY: WDS/ijt

TIME BREAKDOWN ON NEXT PAGE

WIPP #18

TIME BREAKDOWN

SITE PREPARATION

DRILLING OPERATION TIME (DOT)		OTHER SCHEDULED TIME (OST)		OPERATIONAL DELAY TIME (ODT)	
DRILL		MOVE		RIG REPAIRS	
TRIPS		RUN CASING		W. O. DRILLING SUPPLIES	
SURVEYS		CEMENT CASING		CLEAN OUT FILL	
				SECURED WITH CREWS	
SITE DOT	DAYS	SITE OST	DAYS	SITE ODT	

TOTAL SITE PREP TIME _____ DAYS REMARKS:

MAIN HOLE CONSTRUCTION

DRILLING OPERATION TIME (DOT)		OTHER SCHEDULED TIME (OST)		OPERATIONAL DELAY TIME (ODT)	
DRILL	3.27	MOBILIZATION & DEMOBILIZATION		RIG REPAIRS	0.10
TRIPS	0.28	CORE		W. O. EQUIPMENT	
DRESS DRILLING ASSEMBLY		LOG	1.06	FISH	
SINGLE SHOT DEV. SURVEYS	0.06	CASED HOLE DIR. SURVEYS		CLEAN OUT FILL	
OPEN HOLE DIRECTION SURVEYS		UNLOAD CASED HOLE		UNLOAD WATER INFLOW	
		RUN MANDREL		REAM CROOKED HOLE	
		HYDROLOGICAL TESTS		PLUG BACK	
		Rig up and down Government Materials	0.08	DRILL OUT PLUGS	
MAIN HOLE DOT	3.61 DAYS	Lay down drill pipe	0.13	SECURED WITH CREWS	0.29
CASING OPERATION TIME (COT)				Mix & Condition Mud	0.68
RUN 7" CASING	0.04				
RUN CASING					
CEMENT CASING					
CEMENT CASING					
DRILL OUT SHOE					
MAIN HOLE COT	0.04 DAYS	MAIN HOLE OST	1.27 DAYS	MAIN HOLE ODT	1.07 DAYS

TOTAL MAIN HOLE CONST. TIME 5.99 DAYS REMARKS:

TOTAL ELAPSED TIME

TOTAL SITE PREP TIME		DAYS
TOTAL MAIN HOLE CONST. TIME	5.99	DAYS
SEC. W/O CREW SITE PREP		DAYS
SEC. W/O CREW MAIN HOLE CONST.	13.96	DAYS
TOTAL SUSPENDED (NO RIG)		DAYS
TOTAL ELAPSED TIME	19.95	DAYS

REMARKS:

WIPP #18

HOLE HISTORY

3-13-78	Moved in Pennsylvania Drilling Company's rig #1.
3-14-78	Rigged up and mixed mud. Drilled 8-3/4" hole from 0' to 16'. Set 1 piece of 7" O.D., 20# casing at 16', not cemented. Worked days only.
3-15-78	Drilled 6-1/8" hole from 16' to 44'.
3-16-78	Drilled 6-1/8" hole from 44' to 150'.
3-17-78	Drilled 6-1/8" hole from 150' to 249'. Hauled in brine and mixed mud with lost circulation material.
3-20-78	Rig secured from 3-17-78 to 3-20-78. Drilled 6-1/8" hole from 249' to 290'. Losing mud.
3-21-78	Drilled 6-1/8" hole from 290' to 374'. Losing approximately 20 barrels of fluid per hour.
3-22-78	Drilled 6-1/8" hole from 374' to 523'. Losing 10 to 20 barrels of mud per hour.
3-23-78	Drilled 6-1/8" hole from 523' to 622'. Lost 80 barrels of mud, 90% returns.
3-24-78	Drilled 6-1/8" hole from 622' to 710'.
3-28-78	Rig secured from 3-24-78 to 3-28-78. Drilled 6-1/8" hole from 710' to 788'. Lost 10 barrels of mud per hour.
3-29-78	Drilled 6-1/8" hole from 788' to 908'.
3-30-78	Drilled 6-1/8" hole from 908' to 1060'. Ran USGS logs.
3-31-78	Conditioned mud for logging. Ran Schlumberger logs. Ran up hole velocity survey with Seismic Reference Services, Inc.
4-1-78	Completed velocity survey. Loaded hole with mud. Fluid level at 197'. Secured rig at 0600 hour.
4-3-78	Rig secured from 4-1-78 to 4-3-78. Laid down drill pipe. Filled hole with mud. Released rig at 1200 hour. Hole completed.

LOG INDEX SHEET

TYPE LOG	DATE	RUN NO.	DEPTH DRILLER	DEPTH LOGGER	LOGGED FROM	LOGGED TO
SCHLUMBERGER LOGS						
Dual Laterolog Micro - SFL	3-31-78	1	1060	1060	16	1058
Microlaterolog	3-31-78	1	1060	1060	16	1058
Compensated Neutron-Formation Density	3-31-78	1	1060	1060	0	1059
Borehole Compensated Sonic	3-31-78	1	1060	1060	0	1058
Continuous Dipmeter	3-31-78	1	1060	1059	16	1057
Continuous Directional	3-31-78	1	1060	1059	16	1057
SEISMIC REFERENCE SERVICE						
Seismic Survey	4-24-78	1	1060	1060	0	1058

NOTE: List of logs furnished F & S/Mercury.

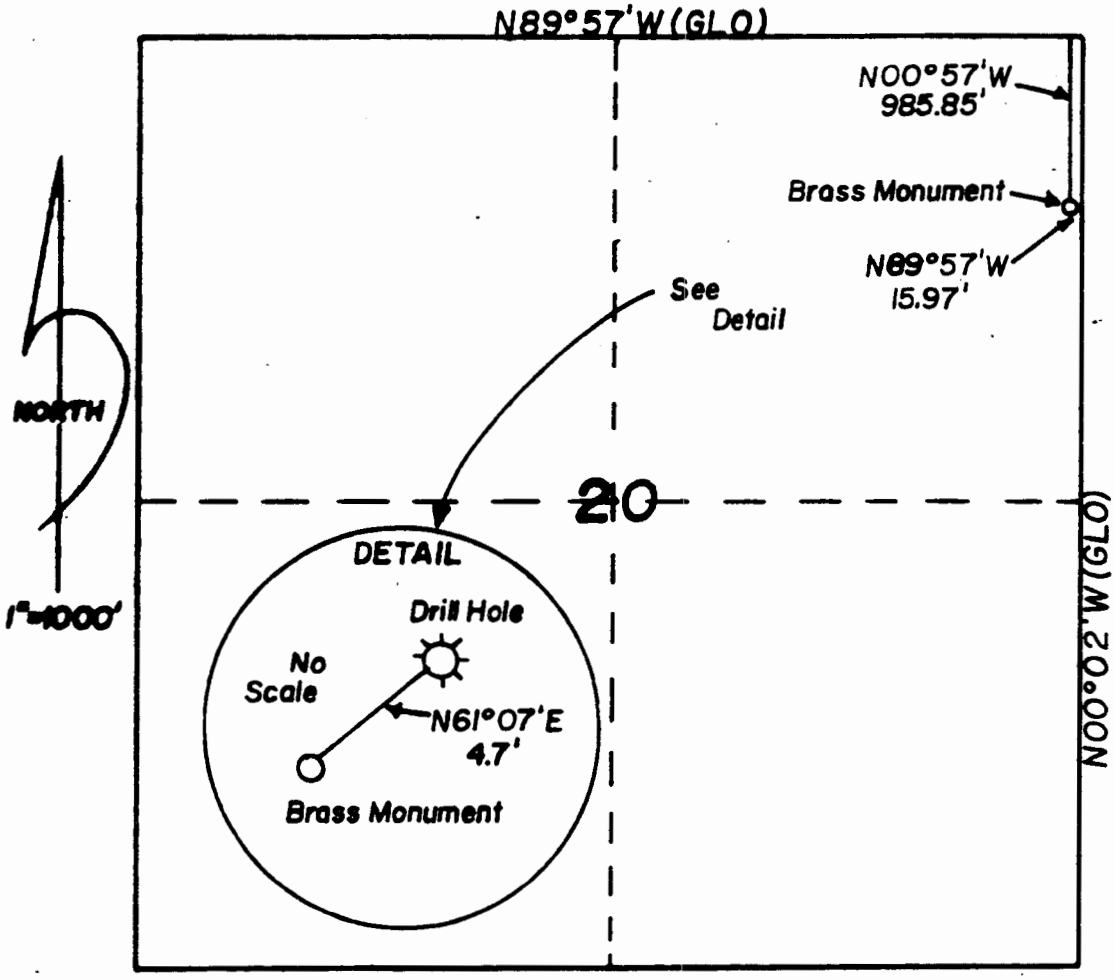
BIT RECORD

BIT NO.	MAKE	SIZE	TYPE	DEPTH OUT	FEET DRILLED	ROTATING HOURS
1	Hughes	8-3/4"	Used	16	16	3
2	Reed	6-1/8"	Y13J	290	274	21¼
3	Varel	6-1/8"	V3S	622	332	21¼
4	Varel	6-1/8"	V3S	788	166	14½
5	?			1060	272	13¼

SURVEY MONUMENT "AS BUILT"
W.I.P.P. 18

SECTION 20, TOWNSHIP 22 S, RANGE 31 E N.M.P.M.
EDDY COUNTY, NEW MEXICO

ELEVATION OF BRASS MONUMENT 3456.47'
985.85' FNL & 15.97' FEL



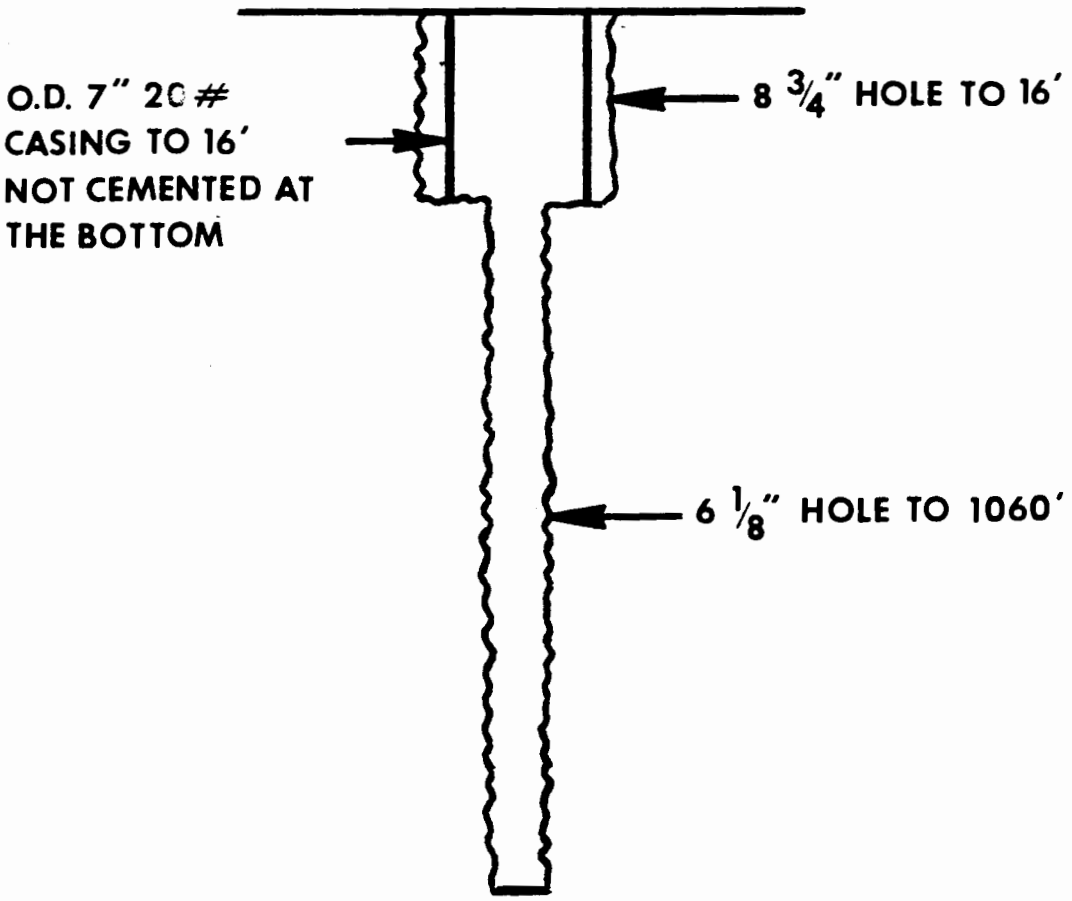
This is to certify that the foregoing plat was made from field notes of a bonafide survey made by me and is true and correct to the best of my knowledge and belief.

Dan R. Reddy

Dan R. Reddy
N.M.P.E. & L.S. #5412

DAN R. REDDY
NEW MEXICO
5412
LAND SURVEYOR
REGISTERED PROFESSIONAL ENGINEER

WIPP 18
AS BUILT HOLE CONDITIONS
AS OF 10/16/78



NOT TO SCALE

Basic Data Report for Drillhole WIPP 19 (Waste Isolation Pilot Plant - WIPP) (SAND79-0276), Section 3.0 pages 6 through 14, and Appendix C pages C-1 through C-11.

1.F - WL 1 F Drillholes

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Basic Data Report for Drillhole WIPP 19 (Waste Isolation Pilot Plant - WIPP)

Sandia Laboratories
United States Geological Survey

Sandia National Laboratories

F 2900-Q(3-80)

3.0 GEOLOGIC DATA FOR BOREHOLE WIPP 19

By

C. L. Jones[1] and J. L. Gonzales[2]

3.1 Abstract

Borehole WIPP 19 is a stratigraphic test hole drilled in eastern Eddy County, New Mexico, to explore for a possible fault indicated by seismic testing in near-surface formations. The formations penetrated include the Mescalero caliche of Pleistocene age; the Santa Rosa Sandstone of Triassic age; and the Dewey Lake Red Beds, the Rustler Formation, and part of the Salado Formation, all of Permian age. Correlated geologic and geophysical logs of WIPP 19 give lithologic, stratigraphic, and physical details of the near-surface formations and establish a normal stratigraphic sequence, in WIPP 19, unbroken by faulting.

3.2 Introduction

Borehole WIPP 19 is one of a series of stratigraphic holes drilled near the center of the proposed site for a Waste Isolation Pilot Plant (WIPP) in eastern Eddy County, New Mexico (Figure 3) on behalf of the U.S. Department of Energy (DOE). The drilling was done to determine the structure of near-surface formations along part of a seismic reflection survey line. On the basis of seismic records, faulting of the near-surface formations with a possible minimum of 100-150 feet of stratigraphic displacement had been inferred. WIPP 19 was located to intersect the "seismic fault" at a depth interval of about 600-800 feet below the surface.

Geologic details of the rocks penetrated by WIPP 19 are tabulated in this chapter. The tabulation includes correlated lithologic and geophysical logs and stratigraphic details. The correlated lithologic log is an interpretation compiled from descriptions of cores from WIPP 19 and from wireline geophysical logs. Other features of the rocks will be reported elsewhere.

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[1]U.S. Geological Survey, Denver, Colorado

[2]Fenix & Scisson, Inc., Carlsbad, New Mexico

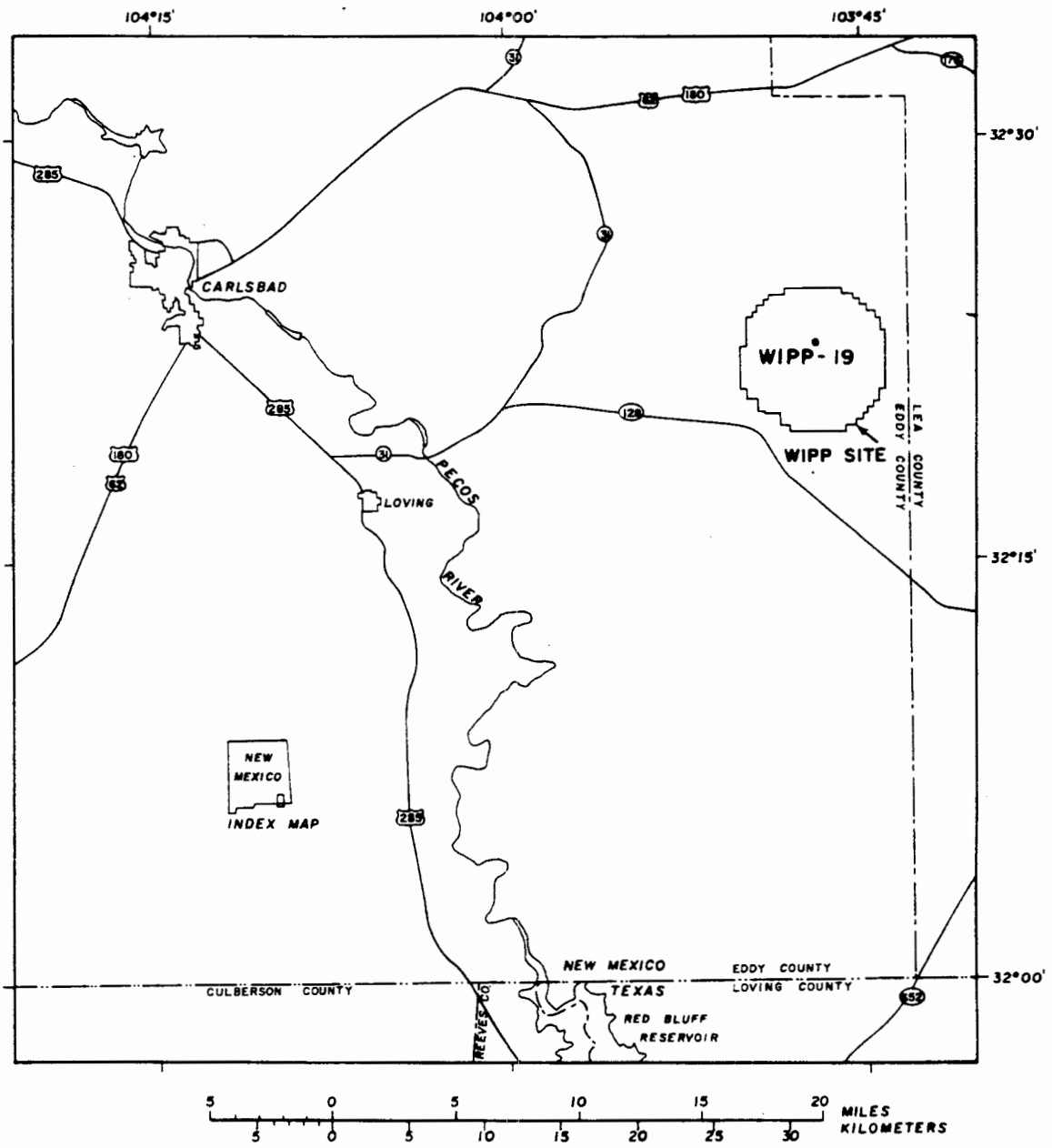


Figure 3. Index map showing location of borehole WIPP 19.

All measurements related to WIPP 19 are reported in the inch-pound system. These units are used to facilitate the comparison of the measurements made by surveyors in establishing the geographic coordinates of the borehole, by drillers in reporting core depths and drilling conditions, and by geophysical loggers in recording inhole variations in rock properties with depth. If the metric equivalents are desired, the following conversion factors are provided:

Multiply English unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
inch (in)	25.4	millimeter (mm)
inch (in)	2.54	centimeter (cm)
pounds (lb)	0.4536	kilogram (kg)
pounds per square inch (lb/in^2)	0.006895	megapascal (MPa)

3.3 Description of WIPP 19

Borehole WIPP 19 is located in eastern Eddy County, New Mexico, in the NE 1/4 Section 20, T.22S., R.31E. The borehole was drilled between April 6 and May 4, 1978, to a depth of 1038.2 feet measured from a land-surface altitude of 3433.13 feet above MSL (mean sea level). Table 1 gives further details concerning the drilling of WIPP 19.

Wireline coring procedures were used to obtain consecutive cores the full length of WIPP 19. All the cores were cleaned to remove a surficial coating of salt-base mud used as drilling fluid. After cleaning, the cores were marked according to the depths reported by the driller, examined for geologic details, wrapped in polyethylene sheets for preservation, and then transported from the drill site to the warehouse for photographing and storage. The results of the drill site core examination are recorded herein and are interpreted and correlated with selected geophysical logs on Figure 3.

A suite of geophysical logs was run the full length of WIPP 19. The logging was done to facilitate the recognition and correlation of rock units, to assure identification of major lithologies (dolomite, anhydrite,

polyhalite, and other rocks) and to provide depth determinations independent of that indicated by drill-rod measurements. The geophysical logs included a (1) gamma-ray curve that recorded variations in the distribution of radioactive elements (potassium, uranium, and thorium), (2) compensated-neutron porosity curve that essentially recorded variations in the distribution of hydrogen, and (3) compensated formation density porosity curve that essentially recorded variations in rock density.

3.4 Geologic Data

The rocks penetrated by WIPP 19 include continental sediments of Quaternary and Triassic age, and marine red beds and evaporites of Permian age. The rocks units are listed in Table 2, and are briefly described in descending order.

The Quaternary sediments consist of unconsolidated dune sand of Holocene age and a well-lithified calcareous soil, known locally as the Mescalero caliche of Pleistocene age. The two units account for the upper 14 feet of section in WIPP 19 (Figure 3).

The rocks underlying the Mescalero caliche, at 14-96 feet below land surface, belong to the Santa Rosa Sandstone of Triassic age. They are mostly reddish-brown and yellowish-brown sandstone with interbeds of reddish-brown mudstone and siltstone. Much of the rock is slightly calcareous, and part of the sandstone is micaceous. All are liberally peppered with greenish-gray reduction spots and streaks.

The Permian rocks penetrated consist of the Dewey Lake Red Beds, the Rustler Formation, and the upper part of the Salado Formation. They account for 938 feet of the section in WIPP 19.

The Dewey Lake Red Beds, 96-590 feet below land surface, are a lithologically distinctive but somehat monotonous sequence of reddish-brown siltstone and mudstone containing sparse interbeds of fine- to coarse-grained sandstone at irregular short to long intervals. Much of the reddish-brown rock is liberally peppered and streaked with greenish-gray reduction spots and streaky lenticular pods. Veinlets of fibrous, white selenite are common in the lower 375 feet of the red beds, and there are sparse calcite veinlets in the upper 100 feet of rock.

The Rustler Formation, 590-895 feet below land surface, is chiefly anhydrite (or gypsum) and fine-grained clastic rocks with interbeds of dolomite and clayey to silty halite. Rocks above a depth of 795 feet are weathered, and many, to a greater or lesser degree, have lost one or more soluble constituent (NaCl, $CaSO_4$, and $CaMg(CO_3)_2$) to dissolution by groundwater. Gypsum rinds containing corroded remnants of anhydrite are well-developed along the sides of anhydrite beds bordering the clastic rocks and dolomite interbeds, and there are veins and porphyroblasts of gypsum scattered through anhydrite and other rocks. Virtually all the clastic rocks above the depth of 795 feet are essentially structureless, unconsolidated clays and silts that are dissolution residues derived from clayey and silty halite; whereas those below that depth are well-indurated sandstone and siltstone containing crystals and veins of halite.

The Salado Formation is the lower 143 feet of rock, between 895 and 1038 feet, in WIPP 19. The rock is chiefly halite and argillaceous halite with thin interbeds of siltstone, polyhalite, and anhydrite. Much of the halite is white and reddish-orange to orange-pink; whereas the argillaceous halite is dominantly reddish-brown. Additional lithologic and stratigrphic details of the Salado are given in Table 3 and on Figure 3.

The geologic section in WIPP 19 is similar lithologically, stratigraphically, and structurally to that in other exploration test holes drilled at the WIPP site (see, for example, Jones 1978). The section is unbroken by faulting, and there are no anomalous dips or structural features, thinning of section, or missing rock units. It is clear that the geologic findings do not support the interpretations from seismic records of a fault cutting the near-surface formations at WIPP 19.

Table 1.--*Abridged history of borehole WIPP-19*

LOCATION: sec. 20, T. 22 S., R. 31 E.
2,987.34 feet from south line
12.68 feet from east line

ALTITUDE (LAND SURFACE): 3,433.13 feet. Datum for all depth measurements.

DESCRIPTION OF CORE PREPARED BY: J. L. Gonzales, April 6 to May 4, 1978.

DRILLING CONTRACTOR: Boyles Bros. Drilling Co.

DRILLING RECORD: Commenced drilling April 6, 1978, and completed May 4, 1978, at 1,038.2 feet below land surface.

Set 7-inch outside-diameter casing in an 8 3/4-inch hole at 8 feet; packed annulus with gel.

Cut consecutive cores with 4 1/2-inch bit, 8-14 feet; with 3 7/8-inch bit, 14-48 feet; and with 3 15/16-inch bit, 48-1,038.2 feet.

On completion of coring, hole opened to 6 1/8 inches for geophysical logging and then capped pending decision concerning possible additional work.

Core No.	Depth interval Feet	RPM	Weight on bit (lbs)	Circulating pressure (lb/in^2)	Interval Feet cored	Interval Feet recovered	Percent recovered
1	8.0- 9.9	175	2,000	100	1.9	1.9	100
2	9.9- 12.6	175	2,000	100	2.7	2.7	100
3	12.6- 14.1	175	2,000	100	1.5	1.3	87
4	14.1- 17.4	175	2,000	100	3.3	3.2	97
5	17.4- 19.9	175	2,000	100	2.5	2.5	100
6	19.9- 26.9	175	2,000	100	7.0	7.9	113.0
7	26.9- 33.9	175	2,000	100	7.0	7.3	104.0
8	33.9- 41.2	175	2,000	100	7.3	8.2	112
9	41.2- 43.2	175	2,000	100	2.0	1.8	90
10	43.2- 48.2	175	2,000	100	5.0	5.3	106
11	48.2- 53.2	175	3,000	100	5.0	4.4	88
12	53.2- 56.2	175	3,000	100	3.0	3.3	110
13	56.2- 63.2	175	3,000	100	7.0	7.0	100
14	63.2- 71.2	175	3,000	100	8.0	8.0	100
15	71.2- 78.2	175	3,000	100	7.0	7.0	100
16	78.2- 88.2	175	3,000	100	10.0	10.2	102
17	88.2- 97.2	175	3,000	100	9.0	9.0	100
18	97.2-106.2	175	4,000	400	9.0	9.1	101
19	106.2-116.2	175	4,000	400	10.0	10.0	100
20	116.2-123.2	175	4,000	400	7.0	7.0	100
21	123.2-133.2	175	4,000	400	10.0	10.0	100
22	133.2-143.2	175	4,000	400	10.0	10.0	100
23	143.2-153.2	150	3,000	400	10.0	10.0	100
24	153.2-163.2	175	3,000	200/400	10.0	10.0	100
25	163.2-173.2	225	3,000	200/400	10.0	10.0	100

Table 1.--*Abridged history of borehole WIPP-19*--Continued

Core No.	Depth interval Feet	RPM	Weight on bit (lbs)	Circulating pressure (lb/in^2)	Interval Feet cored	Interval Feet recovered	Percent recovered
26	173.2-183.2	225	3,000	400/200	10.0	10.0	100
27	183.2-193.2	225	3,000	200/300	10.0	10.0	100
28	193.2-201.2	200	3,000	200/300	8.0	8.0	100
29	201.2-211.2	200	3,000	200/450	10.0	10.0	100
30	211.2-220.2	200	3,000	200/300	9.0	9.0	100
31	220.2-228.2	200	3,000	200/450	8.0	8.0	100
32	228.2-237.2	200	3,200	300	9.0	8.9	99
33	237.2-246.2	175	3,200	300/400	9.0	9.0	100
34	246.2-253.2	200	3,200	300	7.0	7.0	100
35	253.2-263.2	200	3,200	200/400	10.0	10.0	100
36	263.2-273.2	200	3,000	300/400	10.0	10.0	100
37	273.2-283.2	175	3,000	400	10.0	10.0	100
38	283.2-293.2	200	3,200	400	10.0	10.0	100
39	293.2-298.2	175	3,200	300/400	5.0	3.5	70
40	298.2-305.2	175	3,200	400	7.0	8.5	121
41	305.2-315.2	200	4,000	300	10.0	10.0	100
42	315.2-324.2	175	4,200	400	9.0	8.7	97
43	324.2-333.2	200	4,200	300	9.0	9.0	100
44	333.2-343.2	200	4,200	250	10.0	10.0	100
45	343.2-351.2	200	4,200	250	8.0	8.0	100
46	351.2-360.2	200	4,000	400	9.0	9.1	101
47	360.2-369.2	200	4,200	400	9.0	8.9	99
48	369.2-378.2	200	4,200	400	9.0	9.0	100
49	378.2-384.2	200	4,200	400	6.0	6.0	100
50	384.2-393.2	225	5,300	500	9.0	9.0	100
51	393.2-403.2	200	4,500	500	10.0	10.0	100
52	403.2-413.2	200	4,200	600	10.0	10.0	100
53	413.2-423.2	200	4,200	400	10.0	10.0	100
54	423-2-433.2	200	4,200	400	10.0	10.0	100
55	433.2-443.2	225	4,300	400	10.0	10.0	100
56	443.2-453.2	225	4,300	400	10.0	10.0	100
57	453.2-463.2	225	4,300	400	10.0	10.0	100
58	463.2-473.2	225	4,300	400	10.0	10.0	100
59	473.2-483.2	225	4,500	400	10.0	10.0	100
60	483.2-492.2	225	4,500	500	9.0	9.0	100
61	492.2-502.2	225	4,500	500	10.0	10.0	100
62	502.2-512.2	200	4,500	400	10.0	10.0	100
63	512.2-522.2	200	4,500	400	10.0	10.0	100

Table 1.--*Abridged history of borehole WIPP-19*--Continued

Core No.	Depth interval Feet	RPM	Weight on bit (lbs)	Circulating pressure (lb/in ^{2})	Interval Feet cored	Interval Feet recovered	Percent recovered
64	522.2-531.2	200	4,500	400	9.0	9.0	100
65	531.2-533.2	200	4,500	400	2.0	2.0	100
66	533.2-543.2	200	4,600	500	10.0	10.0	100
67	543.2-553.2	175	4,800	600	10.0	10.0	100
68	553.2-563.2	200	4,600	500	10.0	10.0	100
69	563.2-570.2	200	4,600	500	7.0	7.0	100
70	570.2-579.2	225	4,600	500	9.0	9.0	100
71	579.2-588.2	200	4,600	500	9.0	9.0	100
72	588.2-598.2	225	5,100	400	10.0	10.0	100
73	598.2-608.2	225	6,000	300	10.0	10.0	100
74	608.2-618.2	225	6,000	300	10.0	10.0	100
75	618.2-623.2	200	5,000	300	5.0	2.0	40
76	623.2-630.2	300	5,000	300	7.0	8.0	114
77	630.2-639.2	200	5,500	400	9.0	9.0	100
78	639.2-648.2	200	6,000	300	9.0	9.0	100
79	648.2-658.2	200	6,000	300	10.0	10.0	100
80	658.2-668.2	200	6,000	300	10.0	10.0	100
81	668.2-678.2	200	6,000	300	10.0	10.0	100
82	678.2-687.2	200	6,000	300	9.0	9.0	100
83	687.2-697.7	200	6,200	300	10.5	10.3	98
84	697.7-707.7	200	6,200	400	10.0	10.0	100
85	707.7-717.2	200	6,200	300	9.5	9.5	100
86	717.2-727.2	200	6,200	300	10.0	10.0	100
87	727.2-737.2	200	6,200	300	10.0	10.0	100
88	737.2-747.2	200	6,200	500	10.0	5.6	56
89	747.2-751.7	200	6,000	400	4.5	7.7	171
90	751.7-760.2	200	200	400	8.5	10.0	118
91	760.2-770.2	225	6,200	300	10.0	10.0	100
92	770.2-780.2	225	6,200	400	10.0	10.0	100
93	780.2-789.2	200	6,000	400	9.0	9.0	100
94	789.2-798.2	225	6,500	300	9.0	9.0	100
95	798.2-808.2	225	6,200	350	10.0	10.0	100
96	808.2-818.2	225	6,200	300	10.0	10.0	100
97	818.2-828.2	225	6,200	300	10.0	10.0	100
98	823.2-836.2	200	6,200	300	8.0	8.0	100
99	836.2-843.2	200	6,200	400/200	7.0	7.0	100
100	843.2-853.2	225	6,200	400	10.0	10.0	100
101	853.2-863.2	225	6,200	450	10.0	10.0	100

Table 1.--*Abridged history of borehole WIPP-19*--Continued

Core No.	Depth interval Feet	RPM	Weight on bit (lbs)	Circulating pressure (lb/in^2)	Interval Feet cored	Interval Feet recovered	Percent recovered
102	863.2-873.2	227	6,200	450	10.0	10.0	100
103	873.2-883.2	225	6,200	500	10.0	10.0	100
104	883.2-893.2	225	6,200	400	10.0	10.0	100
105	893.2-898.2	200	6,000	300	5.0	5.0	100
106	898.2-908.2	200	6,200	300	10.0	10.0	100
107	908.2-918.2	200	6,200	300	10.0	10.0	100
108	918.2-928.2	200	6,200	300	10.0	10.0	100
109	928.2-938.2	200	6,200	300	10.0	10.0	100
110	938.2-948.2	200	6,200	300	10.0	10.0	100
111	948.2-958.2	200	6,200	300	10.0	10.0	100
112	958.2-968.2	200	6,200	300	10.0	9.7	97
113	968.2-978.2	200	6,200	500/300	10.0	10.0	100
114	978.2-988.2	200	6,200	600/300	10.0	10.0	100
115	988.2-998.2	200	6,200	300	10.0	10.0	100
116	998.2-1,008.2	200	6,200	500	10.0	10.0	100
117	1,008.2-1,010.2	200	6,200	400	2.0	2.0	100
118	1,010.2-1,018.2	200	6,000	200	8.0	8.0	100
119	1,018.2-1,028.2	200	6,000	200	10.0	10.0	100
120	1,028.2-1,038.2	200	6,200	200	10.0	9.4	94

APPENDIX C

HOLE HISTORY

compiled by

R. D. Statler
Division 1133
and
P. D. Seward
Division 1135
Sandia Laboratories

INTRODUCTION TO APPENDIX C, HOLE HISTORY

The hole history is a document provided soon after completion of the borehole, and it summarizes the relevant information on the daily log kept by the contractor. The hole history is not edited to ensure conformance in every detail with later information developed for previous chapters. Further information may be obtained as necessary through examination of the original daily time logs.

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: October 16, 1978 (Rev. #1)
June 8, 1978

HOLE NO.: WIPP #19	W. O. NO.:	I. D. NO.:
USER: Sandia Lab.	TYPE HOLE: Exploratory	
LOCATION New Mexico	COUNTY: Eddy	AREA:
SURFACE COORDINATES: * 2989.60' FSL, 14.94' FEL Sec. 20, T22S, R31E		
GROUND ELEVATION: *	PAD ELEVATION:	TOP CASING ELEVATION:
RIG ON LOCATION:	SPUDDED: 4-6-78	COMPLETED: 5-8-78
CIRCULATING MEDIA: Salt base mud.		
MAIN RIG & CONTRACTOR		NO. OF COMPRESSORS & CAPACITY:

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I.D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	8'	8-3/4"	7" O.D.			Used		0'	8'	NONE
8'	1038'	6-1/8"								

TOTAL DEPTH: 1038' GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @
JUNK & PLUGS LEFT IN HOLE:		
SURVEYS PAGE:	CORING PAGE: 3	CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2		
BOTTOM HOLE COORDINATES: 3004.70' FSL, 3.24' FEL @ 1020'		REFERENCE: Schlumberger

RIGS USED *(Site Prep Rigs *)*

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
3625	Boyles Bros.	Failing 2000		10.91	-	21.09	32.00

REMARKS:

* Location of brass monument: 2985.88' FSL, 16.40' FEL, Sec.20, T22S, R31E. Elevation 3433.13'.

Horizontal displacement at 1020' was 19.2', N 37.6° E (Schlumberger Directional Survey.)

PREPARED BY: WDS/lkm

TIME BREAKDOWN ON NEXT PAGE

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: June 8, 1978

HOLE NO.:	WIPP #19	W. O. NO.:		I. D. NO.:	
USER:	Sandia Lab	TYPE HOLE:	Exploratory		
LOCATION	New Mexico	COUNTY:	Eddy	AREA:	
SURFACE COORDINATES:	2987.34 FSL, 12.87 FEL Sec. 20, T22S, R31E				
GROUND ELEVATION:	3432.8'	PAD ELEVATION:		TOP CASING ELEVATION:	
RIG ON LOCATION:		SPUDDED:	4-6-78	COMPLETED:	5-8-78
CIRCULATING MEDIA:	Salt base mud.				
MAIN RIG & CONTRACTOR				NO. OF COMPRESSORS & CAPACITY:	

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I.D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	8'	8-3/4"	7" O.D.			Used		0'	8'	NONE
8'	1038'	6-1/8"								

TOTAL DEPTH: 1038' GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @	
JUNK & PLUGS LEFT IN HOLE:			
SURVEYS PAGE:	CORING PAGE: 3		CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2			
BOTTOM HOLE COORDINATES: 3002.44' FSL, 1.17' FEL @ 1020'			REFERENCE: Schlumberger

RIGS USED

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
3625	Boyles Bros.	Failing 2000		10.91	-	21.09	32.00

REMARKS:

Horizontal displacement at 1020' was 19.2', N 37.6° E (Schlumberger Directional Survey.)

PREPARED BY: WDS/it

WIPP #19
HOLE HISTORY

4-5-78	Moved in Boyles Bros. rig #3625 and rigged up.
4-6-78	Drilled 8-3/4" hole from 0' to 8'. Set 7" O.D. used casing at 8' and packed annulus with gel. Made up soil sample type tool with 4½" bit and made 3 runs from 8' to 14', recovery 100%. Made up 3-7/8" Christensen insert type bit on a wire line core barrel and cored from 14' to 48'. Cored with salt base mud. Worked days only.
4-7-78	Cored 3-7/8" hole from 48' to 97'.
4-10-78	Rig secured from 4-7-78 to 4-10-78. Changed out bit to a 3-15/16" diamond bit and cored from 97' to 143'.
4-11-78	Cored 3-15/16" hole from 143' to 201'.
4-12-78	Cored 3-15/16" hole from 201' to 263.2'.
4-13-78	Cored 3-15/16" hole from 263.2' to 305.2', 98% mud returns to surface.
4-14-78	Cored 3-15/16" hole from 305.2' to 351.2'.
4-17-78	Rig secured from 4-14-78 to 4-17-78. Fluid level in the hole at 215'. Cored 3-15/16" hole from 351.2' to 384.2'. Had 50% returns from 351.2' to 360.2', regained 85% returns at 384.2'. Lost 50 barrels of mud.
4-18-78	Cored 3-15/16" hole from 384.2' to 433.2'. Returns decreased from 50% to 30%. Pumped in a slug of paper for lost circulation material at 200'.
4-19-78	Cored 3-15/16" hole from 433.2' to 492.2'. 15% lost circulation.
4-20-78	Cored 3-15/16" hole from 492.2' to 533.2'. 15% lost circulation.
4-21-78	Cored 3-15/16" hole from 533.2' to 570.2'. 15% lost circulation.
4-24-78	Rig secured from 4-21-78 to 4-24-78. Cored 3-15/16" hole from 570.2' to 623.2'. 55% lost circulation. Pumped in a slug of paper for lost circulation at 200'.
4-25-78	Cored 3-15/16" hole from 623.2' to 678.2'. 45% lost circulation.
4-26-78	Cored 3-15/16" hole from 678.2' to 727.2'. 50% lost circulation. Pumped in a paper slug at 200'.
4-27-78	Cored 3-15/16" hole from 727.2' to 780.2'. 50% lost circulation at 727.2' reduced to 30% at 780.2'.

2-28-78	Cored 3-15/16" hole from 780.2' to 828.2'. 50% lost circulation.
5-1-78	Rig secured from 4-28-78 to 5-1-78. Cored 3-15/16" hole from 828.2' to 893.2'. 30% lost circulation.
5-2-78	Cored 3-15/16" hole from 893.2' to 958.2'. 30% lost circulation.
5-3-78	Cored 3-15/16" hole from 958.2' to 1010.2'. 30% lost circulation.
5-4-78	Cored 3-15/16" hole from 1010.2' to 1038.2'. 30% lost circulation. Rigged up to open hole. Reamed hole to 6-1/8" from 8' to 97'.
5-5-78	Opened hole to 6-1/8" from 97' to 717'. 2% lost circulation.
5-6-78	Opened hole to 6-1/8" from 717' to 1038'. Ran Schlumberger logs.
5-7-78	Ran USGS logs.
5-8-78	Rigged down. Hole completed.

LOG INDEX

TYPE LOG	DATE	RUN NO.	DEPTH DRILLER	DEPTH LOGGER	LOGGED FROM	LOGGED TO
SCHLUMBERGER LOGS						
Dual Laterolog Micro - SFL	5-6-78	1	1038	1036	0	1034
Compensated Neutron-Formation Density	5-6-78	1	1038	1036	0	1034
Borehole Compensated Sonic	5-6-78	1	1038	1036	0	1033
Continuous Dipmeter	5-6-78	1	1038	1029	0	1028
Dipmeter-Arrow Plot	5-6-78	1	1038	1029	0	1028
Continuous Directional	5-6-78	1	1038	1029	0	1028

NOTE: Listing of logs furnished F&S/Mercury.

WIPP #19 CORE RECORD

CORE NO.	INTERVAL	FEET	RPM	WEIGHT ON BIT	CIRCUL. PRESS. P.S.I.	FEET CORED	FEET RECOVERED	% RECOVERY	
1	8	9.9	175	2000	100	1.9	1.9	100%	
2	9.9	12.6	175	2000	100	2.7	2.7	100%	
3	12.6	14.1	175	2000	100	1.5	1.3	87%	
4	14.1	17.4	175	2000	100	3.3	3.2	97%	
5	17.4	19.9	175	2000	100	2.5	2.5	100%	
6	19.9	26.9	175	2000	100	7	7.85	100%±	
7	26.9	33.9	175	2000	100	7	7.33	100%±	
8	33.9	41.2	175	2000	100	7.3	8.2	100%±	
9	41.2	43.2	175	2000	100	2	1.75	88%	
10	43.2	48.2	175	2000	100	5	5.25	100%±	
11	48.2	53.2	175	3000	100	5	4.4	88%	
12	53.2	56.2	175	3000	100	3	3.3	100%±	
13	56.2	63.2	175	3000	100	7	7	100%	
14	63.2	71.2	175	3000	100	8	8	100%	
15	71.2	78.2	175	3000	100	7	7	100%	
16	78.2	88.2	175	3000	100	10	10.2	100%±	
17	88.2	97.2	175	3000	100	9	9	100%	
18	97.2	106.2	175	4000	400	9	9.1	100%±	
19	106.2	116.2	175	4000	400	10	10	100%	
20	116.2	123.2	175	4000	400	7	7	100%	
21	123.2	133.2	175	4000	400	10	10	100%	
22	133.2	143.2	175	4000	400	10	10	100%	
23	143.2	153.2	150	3000	400	10	10	100%	
24	153.2	163.2	175	3000	200/400	10	10	100%	
25	163.2	173.2	225	3000	200/400	10	10	100%	
26	173.2	183.2	225	3000	400/200	10	10	100%	
27	183.2	193.2	225	3000	200/300	10	10	100%	
28	193.2	201.2	200	3000	200/300	8	8	100%	
29	201.2	211.2	200	3000	200/450	10	10	100%	
30	211.2	220.2	200	3000	200/300	9	9	100%	Some Fluid Loss
31	220.2	228.2	200	3000	200/450	8	8	100%	
32	228.2	237.2	200	3200	300	9	8.9	99%	
33	237.2	246.2	175	3200	300/400	9	9	100%	
34	246.2	256.2	200	3200	300	7	7	100%	
35	256.2	263.2	200	3200	200/400	10	10	100%	
36	263.2	273.2	200	3000	300/400	10	10	100%	
37	273.2	283.2	175	3000	400	10	10	100%	
38	283.2	293.2	200	3200	400	10	10	100%	
39	293.2	298.2	175	3200	300/400	5	3.5	70%	

WIPP #19 CORE RECORD

CORE NO.	INTERVAL	FEET	RPM	WEIGHT ON BIT	CIRCUL. PRESS. P.S.I.	FEET CORED	FEET RECOVERED	% RECOVERY	
40	298.2	305.2	175	3200	400	7	8.5	100%±	
41	305.2	315.2	200	4000	300	10	10	100%	
42	315.2	324.2	175	4200	400	9	8.7	97%	
43	324.2	333.2	200	4200	300	9	9	100%	Some Fluid Loss
44	333.2	343.2	200	4200	250	10	10	100%	Some Fluid Loss
45	343.2	351.2	200	4200	250	8	8	100%	"
46	351.2	360.2	200	4000	400	9	9.1	100%±	"
47	360.2	369.2	200	4200	400	9	8.9	99%	"
48	369.2	378.2	200	4200	400	9	9	100%	"
49	378.2	384.2	200	4200	400	6	6	100%	"
50	384.2	393.2	225	5300	500	9	9	100%	"
51	393.2	403.2	200	4500	500	10	10	100%	Some Fluid Loss
52	403.2	413.2	200	4200	600	10	10	100%	"
53	413.2	423.2	200	4200	400	10	10	100%	"
54	423.2	433.2	200	4200	400	10	10	100%	"
55	433.2	443.2	225	4300	400	10	10	100%	"
56	443.2	453.2	225	4300	400	10	10	100%	"
57	453.2	463.2	225	4300	400	10	10	100%	"
58	463.2	473.2	225	4300	400	10	10	100%	Some Fluid Loss
59	473.2	483.2	225	4500	400	10	10	100%	"
60	483.2	492.2	225	4500	500	9	9	100%	"
61	492.2	502.2	225	4500	500	10	10	100%	"
62	502.2	512.2	200	4500	400	10	10	100%	"
63	512.2	522.2	200	4500	400	10	10	100%	"
64	522.2	531.2	200	4500	400	9	9	100%	"
65	531.2	533.2	200	4500	400	2	2	100%	"
66	533.2	543.2	200	4600	500	10	10	100%	"
67	543.2	553.2	175	4800	600	10	10	100%	Some Fluid Loss
68	553.2	563.2	200	4600	500	10	10	100%	"
69	563.2	570.2	200	4600	500	7	7	100%	"
70	570.2	579.2	225	4600	500	9	9	100%	"
71	579.2	588.2	200	4600	500	9	9	100%	"
72	588.2	598.2	225	5100	400	10	10	100%	"
73	598.2	608.2	225	6000	300	10	10	100%	"
74	608.2	618.2	225	6000	300	10	10	100%	Some Fluid Loss
75	618.2	623.2	200	5000	300	5	2	40%	"
76	623.2	630.2	300	5000	300	7	8	100%±	"
77	630.2	639.2	200	5500	400	9	9	100%	"
78	639.2	648.2	200	6000	300	9	9	100%	"

WIPP #19 CORE RECORD

CORE NO.	INTERVAL	FEET	RPM	WEIGHT ON BIT	CIRCUL. PRESS. P.S.I.	FEET CORED	FEET RECOVERED	% RECOVERY	
79	648.2	658.2	200	6000	300	10	10	100%	Some Fluid Loss
80	658.2	668.2	200	6000	300	10	10	100%	Some Fluid Loss
81	668.2	678.2	200	6000	300	10	10	100%	"
82	678.2	687.2	200	6000	300	9	9	100%	"
83	687.2	697.7	200	6200	300	10.5	10.3	98%	
84	697.7	707.7	200	6200	400	10	10	100%	
85	707.7	717.2	200	6200	300	9.5	9.5	100%	
86	717.2	727.2	200	6200	300	10	10	100%	
87	727.2	737.2	200	6200	300	10	10	100%	
88	737.2	747.2	200	6200	500	10	5.6	56%	
89	747.2	751.7	200	6000	400	4.5	7.7	100%±	
90	751.7	760.2	200	6200	400	8.5	10	100%±	
91	760.2	770.2	225	6200	300	10	10	100%±	
92	770.2	780.2	225	6200	400	10	10	100%	
93	780.2	789.2	200	6000	400	9	9	100%	
94	789.2	798.2	225	6500	300	9	9	100%	
95	798.2	808.2	225	6200	350	10	10	100%	
96	808.2	818.2	225	6200	300	10	10	100%	
97	818.2	828.2	225	6200	300	10	10	100%	
98	828.2	836.2	200	6200	300	8	8	100%	
99	836.2	843.2	200	6200	400/200	7	7	100%	
100	843.2	853.2	225	6200	400	10	10	100%	
101	853.2	863.2	225	6200	450	10	10	100%	
102	863.2	873.2	227	6200	450	10	10	100%	
103	873.2	883.2	225	6200	500	10	10	100%	
104	883.2	893.2	225	6200	400	10	10	100%	
105	893.2	898.2	200	6000	300	5	5	100%	
106	898.2	908.2	200	6200	300	10	10	100%	
107	908.2	918.2	200	6200	300	10	10	100%	
108	918.2	928.2	200	6200	300	10	10	100%	
109	928.2	938.2	200	6200	300	10	10	100%	
110	938.2	948.2	200	6200	300	10	10	100%	
111	948.2	958.2	200	6200	300	10	10	100%	
112	958.2	968.2	200	6200	300	10	9.7	97%	
113	968.2	978.2	200	6200	500/300	10	10	100%	
114	978.2	988.2	200	6200	600/300	10	10	100%	
115	988.2	998.2	200	6200	300	10	10	100%	

WIPP #19 CORE RECORD

CORE NO.	INTERVAL	FEET	RPM	WEIGHT ON BIT	CIRCUL. PRESS. P.S.I.	FEET CORED	FEET RECOVERED	% RECOVERY
116	998.2	1008.2	200	6200	500	10	10	100%
117	1008.2	1010.2	200	6200	400	2	2	100%
118	1010.2	1018.2	200	6000	200	8	8	100%
119	1018.2	1028.2	200	6000	200	10	10	100%
120	1028.2	1038.2	200	6200	200	10	9.4	94%

SURVEY MONUMENT "AS BUILT"

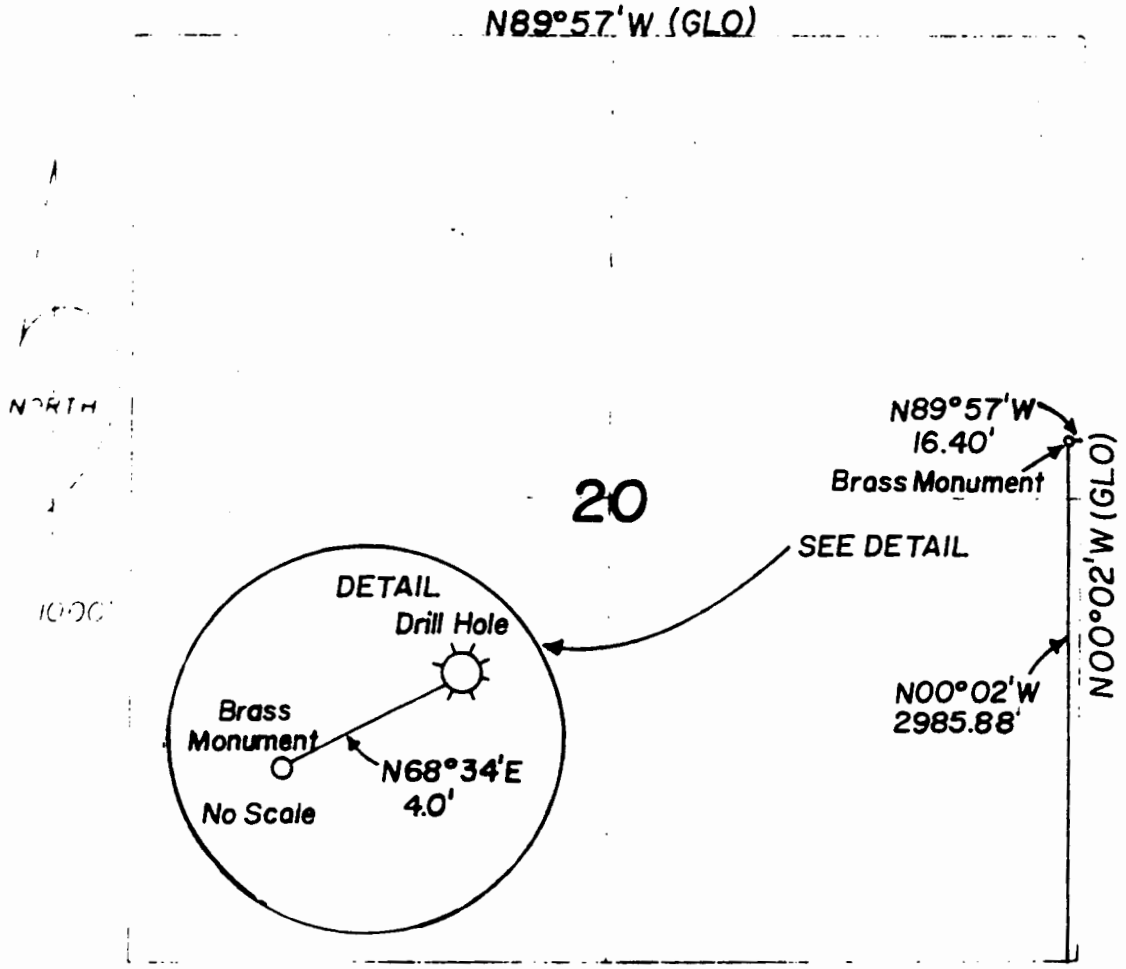
W.I.P.P. 19

SECTION 20, TOWNSHIP 22S, RANGE 31E N.M.P.M.

EDDY COUNTY, NEW MEXICO

ELEVATION OF BRASS MONUMENT 3433.13'

2985.88' FSL & 16.40' FEL



This is to certify that the foregoing plat was made from field notes of a bona fide survey, made by me or under my direction and correct to the best of my knowledge and belief.

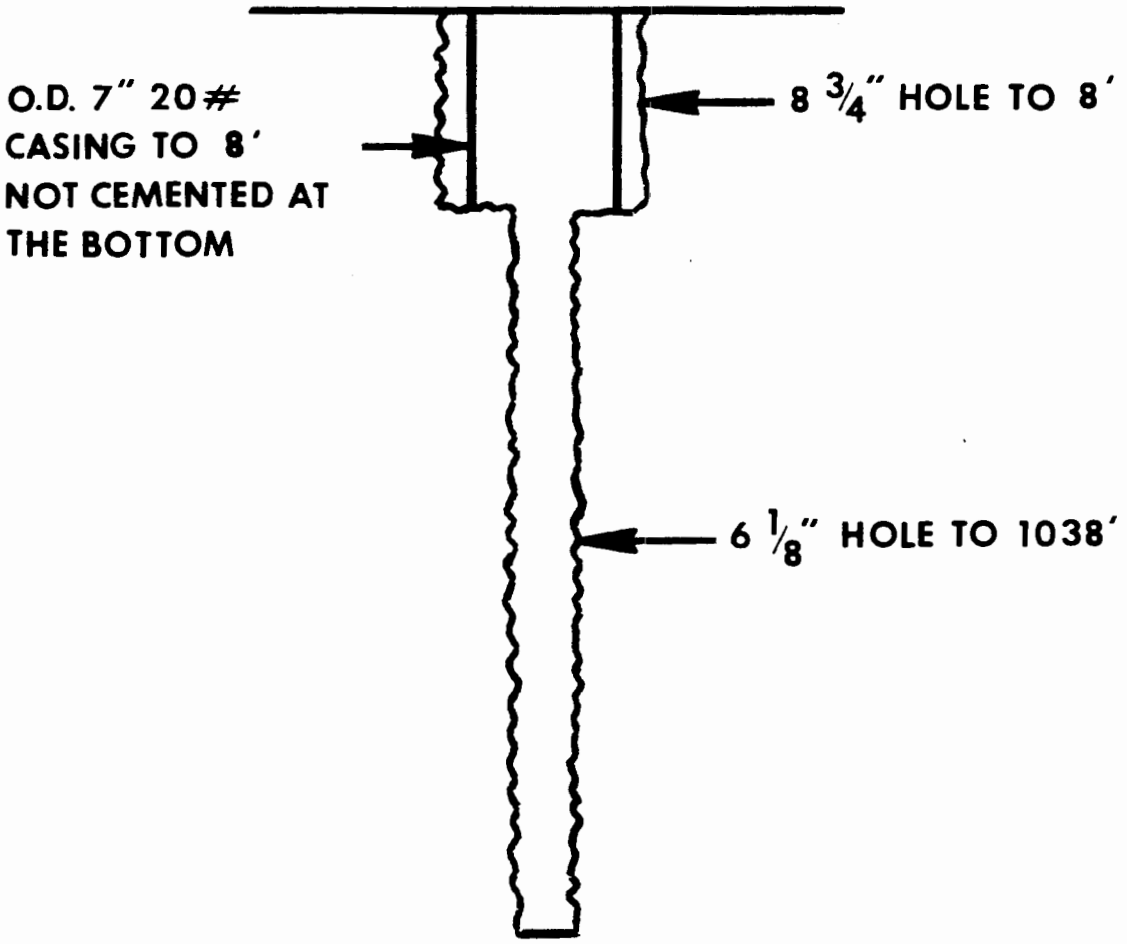
Dan R. Reddy

Dan R. Reddy

NM REG. L.S. #5412

DAN R. REDDY
NEW MEXICO
5412
LAND SURVEYOR
REGISTERED PROFESSIONAL ENGINEER

WIPP 19
AS BUILT HOLE CONDITIONS
AS OF 5/8/78



NOT TO SCALE

Basic Data Report for Drillhole WIPP 21 (Waste Isolation Pilot Plant - WIPP) (SAND79-0277), Section 3.0 pages 6 through 10, and Appendix C pages C-1 through C-5.

SAND79-0277
Unlimited Release
UC-70

Basic Data Report for Drillhole WIPP 21 (Waste Isolation Pilot Plant - WIPP)

Sandia Laboratories
United States Geological Survey

Sandia National Laboratories

SF 2900-Q(3-80)

3.0 GEOLOGICAL DATA FOR BOREHOLE WIPP 21

By

C. L. Jones[1] and J. L. Gonzales[2]

3.1 Abstract

Borehole WIPP 21 is a stratigraphic test hole drilled in eastern Eddy County, New Mexico, to explore for a possible fault indicated by seismic testing in near-surface formations. The formations penetrated include (1) the Mescalero caliche and Gatuna Formation of Pleistocene age, (2) the Santa Rosa Sandstone of Triassic age, and (3) the Dewey Lake Red Beds, the Rustler Formation, and the upper part of the Salado Formation, all of Permian age. Correlated geologic and geophysical logs of WIPP 21 give stratigraphic, lithologic, and physical details of the near-surface formations and establish a normal stratigraphic section, WIPP 21, unbroken by faulting.

3.2 Introduction

Borehole WIPP 21 is one of a series of stratigraphic tests drilled near the center of the proposed site for a Waste Isolation Pilot Plant (WIPP) in eastern Eddy County, New Mexico (Figure 3) on behalf of the WIPP project office of the U.S. Department of Energy (DOE). The drilling was done to determine the structure of near-surface formations along part of a seismic reflection survey line. On the basis of seismic records, faulting of the near-surface formations with a possible minimum of 100-150 feet of stratigraphic displacement had been inferred.

Geologic details of the section penetrated by WIPP 21 are tabulated herein. The tabulation includes detals of the location and the drilling of WIPP 21; stratigraphic details of the geologic section and lithologic features of the rocks. The lithology is interpreted and correlated with selected geophysical logs on Figure 3. Results of the other drilling will be reported elsehwere.

[1]U.S. Geological Survey, Denver, Colorado
[2]Fenix & Scisson, Inc., Carlsbad, New Mexico

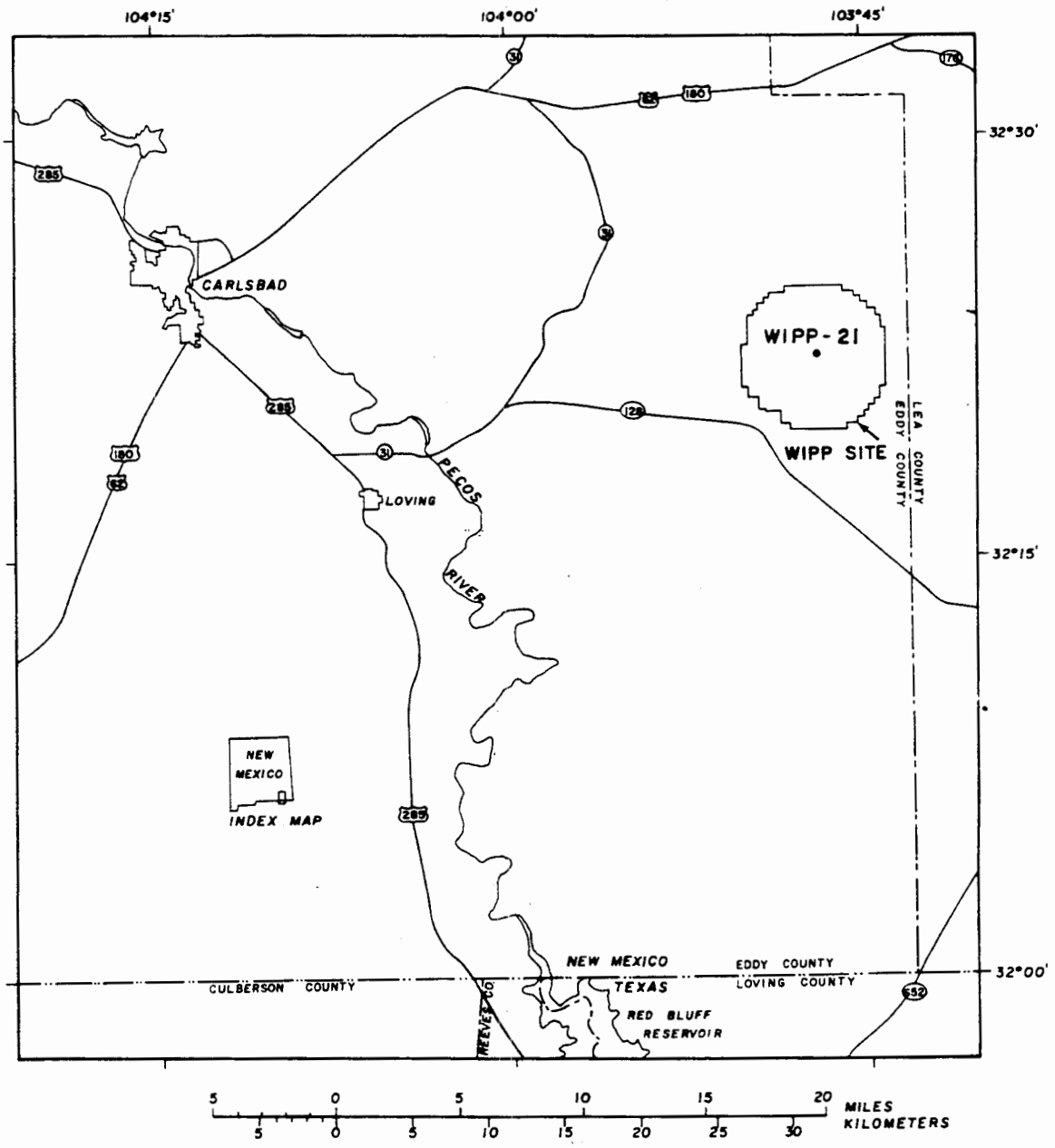


Figure 3: Index map showing location of borehole WIPP 21.

All measurements related to WIPP 21 are reported in the inch-pound system. The system is used to facilitate the comparison of original measurements and observations by surveyors in establishing the geographic coordinates of the hole, by drillers in reporting sample depths, and by geophysical loggers in recording inhole variations in rock properties with depth. If metric equivalents of the inch-pound system are desired, the following conversion factors are provided:

Multiply English unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
inch (in)	25.4	millimeter (mm)
inch (in)	2.54	centimeter (cm)

3.3 Description of WIPP 21

Borehole WIPP 21 is located in eastern Eddy County, New Mexico, in the SE 1/4 Section 20, T.22S., R.31E. The hole was drilled between May 24 and 26, 1978, to a depth of 1046 feet measured from a land-surface altitude of 3417 feet above MSL (mean sea level). Table 1 gives further details concerning the drilling of WIPP 21.

Conventional rotary drilling procedures were used to drill WIPP 21. Cuttings were collected at 10-foot intervals by the driller, and all were washed to remove a coating of drilling fluid, and then examined at the drill site. The examination was made with a binocular microscope, and a descriptive lithologic log was prepared by J. L. Gonzales.

On completion of drilling, a suite of wireline geophysical logs was run the full depth of WIPP 21 under open-hole, fluid-filled conditions. The logging was done to facilitate the recognition and correlation of rock units, to assure identification of major lithologies (dolomite, anhydrite, polyhalite, and other evaporites), and to provide depth determinations independent of that indicated by drill-pipe measurements. The geophysical logs included (1) a gamma-ray curve recording variations in distribution of potassium and other radioactive elements, (2) a neutron-porosity curve recording essentially variations in the distribution of hydrogen, and (3) a density-porosity curve recording essentially variations in rock density (Figure 4).

3.4 Geologic Data

The geologic section in WIPP 21 includes continental sediments of Quaternary and Triassic age, and marine red beds and evaporites of Permian age. The Quaternary, Triassic, and Permian parts of the section are listed in Table 2, and are briefly described in descending order.

The Quaternary sediments consist of unnamed deposits of Holocene age, and the Mescalero caliche and Gatuna Formation, both of Pleistocene age. The Holocene deposits areeeunconsolidated sands, the Mescalero caliche is a well-lithified calcareous soil, and the Gatuna is weakly cemented, very fine grained sandstone. The three units from the upper 39 feet of section in WIPP 21.

The Triassic Santa Rosa Sandstone, 39-73 feet below the land surface, is represented by reddish-brown mudstone, siltstone, and sandstone.

The Permian rocks include the Dewey Lake Red Beds (73-560 feet below land surface), the Rustler Formation (560-868 feet below land surface), and the upper part of the Salado Formation (868-1046 feet below land surface), all of Permian age. The Dewey Lake is 487 feet of mostly siltstone with subordinate mudstone and sandstone. The rock is dominantly reddish-brown peppered with greenish-gray reduction spots; much of it carries veins of fibrous selenite. The underlying Rustler Formation is 308 feet of anhydrite and subordinate siltstone, dolomite, and clayey halite; it includes a thick upper interval from which halite and other water-soluble materials have been leached by groundwater, and a thinner lower, halite-bearing interval that has escaped dissolution by groundwater. The underlying upper part of the Salado Formation is 178 feet of chiefly halite with thin interbeds of siltstone, polyhalite, argillaceous halite, and anhydrite.

The geologic section in WIPP 21 is similar lithologically, stratigraphically, and structurally to that reported from other exploratory wells at the WIPP site (Jones, 1978). The section is not disrupted by faulting, and there are no anomalous structural features, thinning of section, or missing rock units. The drilling results very clearly do not confirm the interpretation from seismic records of faulting of near-surface formations at WIPP 21.

Table 1.--*Abridged history of borehole WIPP-21*

LOCATION: sec. 20, T. 22 S., R. 31 E.
1,451.08 feet from south line
11.74 feet from east line

ALTITUDE: LS (land surface) 3,417.00 feet. Datum for depth measurements.

LITHOLOGIC LOG OF CUTTINGS PREPARED BY: J. L. Gonzales

DRILLING CONTRACTOR: Boyles Bros. Drilling Co.

DRILLING RECORD: Commenced drilling on May 24, 1978, and completed on May 26, 1978, at 1,045 feet below land surface.

Drilled 8 3/4-inch hole to 15 feet. Set 7-inch outside-diameter casing at at 15 feet, and packed annulus with dirt.

Drilled 6 1/8-inch hole from 15 to 1,045 feet.

On completion of drilling and logging, borehole was filled with mud and capped pending decision on further work.

APPENDIX C

HOLE HISTORY

compiled by

R. D. Statler
Division 1133
and
P. D. Seward
Division 1135
Sandia Laboratories

INTRODUCTION TO APPENDIX C, HOLE HISTORY

The hole history is a document provided soon after completion of the borehole, and it summarizes the relevant information on the daily log kept by the contractor. The hole history is not edited to ensure conformance in every detail with later information developed for previous chapters. Further information may be obtained as necessary through examination of the original daily time logs.

FENIX & SCISSON, INC.
HOLE HISTORY DATA

DATE: 11-6-78 Rev. #1
10-16-78

HOLE NO.: WIPP #2	W. O. NO.:		I. D. NO.:
USER: Sandia Lab.	TYPE HOLE: Exploratory		
LOCATION New Mexico	COUNTY: Eddy	AREA: WIPP	
SURFACE COORDINATES: *1452.80' FSL, 13.46' FEL, Sec. 20, T22S, R31E			
GROUND ELEVATION: *	PAD ELEVATION:	TOP CASING ELEVATION:	
RIG ON LOCATION:	SPUDDED: 5-24-78	COMPLETED: 5-26-78	
CIRCULATING MEDIA: Salt base mud			
MAIN RIG & CONTRACTOR		NO. OF COMPRESSORS & CAPACITY:	

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	20'	8-3/4"	6.366"	23#		J-55		0'	20'	Dirt
20'	1045'	6-1/8"								

TOTAL DEPTH: 1045'GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @
JUNK & PLUGS LEFT IN HOLE:		
SURVEYS PAGE:	CORING PAGE:	CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 1		
BOTTOM HOLE COORDINATES: 1442.60' FSL Sec.20, 5.54' FWL Sec. 21 @1047'		REFERENCE: Schlumberger

RIGS USED *(Site Prep Rigs *)*

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
3625	Boyles Bros.	Failing 2000		2.79	-	-	2.79

REMARKS: * *Site Prep Items*

Sample Description Attached

* Location of brass monument: 1449.17' FSL, 15.37' FWL, Sec.20, T22S, R31E, Elevation 3417.00.

PREPARED BY:

TIME BREAKDOWN ON NEXT PAGE

WIPP #21
HOLE HISTORY

5-24-78 Moved in Boyles Bros. rig #3625 and rigged up. Mixed up salt base mud. Drilled 8-3/4" hole from 0' to 15'. Set 7" O.D. casing at 15' and backfilled annulus with dirt. Drilled 6-1/8" hole from 15' to 558'.

5-25-78 Drilled 6-1/8" hole from 558' to 960'. Made trips for bits at 579' and 825'.

5-26-78 Drilled 6-1/8" hole from 960' to 1045'. Ran Schlumberger and USGS logs. Rigged down and released rig at 2400 hours. Hole completed.

BIT RECORD

BIT NO	MAKE	SIZE	TYPE	DEPTH OUT	FEET DRILLED	ROTATING HOURS
1	Hughes	8-3/4	OSC3J	15	15	1/4
2	Security	6-1/8	S3J	579	564	17-3/4
3	Security	6-1/8	S3J	825	246	14
4	Hughes	6-1/8	OSC3J	1045	220	6-1/4

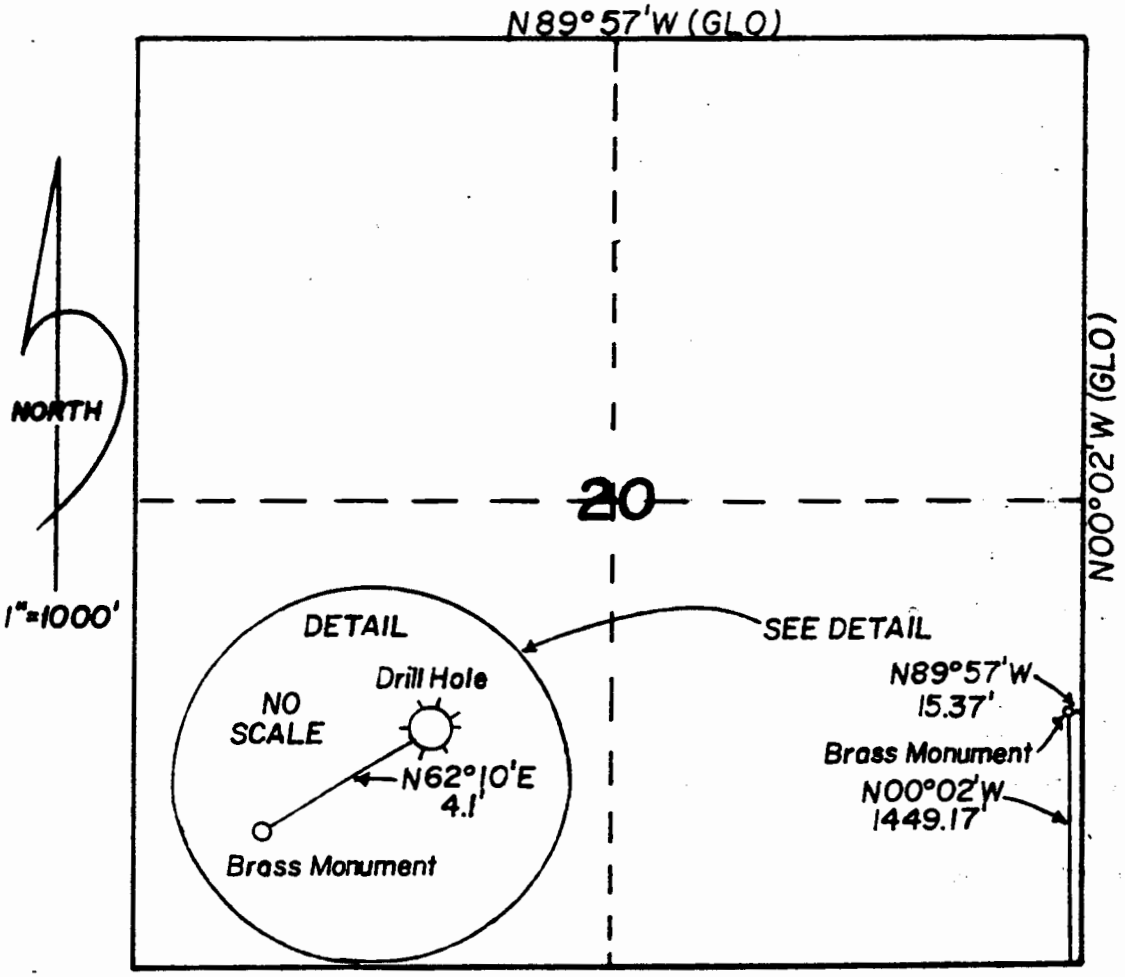
LOG INDEX SHEET

TYPE LOG	DATE	RUN NO	DEPTH DRILLER	DEPTH LOGGER	LOGGED FROM	LOGGED TO
SCHLUMBERGER						
Dual Laterolog-Micro SFL	5-26-78	1	1045	1049	25	1047
Compensated Neutron-Formation Density	5-26-78	1	1045	1047	0	1046
Borehole Compensated Sonic	5-26-78	1	1045	1047	0	1034
Dipmeter-Computed	5-26-78	1	1045	1047	-	1046
Dipmeter-Basic Data	5-26-78	1	1045	1047	-	1046
Directional	5-26-78	1	1045	1047	-	1046

NOTE: Logs furnished F&S/Mercury.

SURVEY MONUMENT "AS BUILT"
W.I.P.P. 21
SECTION 20, TOWNSHIP 22S, RANGE 31E N.M.P.M.
EDDY COUNTY, NEW MEXICO

ELEVATION OF BRASS MONUMENT 3417.00'
1449.17' FSL & 15.37 FEL

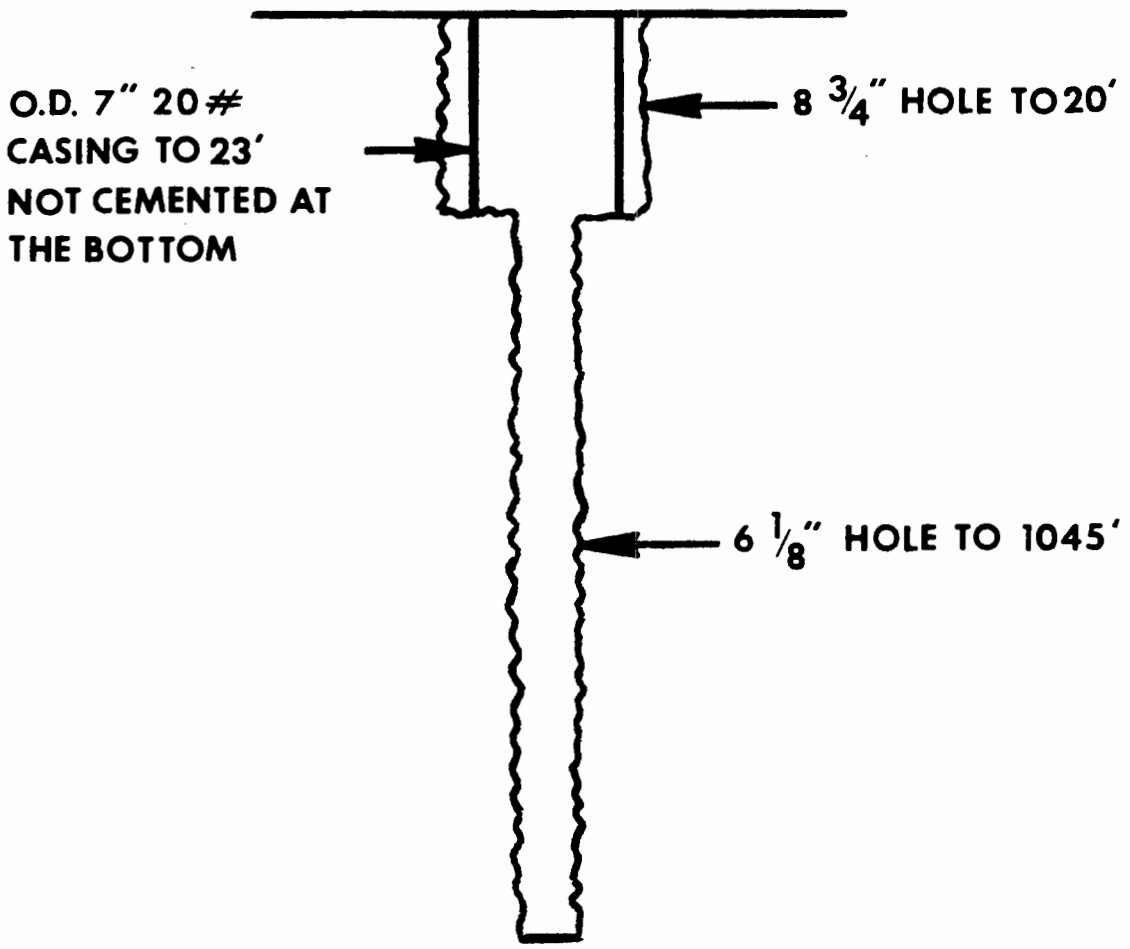


This is to certify that the foregoing plat was made from field notes of a bonafide survey made by me and is true and correct to the best of my knowledge and belief.

Dan R. Reddy
N.M.P.E. & L.S. #5412

DAN R. REDDY
NEW MEXICO
5412
LAND SURVEYOR
REGISTERED PROFESSIONAL ENGINEER

WIPP 21
AS BUILT HOLE CONDITIONS
AS OF 5/26/78



NOT TO SCALE

Basic Data Report for Drillhole WIPP 22 (Waste Isolation Pilot Plant - WIPP) (SAND79-0275), Section 3.0 pages 6 through 12, and Appendix C pages C-1 through C-6.

SAND79-0278
Unlimited Release
UC-70

Basic Data Report for Drillhole WIPP 22 (Waste Isolation Pilot Plant - WIPP)

Sandia Laboratories
United States Geological Survey

Sandia National Laboratories

SF 2900-Q(3-80)

3.0 GEOLOGIC DATA FOR BOREHOLE WIPP 22

By

C. L. Jones[1] and G. L. Gonzales[2]

3.1 Abstract

Borehole WIPP 22 is an exploratory well drilled in eastern Eddy County, New Mexico, to explore for a possible fault indicated by seismic testing in near-surface rocks. The rocks penetrated include the Mescalero caliche of Pleistocene age, the Santa Rosa Sandstone of Triassic age, and the Dewey Lake Red Beds, the Rustler Formation, and the upper part of the Salado Formation, all of Permian age. Correlated geologic and geophysical logs of WIPP 22 give stratigraphic, lithologic, and physical details of the near-surface rocks. The drilling results establish the presence of a normal representative geologic section unbroken by faulting.

3.2 Introduction

Borehole WIPP 22 is one of a series of exploratory wells drilled near the center of the proposed site for a Waste Isolation Pilot Plant (WIPP) in eastern Eddy County, New Mexico (Figure 3) on behalf of the WIPP project office of the U.S. Department of Energy (DOE). The exploratory drilling was undertaken to search for a fault inferred from a seismic reflection survey record to cut the near-surface formations with a possible minimum of 100-150 feet of stratigraphic displacement.

Basic data concerning the geologic section in WIPP 22 are tabulated herein. The tabulation includes details of the location and the drilling of the borehole, stratigraphic details of the geologic section, and a lithologic description of the drill cuttings. The lithology of geologic section is interpreted and correlated with selected geophysical logs on Figure 3.

[1]U.S. Geological Survey, Denver, Colorado
[2]Fenix & Scisson, Inc., Carlsbad, New Mexico

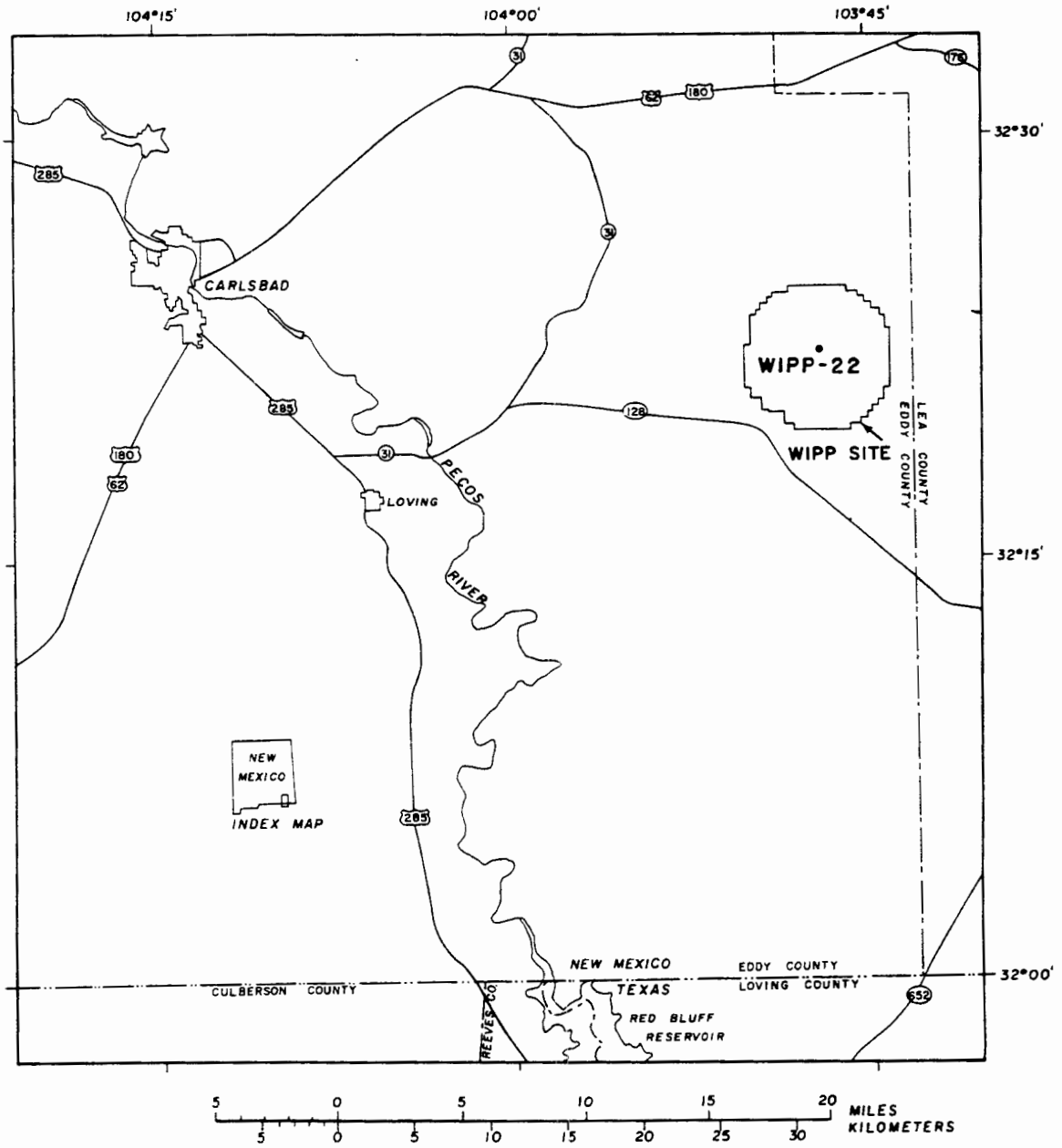


Figure 3: Index map showing location of borehole WIPP 22.

All measurements related to WIPP 22 are reported in the inch-pound system. The system is used to facilitate the comparison of original measurements and observations by surveyors in establishing the geographic coordinates of the borehole, by drillers in reporting sample depth, and by geophysical loggers in recording inhole variations in rock properties with depth. If metric equivalents of the inch-pound system are required, the following conversion factors are provided:

Multiply English unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
inch (in)	25.4	millimeter (mm)
inch (in)	2.54	centimeter (cm)
pounds (lb)	0.4536	kilogram (kg)
pounds per square inch (lb/in^2)	0.006895	megapascal (MPa)

3.3 Description of WIPP 22

Borehole WIPP 22 is located in eastern Eddy County, New Mexico, in the SE 1/4 Section 20, T.22S., R.31E. The borehole was drilled between May 8 and 23, 1978, to a depth of 1450 feet measured from a land-surface altitude of 3425.83 feet above MSL (mean sea level). Table 1 gives further details concerning the drilling of WIPP 22.

Conventional rotary-drilling procedures were used to drill WIPP 22. Salt-base mud containing starch, drispac, and other additives was used as the drilling fluid. Cuttings were collected at 10-foot intervals by the driller and were washed at the drill site prior to examination through a binocular microscope. A lithologic description of the cuttings was prepared by S. L. Drellack, Jr., and J. L. Gonzales of Fenis & Scisson, Inc.

On completion of drilling, a suite of wireline geophysical logs was run the full depth of WIPP 22 under open-file fluid-filled conditions. The logging was done to facilitate the recognition and correlation of rock units, to assure identification of major lithologies (dolomite, anhydrite, polyhalite, and other evaporites), and to provide depth determinations independent of that indicated by drill-pipe measurements.

The geophysical logs included (1) a gamma-ray curve that recorded variations in the distribution of potassium and other radioactive elements, (2) a neutron-porosity curve that essentially recorded variations in rock density (Figure 3).

3.4 Geologic Data

The geologic section in WIPP 22 includes continental sediments of Quaternary and Triassic age, and marine red beds and evaporites of Permian age. The Quaternary, Triassic, and Permian units are listed in Table 2, and are briefly described in descending order.

The Quaternary sediments consist of unconsolidated dune sand of Holocene age, and a well-lithified calcareous soil, known locally as the Mescalero caliche, of Pleistocene age. The two rock units account for the upper 13 feet of section in WIPP 22.

Rocks underlying the Quaternary units, at 13-81 feet below land surface, represent the lower part of the Santa Rosa Sandstone of Triassic age. This part of the Santa Rosa consists of brown, reddish-brown, and grayish-red siltstone and sandstone. The rocks have a dolomitic cement and are somewhat micaceous.

Rocks belonging to the Permian System are represented by the Dewey Lake Red Beds, the Rustler Formation, and the upper part of the Salado Formation. The Dewey Lake Red Beds, at 81-574 feet below the surface, are a monotonous sequence of chiefly reddish-brown siltstones, with subordinate mudstone and sandstone. The underlying Rustler Formation at 574-885 feet below the surface, is chiefly anhydrite and siltstone, with subordinate dolomite, clayey halite, and unconsolidated silt derived from dissolution of clayey halite. The underlying upper part of the Salado Formation, at 885-1450 feet below the surface, is chiefly halite and argillaceous halite, with thin interbeds of anhydrite, polyhalite, and siltstone.

Insofar as has been demonstrated by drilling, the geologic section in WIPP 22 is unbroken by faulting, and there are no missing rock units, anomalous thicknesses, or structural discontinuities. In fact, the section is representative for the near-surface formations at the WIPP site,

and it is similar lithologically, stratigraphically, and structurally to that in other exploratory wells drilled in the area (see, for example, Jones 1978). The drilling results do not confirm the interpretations from seismic records of the faulting of near-surface formations at WIPP 22.

Table 1.--*Abridged history of borehole WIPP-22*

LOCATION: sec. 20, T. 22 S., R. 31 E.
2,544.45 feet from south line
10.94 feet from east line

ALTITUDE: LS (land surface) 3,425.83 feet. Datum for all depth measurements.

LITHOLOGIC DESCRIPTION OF CUTTINGS PREPARED BY: S. L. Drellack, Jr., and J. L. Gonzales (F&S), May 8-23, 1978.

DRILLING CONTRACTOR: Boyles Bros. Drilling Co.

DRILLING RECORD: Commenced drilling on May 8, 1978, and completed on May 23, 1978, at 1,450 feet below LS.

Drilled 8 3/4-inch hole to 20 feet, and set 7-inch outside-diameter casing at 20 feet. Packed annulus with dirt.

Drilled 6 1/8-inch hole to 1,450 feet.

On completion of drilling, suite of wireline geophysical logs was run, and hole capped pending decision on further work.

Table 2.--*Geologic section in borehole WIPP-22*

Rock unit	Thickness Feet	Depth interval[1] Feet
Quaternary rocks		
Holocene deposits[2]	6	0- 6
Mescalero caliche	7	6- 13
Triassic rocks		
Santa Rosa Sandstone	68	13- 81
Permian rocks		
Dewey Lake Red Beds	492	81- 574
Rustler Formation	311	574- 885
Dissolution residue	11	603- 614
Magenta Dolomite Member	24	630- 654
Dissolution residue	11	717- 728
Culebra Dolomite Member	22	742- 764
Dissolution residue	6	767- 773
Salt interval	108	777- 885
Salado Formation	565	885-1,450
Upper member	480	883-1,363
[3]MB 101	3	1,000-1,003
[3]MB 102	1	1,036-1,037
[3]MB 103	14	1,049-1,063
[3]MB 104	1	1,071-1,072
[3]MB 105	1	1,086-1,087
[3]MB 106	1	1,102-1,103
[3]MB 107	1	1,142-1,143
[3]MB 108	1	1,150-1,151
[3]MB 109	22	1,172-1,196
[3]MB 111	1	1,242-1,243
[3]MB 112	2	1,259-1,261
[3]MB 113	1	1,285-1,286
[3]MB 114	1	1,307-1,308
[3]MB 115	2	1,342-1,344
[3]MB 116	2	1,353-1,355
McNutt potash unit	87	1,363-1,450
Vaca Triste Sandstone Member[4]	4	1,363-1,367
[3]MB 117	1	1,426-1,427
Maximum depth recorded----------		1,448

[1]Depth recorded on Compensated Neutron-Formation Density log.
[2]Includes artificial fill for drill pad.
[3]Marker Bed.
[4]Of Adams, 1944.

APPENDIX C

HOLE HISTORY

compiled by

R. D. Statler
Division 1133
and
P. D. Seward
Division 1135
Sandia Laboratories

INTRODUCTION TO APPENDIX C, HOLE HISTORY

The hole history is a document provided soon after completion of the borehole, and it summarizes the relevant information on the daily log kept by the contractor. The hole history is not edited to ensure conformance in every detail with later information developed for previous chapters. Further information may be obtained as necessary through examination of the original daily time logs.

FENIX & SCISSON, INC.

HOLE HISTORY DATA

10-16-78 (Rev. #1)

DATE: 6-29-78

HOLE NO.: WIPP #22	W. O. NO.:	I. D. NO.:
USER: Sandia Lab.	TYPE HOLE: Exploratory	
LOCATION New Mexico	COUNTY: Eddy	AREA:
SURFACE COORDINATES: * 2546.95' FSL, 13.44' FEL, Sec.20, T22S, R31E		
GROUND ELEVATION: *	PAD ELEVATION:	TOP CASING ELEVATION:
RIG ON LOCATION:	SPUDDED: 5-8-78	COMPLETED: 5-24-78
CIRCULATING MEDIA: Salt base mud.		
MAIN RIG & CONTRACTOR		NO. OF COMPRESSORS & CAPACITY:

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	20'	8-3/4"	7" (O.D.)			USED		0'	20'	NONE
20'	1450'	6-1/8"								

TOTAL DEPTH: 1450' GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @
JUNK & PLUGS LEFT IN HOLE:		
SURVEYS PAGE:	CORING PAGE:	CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2		
BOTTOM HOLE COORDINATES: NONE		REFERENCE:

RIGS USED *(Site Prep Rigs *)*

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
3625	Boyles Bros.	Failing 2000		5.31	1.10	9.50	15.91

REMARKS:

Sample Description: Page 3

* Brass monument location: 2542.70' FSL, 15.19' FEL, T22S, R31E.

Elevation 3425.83'.

PREPARED BY: WDS/lkm

TIME BREAKDOWN ON NEXT PAGE

FENIX & SCISSON, INC.

HOLE HISTORY DATA

DATE: 6-29-78

HOLE NO.:	WIPP #22	W. O. NO.:		I. D. NO.:	
USER:	Sandia Lab	TYPE HOLE:	Exploratory		
LOCATION	New Mexico	COUNTY:	Eddy	AREA:	
SURFACE COORDINATES:	2544.66' FSL, 11.35' FEL, Sec. 20, T 22S, R 31 E				
GROUND ELEVATION:	3426.95'	PAD ELEVATION:		TOP CASING ELEVATION:	
RIG ON LOCATION:		SPUDDED:	5-8-78	COMPLETED:	5-24-78
CIRCULATING MEDIA:	Salt base mud				
MAIN RIG & CONTRACTOR				NO. OF COMPRESSORS & CAPACITY:	

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I.D.	WT./FT.	WALL	GRADE	CPL'G.	FROM	TO	CU. FT. CMT.
0'	20'	8-3/4"	7" (O.D.)			USED		0'	20'	NONE
20'	1450'	6-1/8"								

TOTAL DEPTH: 1450'GL	AVERAGE MANDREL DEPTH:	FROM REFERENCE ELEVATION @	
JUNK & PLUGS LEFT IN HOLE:			
SURVEYS PAGE:	CORING PAGE:		CU. FT. CMT. TOTAL IN PLUGS, ETC:
LOGGING DATA: Page 2			
BOTTOM HOLE COORDINATES: NONE			REFERENCE:

RIGS USED

RIG NO.	NAME	TYPE	CLASS	DAYS OPERATING	SECURED W CREW	SECURED W/O CREW	TOTAL DAYS ON LOC.
3625	Boyles Bros.	Failing 2000		5.31	1.10	9.50	15.91

REMARKS:

Sample Description: Page 3

PREPARED BY: WDS/it

TIME BREAKDOWN ON NEXT PAGE

WIPP #22

HOLE HISTORY

5-8-78	Moved in Boyles Bros. rig #3625 and rigged up. Drilled 8-3/4" hole from 0' to 20' using salt base mud. Set 7" O.D. casing at 20' and packed around the top. Drilled 6-1/8" hole from 20' to 400'. Mixed mud with loss circulation materials at 202', 100% returns.
5-9-78	Drilled 6-1/8" hole from 400' to 700'. Changed out bit at 532'.
5-10-78	Drilled 6-1/8" hole from 700' to 1045'. Changed out bit at 787'. Conditioned mud to log and laid down drill pipe. Ran Schlumberger logs.
5-11-78	Completed Schlumberger logs. Ran USGS logs.
5-22-78	Rig secured from 5-11-78 to 5-22-78. Drilled 6-1/8" hole from 1045' to 1342'.
5-23-78	Drilled 6-1/8" hole from 1342' to 1450'. Ran Schlumberger logs.
5-24-78	Ran USGS logs. Rigged down. Hole completed.

BIT RECORD

BIT NO.	MAKE	SIZE	TYPE	DEPTH OUT	FEET DRILLED	ROTATING HOURS
1	Rerun	8-3/4		20	20	1/2
2	Security	6-1/8	S3J	532	512	20-3/4
3	Hughes	6-1/8	OSC3J	787	255	20
4	Security	6-1/8	S3J	1045	258	7
5	Security	6-1/8	S3J	1450	405	19-1/2

LOG INDEX SHEET

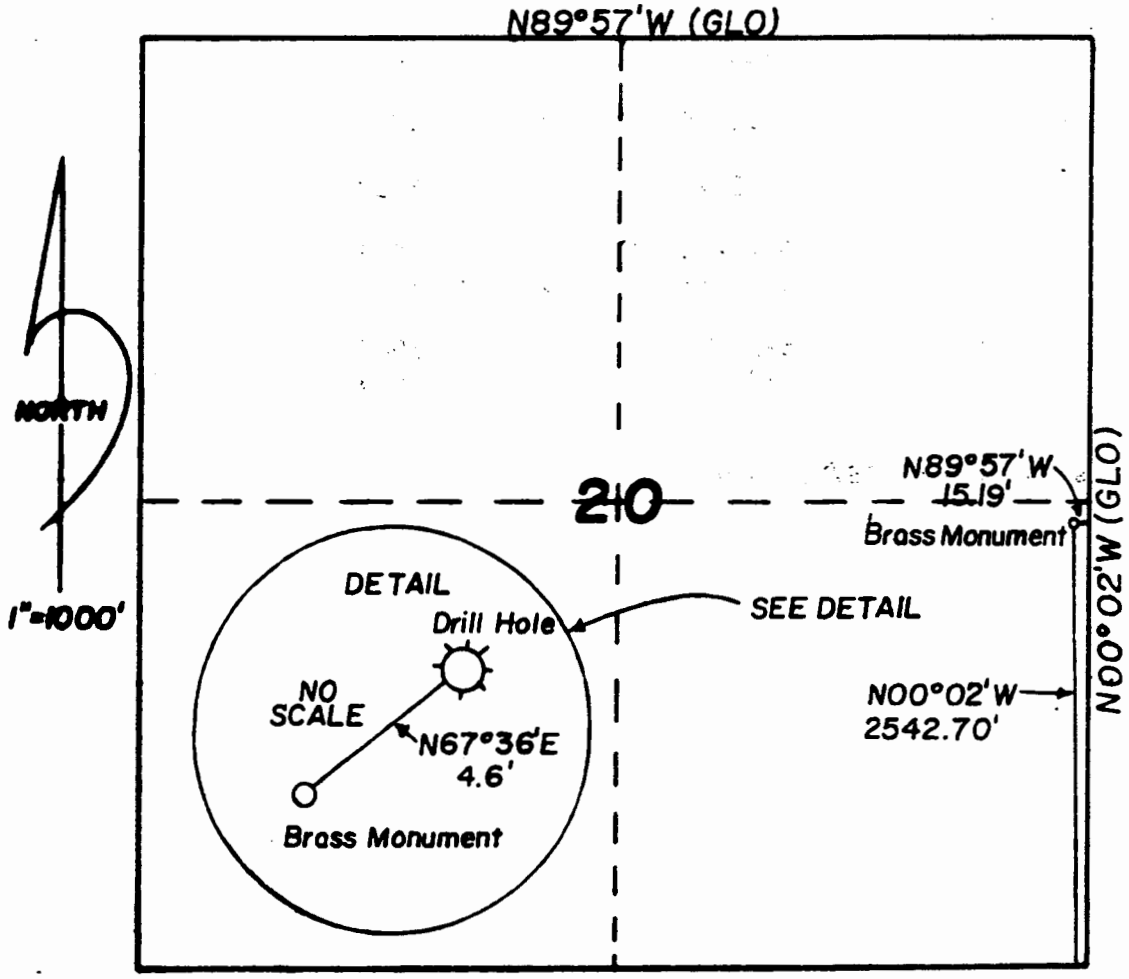
TYPE LOG	DATE	RUN NO	DEPTH DRILLER	DEPTH LOGGER	LOGGED FROM	LOGGED TO
SCHLUMBERGER LOGS						
Dual Laterolog Micro-SFL	5-11-78	1	1045	1034	22	1032
	5-23-78	2	1450	1450	10	1448
Compensated Neutron-Formation Density	5-10-78	1	1045	1034	20	1033
	5-23-78	2	1450	1450	0	1448
Borehole Compensated Sonic	5-11-78	1	1045	1034	10	1029
	5-23-78	2	1450	1449	10	1447
Dipmeter-Computed	5-10-78	1	1045	1034	20	1032
	5-23-78	2	1450	1452	20	1452
Dipmeter-Basic Data	5-10-78	1	1045	1034	20	1032
	5-23-78	2	1450	1452	20	1452

NOTE: Logs furnished F&S/Mercury.

SURVEY MONUMENT "AS BUILT"
W.I.P.P. 22

SECTION 20, TOWNSHIP 22S, RANGE 31E N.M.P.M.
EDDY COUNTY, NEW MEXICO

ELEVATION OF BRASS MONUMENT 3425.83'
2542.70' FSL & 15.19' FEL



This is to certify that the foregoing plat was made from field notes of a benefitted survey made by me and is true and correct to the best of my knowledge and belief.

Dan R. Reddy
N.M.P.E. & L.S. #5412

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REGISTERED PROFESSIONAL ENGINEER

WIPP Hydrology Program, Waste Isolation Pilot Plant, Southeastern New Mexico, Hydrologic Data Report #4 (SAND86-7166), Part C, Sections 1.0 through 5.0, Figure 1.1, Figure 1.2, and Figure 1.3 (21 pages total).

CONTRACTOR REPORT

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WIPP Hydrology Program Waste Isolation Pilot Plant Southeastern New Mexico

Hydrologic Data Report #4

G. J. Saulnier, Jr., G. A. Freeze, W. A. Stensrud
INTERA Technologies, Inc.
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Austin, Texas 78731

Prepared by Sandia National Laboratories Albuquerque, New Mexico 87185 and Livermore, California 94550 for the United States Department of Energy under Contract DE-AC04-76DP00789

Printed February 1987

PART C. WELL DEVELOPMENT AND HYDRAULIC TESTING AT WELLS WIPP-12, WIPP-13, WIPP-18, WIPP-19, WIPP-21, AND WIPP-22 CONDUCTED FROM APRIL TO AUGUST 1986

1.0 INTRODUCTION

Well development and hydraulic testing were performed at six wells in the central-northwest part of the WIPP site (Figure 1.1) by INTERA Technologies, Inc., under contract to Sandia National Laboratories to participate in the hydrogeologic characterization of the WIPP site. The six wells, WIPP-12, WIPP-13, WIPP-18, WIPP-19, WIPP-21, and WIPP-22 (denoted the WIPP wells), were drilled in 1978 and 1979 as exploratory boreholes to expand stratigraphic and structural understanding of the WIPP site and to provide information on possible deep pressurized zones (WIPP-12 and WIPP-13). WIPP-12 and WIPP-13 were cased through the Rustler Formation until September 1985, when retrievable bridge plugs were set in the casing in the lower Rustler. The Culebra-dolomite intervals were then perforated to allow hydrologic observation and testing.

WIPP-18, WIPP-19, WIPP-21, and WIPP-22 were left open and filled with brine mud from the time of drilling until October 1985 when they were cleaned, cased, and cemented through the Rustler Formation, leaving a cement plug in the bottom of the boreholes. The Culebra-dolomite interval was then perforated in all wells and the water level has been monitored since mid-October 1985.

1.1 Objectives

The objectives of the development and testing of the WIPP wells were to establish good hydraulic communication between the boreholes and the Culebra dolomite, to provide hydraulic formation parameters for each of the wells, and to evaluate these wells as candidates for the northern multipad pumping test to be conducted in early 1987. In addition, the

development of the wells was intended to provide estimates of specific gravity and electrolytic conductivity of the water produced from these wells to aid in developing a more complete understanding of the regional ground-water flow system in the Culebra dolomite.

1.2 Scope

The well development and testing of the WIPP wells was accomplished in two phases. First, a downhole pump was used to impart maximum stress to the formation to aid in cleaning mud and cement from the near-borehole environment. The pumping was performed without a downhole check valve to provide a surging action on the perforations. The pumping rate was varied as much as possible to indicate whether or not pumping tests were possible and to estimate the sustainable pumping rate for a minimum 25-hour constant-rate pumping test. For wells with a permeability too low to sustain a constant-rate pumping test, slug-injection tests were to be used to provide estimates of formation hydraulic parameters. The preliminary evaluation of WIPP-13 indicated a well-efficiency problem. This problem was addressed with an acid-treatment program designed to provide a better hydraulic connection from the wellbore to the formation. WIPP-12 initially appeared to have extremely low permeability or to have been unsuccessfully perforated. WIPP-12 was also acid treated to attempt to solve this problem.

The second phase of the WIPP-wells' development and testing program consisted of the hydrologic tests performed on the wells. Only WIPP-13 was capable of sustaining a continuous pumping rate greater than one gpm. WIPP-18, WIPP-19, WIPP-21, and WIPP-22 were tested by slug injection. The permeability at WIPP-12 was judged too low to allow either sustained pumping during well development or short-term slug testing.

1.3 Well Configurations

Figure 1.2 shows the typical well configuration for well development. The wells were equipped with a downhole electric submersible pump to stress the formation and a downhole pressure transducer to assess the effect of pumping on the fluid pressure in the boreholes. The pump was not equipped with a downhole check valve, thus allowing water in the discharge line to exert a slight overpressure on the formation after the pump was turned off. Tables in Appendix C1.0 contain details of the pump intake and transducer depths during the development phases of the WIPP wells. Figure 1.3 shows the typical well configuration for both slug and pumping tests. The downhole assembly contained a downhole pump, a packer with feed-through assembly to isolate the test interval, and a downhole transducer to measure the borehole's fluid-pressure response. For this configuration a check valve was used to allow a pumping test, if possible, with controlled flow conditions.

2.0 TEST EQUIPMENT

2.1 Data-Acquisition System

The automated data-acquisition system (DAS) used for testing the WIPP wells was the same Hewlett Packard (HP)-9845b-controlled system used at the WIPP site for past and present hydrologic investigations. The basic system, illustrated schematically in Part A, Figure 2.1, utilizes downhole pressure transducers to sense downhole fluid pressure in the test interval and in the annulus above the downhole packer. The DAS is described in Hydrologic Data Reports #2 and #3 (INTERA Technologies and Hydro Geo Chem, 1985, and INTERA Technologies, 1986).

2.2 Downhole Transducers

Druck PDCR 10/D pressure transducers were used in all wells for both well development and testing. The transducers are rated either 0 to 100 or 0 to 250 psi and are calibrated before and after use relative to a Heise pressure gage.

Pretest and posttest calibration data are presented in Tables C1.1 to C1.10, Appendix C1.0.

2.3 Downhole Assemblies

Two basic downhole equipment configurations were used in the WIPP-well testing, pumping with and without a downhole packer. In addition, a larger capacity 15-horsepower (hp) pump was used at WIPP-13 for the 50-hour pumping test that was conducted following the acid treatment of the well. The downhole packer was used during hydraulic testing to isolate the test interval and minimize wellbore storage.

The downhole assembly was used without a packer for well development and consisted of a 3-hp Red Jacket 32BC electric submersible pump installed without a check valve immediately above the pump. A transducer placed just above the pump and taped to the discharge line was used to monitor the borehole fluid level to ensure submergence of the pump and to assess improvements in well performance. Operating the pump without a check valve allowed the water in the discharge line to flow back through the pump after it was turned off. This back flow provided a slight overpressure on the formation and a surge effect on the perforations, helping to stimulate production.

Only WIPP-13 was tested by constant-rate pumping. The pumping test was conducted after acid treatment of WIPP-13 and required a 15-hp pump because of the increased production capability of WIPP-13 after acid

treatment. For the pumping test, a check valve was installed in the discharge line just above the pump. The use of the check valve allowed the discharge line to be filled before the start of the test, thus providing stable pretest conditions and regulated flow during the test, especially immediately after turning on the pump.

A packer feed-through assembly was used during pumping and slug testing to isolate the test interval from the fluid column in the casing above the test interval, thus minimizing wellbore storage. The packer feed-through assembly consisted of a Baski 3-3/4-inch packer (a 7-inch packer in WIPP-13), a discharge pipe, transducers, a check valve, and a feed-through plug. The feed-through plug, described in Hydrologic Data Report #3, Part A (INTERA Technologies, 1986), allows the transducer mounted above the packer to sense fluid pressure in the test interval using a tube which is attached to the feed-through plug and runs along the packer mandrel. The packer feed-through assembly was installed with the submersible pump for most tests (see Figure 1.3). However for some low-permeability wells requiring slug tests, the packer assembly was used without the pump.

2.4 Discharge-Measurement and Flow-Regulation System

Figure 2.2, Part B, is a schematic diagram of the discharge-measurement and flow-regulation system used during the well-development pumping and the WIPP-13 pumping test. The system utilized two means of estimating pumping rate and two flow-regulation devices. In addition, the discharge line was equipped with a fill pipe which allowed complete pretest filling of the surface-discharge pipe, including the section containing the flow meter and flow-regulation valve. Coupled with the pump's check valve, the filling of the discharge line insured that regulated flow conditions were in effect from the moment the pump was turned on. Thus, average pumping-rate data were obtained for all drawdown data collected during the test, including the early-time data.

Two totalizing flow meters were used during well development and testing of the WIPP wells. The Precision flow meter was used for all well-development pumping and the Hays flow meter was used for the WIPP-13 50-hour pumping test. Both flow meters recorded total production volume and provided data for time-averaged discharge measurements. A twelve-foot high, six-inch diameter, calibrated standpipe was used to make timed-volume measurements to check flow-meter performance. Correlation between the two measurement methods was established prior to the test. Comparison of the pumping rate measured by the totalizing flow meter and the standpipe showed that the standpipe measurement was 0.938 times the Hays flow-meter value.

Flow regulation was maintained through the use of an adjustable, one-inch ball valve placed upstream of the Precision flow meter, and a fixed-orifice Dole valve downstream of the totalizing flow meters. These two in-line devices exerted sufficient back-pressure on the pump to provide a regulated and relatively constant pumping rate.

2.5 Water-Level Measurement Devices

During the WIPP-13 50-hour pumping test, water-level measurements in observation wells H-2b2, H-6a, WIPP-12, WIPP-18, WIPP-21, WIPP-30, and P-14 were performed with the Solinst electric water-level sounder and with the Iron Horse electric water-level sounder. The function and use of the Iron Horse and Solinst electric water-level sounders are described in detail in Part B, Section 2.5.1.

2.6 Water-Quality Measurement Devices

Measurements of the electrolytic conductivity, specific gravity, and temperature of the water produced during all well-development activities and the WIPP-13 pumping test were made at periodic intervals during pumping operations. The electrolytic conductivity was measured

with a Labline Lectro Mho-Meter, which provided stable and consistent measurements throughout testing, and the specific gravity was measured with calibrated hydrometers with specific-gravity ranges of 1.00 to 1.07 and 1.00 to 1.20 (See Part B, Section 2.6).

3.0 HISTORY OF WELL DEVELOPMENT AND TESTING

3.1 WIPP-12

3.1.1 Drilling and Perforation

Well WIPP-12 was drilled in late 1978 to investigate the Salado and Castile Formations (Sandia National Laboratories and D'Appolonia Consulting Engineers, 1982a). The well was drilled to a 12-1/4-inch open-hole diameter through the Rustler Formation with a salt-based drilling mud, and then cased with 9-5/8-inch casing and cemented to 1001.8 feet below land surface (bls). The well was then drilled and cored through the Salado and Castile Formations to a depth of 2773.3 feet bls using a 10.0 lb/gal brine mixed with starch, soda ash, and caustic soda. In 1981 and 1982, WIPP-12 was deepened through the Castile Formation to a total depth of 3927.5 feet bls, using brine with a brine-gel clay additive as a drilling fluid (Black, 1982). During the deepening, a pressurized brine reservoir was encountered in the Castile Formation at a depth of 3016 feet bls. In 1983, the brine reservoir was sealed from the upper part of the borehole by installing a borehole plug from 2784 to 3000 feet, using a bridge plug covered by 27 feet of sand and 189 feet of cement (D'Appolonia, 1984). The well was capped and left open hole with a pressure gage until 1985 when the well was reopened for drill-stem testing by Sandia National Laboratories. Following testing, a retrievable bridge plug was set in the casing below the Culebra-dolomite interval. The Culebra was then shot perforated on October 14, 1985 from 815 to 840 feet below land surface and left open for water-level measurements. The water-level

data for WIPP-12 are presented in Hydrologic Data Reports #2, Part C (INTERA Technologies and Hydro Geo Chem, 1985), Hydrologic Data Report #3, Part F (INTERA Technologies, 1986), and Part E, Appendix E1.0, of this report.

3.1.2 Well Development

The development of well WIPP-12 began on May 1, 1986 with a step-drawdown test. During the test, the pump was operated at 90-minute intervals at 1.9, 3.2, 4.7, and 6.0 gpm. The last pumping period was stopped after 30 minutes because only about 24 feet of water was present above the transducer. The well recovered only 25.7 psi as of May 5, an indication of extremely low permeability or poor connection to the Culebra dolomite. Because the well would not support developmental pumping, the pump was removed from WIPP-12 on May 7, to await acid treatment to attempt to improve the well's hydraulic connection to the formation.

3.1.3 Acid Treatment

WIPP-12 was treated with 20% hydrochloric acid (HCl) on May 21, 1986 in an effort to improve well efficiency. The borehole fluid was exchanged for a 2% potassium-chloride solution, and then about 3 barrels of 20% HCl solution were placed at the level of the Culebra perforations. The downhole packer was then set at 764.8 feet below top of casing (BTC) to begin the acid injection. A total of about 50 gallons of 20% HCl was injected at 300 to 500 psi surface pressure from 11:00 to 12:35. Because the formation was not accepting the acid, the packer was released and 500 gallons of 20% HCl were placed at and above the perforation level and allowed to remain in the borehole. The water level in the well fell from 33 feet BTC on May 23 to 175.15 feet BTC on May 27. The apparent low permeability of the formation at this location led to the decision to discontinue testing at WIPP-12.

3.2 WIPP-13

3.2.1 Drilling and Perforation

WIPP-13 was drilled to a 7-7/8-inch open-hole diameter to the upper part of the Salado Formation in 1978 and left filled with salt-based drilling mud. In 1979, the well was reamed to a 12-1/4-inch open-hole diameter, cased and cemented through the Rustler Formation with 9-5/8-inch casing, and then deepened to the Castile Formation (Sandia National Laboratories and U.S. Geological Survey, 1979; Sandia National Laboratories and D'Appolonia Consulting Engineers, 1982b). WIPP-13 was left filled with a brine-gel drilling fluid, capped, and left open hole through the Salado until 1985, when a retrievable bridge plug was set in the casing below the Culebra-dolomite interval. The Culebra was shot perforated on October 26, 1985 from 702 to 727 feet bls and left open for water-level measurements. Water levels for WIPP-13 are presented in Hydrologic Data Report #2 (INTERA Technologies and Hydro Geo Chem, 1985), Hydrologic Data Report #3 (INTERA Technologies, 1986), and Part E, Appendix E1.0, of this report.

3.2.2 Well Development

Well development of WIPP-13 began on April 4, 1986 with a step-drawdown test (Figure 3.1). The pump was operated for successive 90-minute intervals at 1.7, 3.2, 4.4, and 6.0 gpm during which time the transducer-measured fluid pressure fell from 203 psi to 24.5 psi. The fluid pressure recovered overnight to a stabilized pressure of 151.5 psi, about 50 psi lower than the pretest pressure. From April 5 to 14, 1986, six periods of surge and development pumping, including one step-drawdown period and a 3-day pumping period, were performed on WIPP-13 with pumping rates ranging from 3 to 6 gpm. The post-development fluid pressure remained stable at the 151.5 psi level. The large wellbore-storage effect noted after turning the pump on and off

and the change in stabilized fluid pressure before and after these excercises indicated significant wellbore damage and insufficient hydraulic connection of the wellbore to the formation. Therefore, acid treatment was scheduled to improve the well's performance. The pump was removed from the well following the developmental pumping and the water level was monitored until the start of acid-treatment operations.

3.2.3 Acid Treatment

WIPP-13 was treated with 20% hydrochloric acid (HCl) on June 12, 1986 to improve well efficiency and performance (see Part B, Section 2.7 of this report for a description of some of the equipment used in acid treatment). The borehole fluid was exchanged for a 2% potassium-chloride solution, and then about 3 barrels of 20% HCl were placed at the level of the Culebra perforations. The downhole packer was then set above the Culebra at 664.20 feet BTC to begin acid injection. About 54 barrels (2270 gallons) of 20% HCl solution were injected into the formation through the packer, using no added injection pressure from the surface. The acid was allowed to remain in the formation for one hour and then the acid solution was swabbed, removing about 1950 gallons of fluid from the borehole through the 2-3/8-inch tubing above the packer. The acid-treatment equipment was removed from WIPP-13 and the well's water level was monitored until the 50-hour pumping test.

3.2.4 Pumping Test

Preparation for the 50-hour pumping test at WIPP-13 began on August 4 and 5 when two 2-hour pumping tests were performed to establish the potential pumping rate for a 50-hour test. The well sustained a pumping rate of greater than 35 gpm, a pronounced increase from its pre-acid-treatment performance. From August 7 to August 9, a 50-hour pumping-test was conducted at WIPP-13 with the 15-hp Red Jacket pump.

Figure 3.2 illustrates the well configuration for the 50-hour pumping test in WIPP-13. During the test, water levels were measured in wells H-2b2, H-6a, P-14, DOE-2, WIPP-12, WIPP-18, WIPP-21, and WIPP-30. After the 50-hour pumping test, the pump was removed from the well and water-level monitoring resumed.

3.3 Well Development and Slug Testing at WIPP-18, WIPP-19, WIPP-21, and WIPP-22

3.3.1 Drilling and Perforation

Wells WIPP-18, WIPP-19, WIPP-21, and WIPP-22 were drilled in 1978 and had been left open, uncased, and filled with brine or brine mud since they were drilled (Sandia National Laboratories and U.S. Geological Survey, 1980a, 1980b, 1980c, and 1980d). These wells were recompleted as hydrologic monitoring wells for the Culebra dolomite in September and October 1985. The recompletion activity consisted of the cleaning and reaming of these wells to a diameter of 7-7/8-inches using ten-pound per gallon salt-brine as a drilling fluid; fully cementing 5-1/2-inch casing to the top of the Salado Formation leaving a cement plug in the bottom of the casing; filling the casing in WIPP-18, WIPP-19, and WIPP-22 with ten-pound per gallon salt-brine and in WIPP-21 with fresh water; and shot-perforating the Culebra-dolomite interval in each well. The water levels in these wells have been monitored since they were perforated. Post-perforation water levels can be found in Hydrologic Data Report #2 (INTERA Technologies and Hydro Geo Chem, 1985), Hydrologic Data Report #3 (INTERA Technologies, 1986), and Part E, Appendix E1.0, of this report. The perforation intervals and dates of perforation for these wells are as follows:

- WIPP-18, perforated October 11, 1985 from 784 to 806 ft bls;
- WIPP-19, perforated October 9, 1985 from 754 to 780 ft bls;
- WIPP-21, perforated October 6, 1985 from 727 to 751 ft bls;
- WIPP-22, perforated October 8, 1985 from 748 to 770 ft bls.

3.3.2 Well Development

Well development at wells WIPP-18, WIPP-19, WIPP-21, and WIPP-22 consisted of a limited number of pumping periods to establish each well's capacity and improve their efficiency. During development, each well was observed to have a low apparent permeability and none could sustain pumping for periods of time greater than two hours at pumping rates from 1 to 3 gpm. Because the apparently low permeability could have been the result of either natural conditions or damage to the formation near the borehole, a rapid lowering of borehole fluid pressure (surging) was used to apply maximum under-pressure to the formation in hopes of clearing any restrictions to ground-water flow to the perforations. Surging was performed by using step increases in pumping rate (step-rate surge); by operating the pump at a high rate and drawing down the pressure to near zero in less than two hours (single-stage surge); and by alternately turning the pump on at a moderate rate and turning it off for hour-long intervals until the accumulated drawdown was near zero indicating a borehole-fluid level just above the transducer, a condition normally achieved after three to four pumping intervals (multiple-stage surge). Figures 3.3 to 3.6 illustrate the well-development periods for WIPP-18, WIPP-19, WIPP-21, and WIPP-22. The well-development activities are summarized as follows:

Well	Date	Development Operation	Average Pumping Rate (gpm)
WIPP-18	05/10/86	Three stage surge	1.5
	05/11/86	Single-stage surge	5
	05/12/86	Single-stage surge	3
	05/13/86	Single-stage surge	3
	05/14/86	Single-stage surge	3
WIPP-19	05/29/86	Step-rate surge	1.5, 3.0
	05/29/86	Single-stage surge	1.5
WIPP-21	06/28/86	Step-rate surge	1.8, 3.3
	07/01/86	Single-stage surge	2.7

WIPP-22	06/12/86	Single-stage surge	1.5
	06/14/86	Three-stage surge	2.0
	06/17/86	Three-stage surge	2.0

3.3.3 Slug Testing

Slug-injection tests were performed on WIPP-18, WIPP-19, WIPP-21, and WIPP-22 to obtain data for estimating the Culebra's hydraulic parameters at these locations, because the wells could not sustain pumping rates as low as one gpm for more than two to three hours. To perform the tests, either the standard single downhole packer assembly, described in Section 2.3, or a single downhole packer without pump was lowered into the well on 2-3/8-inch tubing. The packer was inflated in the casing above the perforations and the fluid pressure was allowed to stabilize. A measured volume of fluid was added to the annulus between the tubing and the casing, and the fluid level was allowed to stabilize. Then the packer inflation pressure was released, transmitting a near-instantaneous (usually in one to two minutes) pressure increase to the formation. The fluid-pressure response to this pressure slug was then recorded with the DAS until the fluid pressure returned to the pretest value, or until 90% of the pressure slug had dissipated.

4.0 TESTING RESULTS

4.1 Fluid-Pressure Responses

4.1.1 WIPP-12 Step-Drawdown Pumping

Figure 4.1 shows the fluid-pressure response of WIPP-12 to the step-drawdown pumping on May 1, 1986. The figure shows that WIPP-12 had a very slow recovery to the pumping and no further testing was possible.

4.1.2 WIPP-13 50-Hour Pumping Test

4.1.2.1 Fluid-Pressure Response in Pumping Well WIPP-13

Figure 4.2 shows the fluid-pressure response to pumping and recovery in WIPP-13 during the 50-hour pumping test conducted from August 7 to 9, 1986 and Figure 4.3 shows a plot of pumping rate versus time for this test. The plots show a somewhat irregular response at early time, and a pumping-rate adjustment on Day 220 to increase the pumping rate in response to a pumping-rate decrease due to the increased lift. The irregular early-time data may be due to post-acid-treatment degassing of water in the wellbore, as water produced during the early part of the test was gaseous with a strong odor.

Tabulated pumping-rate data for the test are presented in Table C2.1, Appendix C2.0. Tabulated data for the fluid-pressure response of WIPP-13 during the 50-hour pumping test are presented in Table C3.1, Appendix C3.0.

4.1.2.2 Water-Level Responses in Observation Wells

Figures 4.4 to 4.9 show the water levels in observation wells H-6a, P-14, WIPP-18, WIPP-21, WIPP-30, and H-2b2 during the pumping at WIPP-13 (the tabulated data for Figures 4.4 to 4.9 are found in Part E of this report). These figures show that water-level responses possibly attributable to the WIPP-13 pumping were measured at H-6, WIPP-18, and WIPP-30. The other wells apparently showed no responses during the 50-hour test. H-6a appears to have responded 11 to 12 hours after the start of pumping, while WIPP-18 appears to have responded about 3 days after the end of the test. WIPP-30 shows a water-level change, but exact linkage of this response to the WIPP-13 test is in doubt because of pumping at DOE-2 as part of the Water Quality Sampling Program. WIPP-21 shows a water-level

response after the pumping test, but this response appears to be due to grouting of the Culebra in the exhaust shaft at the WIPP-site main facility. Well DOE-2 may have responded to pumping at WIPP-13, but the well was unavailable for measurement at the time of the 50-hour pumping test because of the water-quality sampling activity. WIPP-12 was still responding to the acid injection and did not provide unequivocal results.

4.1.3 Slug Testing at WIPP-18, WIPP-19, WIPP-21, and WIPP-22

Figures 4.10 to 4.13 show the fluid-pressure responses to slug testing in WIPP-18, WIPP-19, WIPP-21, and WIPP-22. The figures show that the fluid pressure during each test decreased to pretest or near-pretest values within 2 days of the slug injection. A response to the slug injections was not detected at nearby wells.

Tabulated data for the fluid-pressure responses to slug testing at WIPP-18, WIPP-19, WIPP-21, and WIPP-22 can be found in Tables C3.2, C3.3, C3.4, and C3.5 in Appendix C3.0.

4.2 Water-Quality Data

Table C4.1, Appendix 4.0, contains water-quality data collected during well-development and during the 50-hour pumping test at WIPP-13. The table contains electrolytic-conductivity, specific-gravity, and temperature data from water discharged during pumping episodes at WIPP-13. Figure 4.14 is a plot of the electrolytic-conductivity and the specific-gravity data. The initial water produced from WIPP-13 appears to represent the brine that was in the borehole prior to perforation, and the last water produced probably represents some mixture of that brine, the brine used during drilling the original well, and formation water.

Table C4.2, Appendix C4.0, contains water-quality data collected during well-development pumping at WIPP-18, WIPP-19, WIPP-21, and WIPP-22. Only a limited amount of pumping was performed at these wells and, therefore, only limited data are available. The electrolytic-conductivity data from WIPP-18, WIPP-19, and WIPP-22 indicate the probability that the water produced from these wells reflects the brine used in drilling these wells and the brine in the casing at the time of perforation. The water from WIPP-21, on the other hand, was uncharacteristically fresh and may be indicative of the fresh water left in the borehole following the cementing of the casing in 1985.

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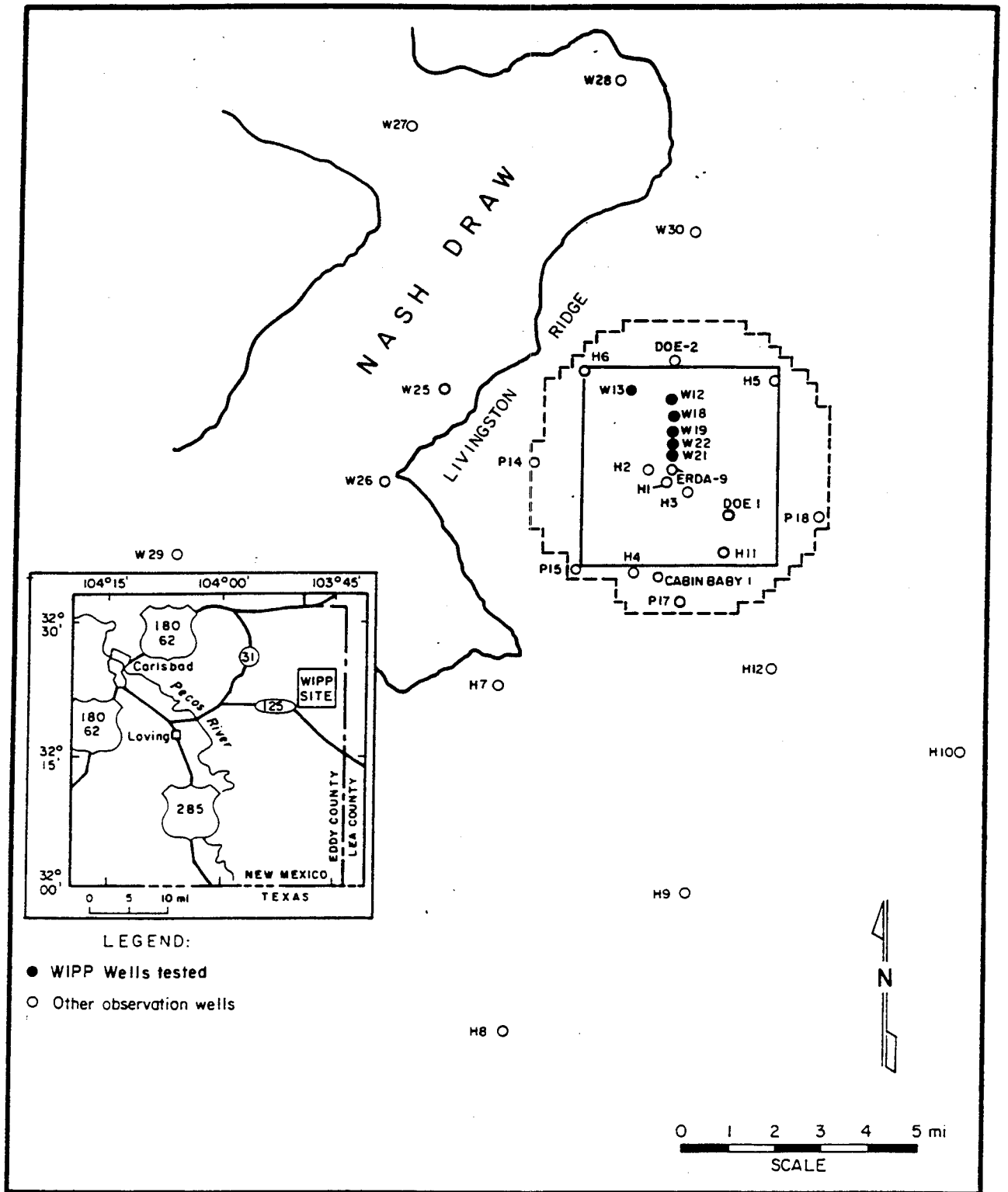
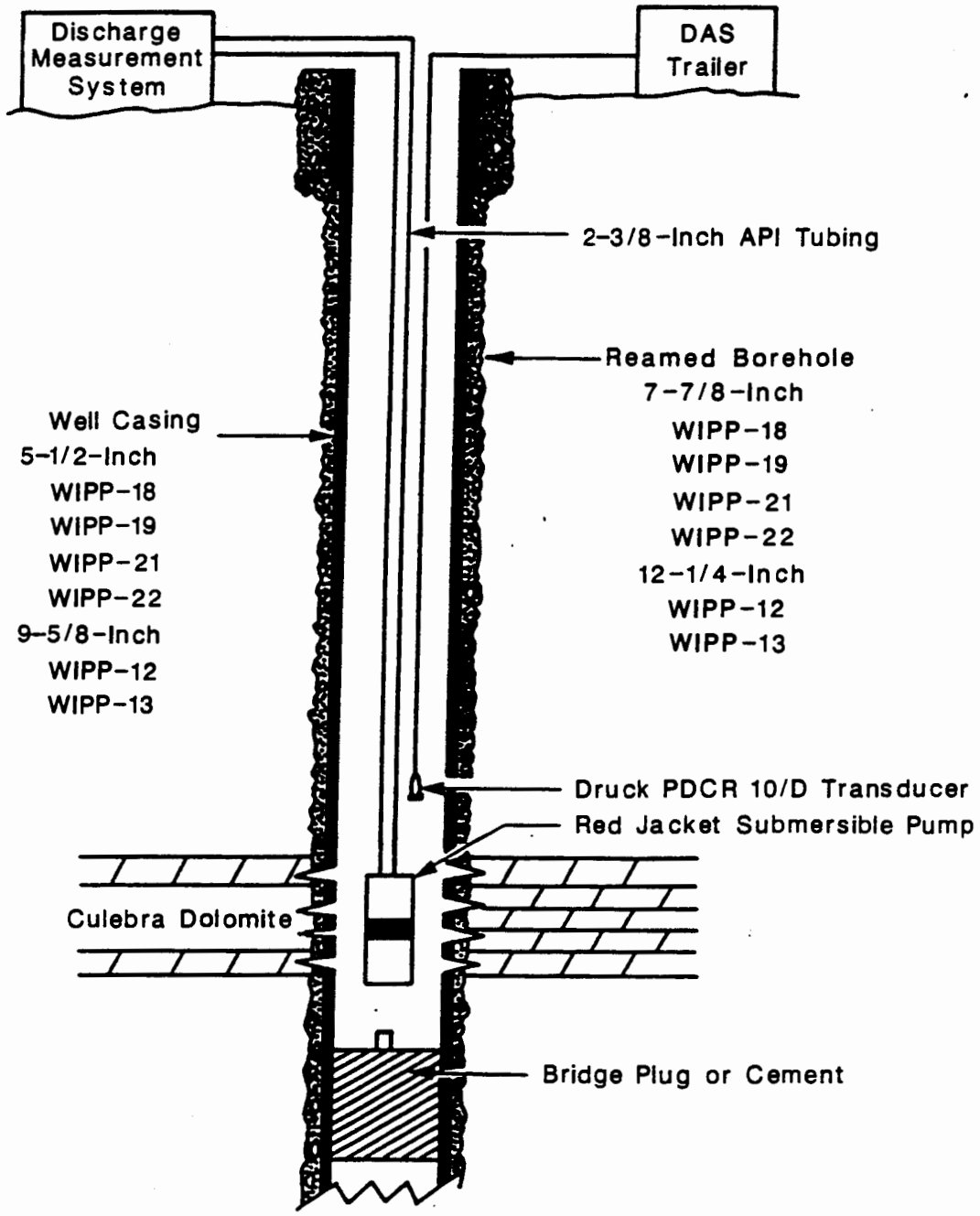


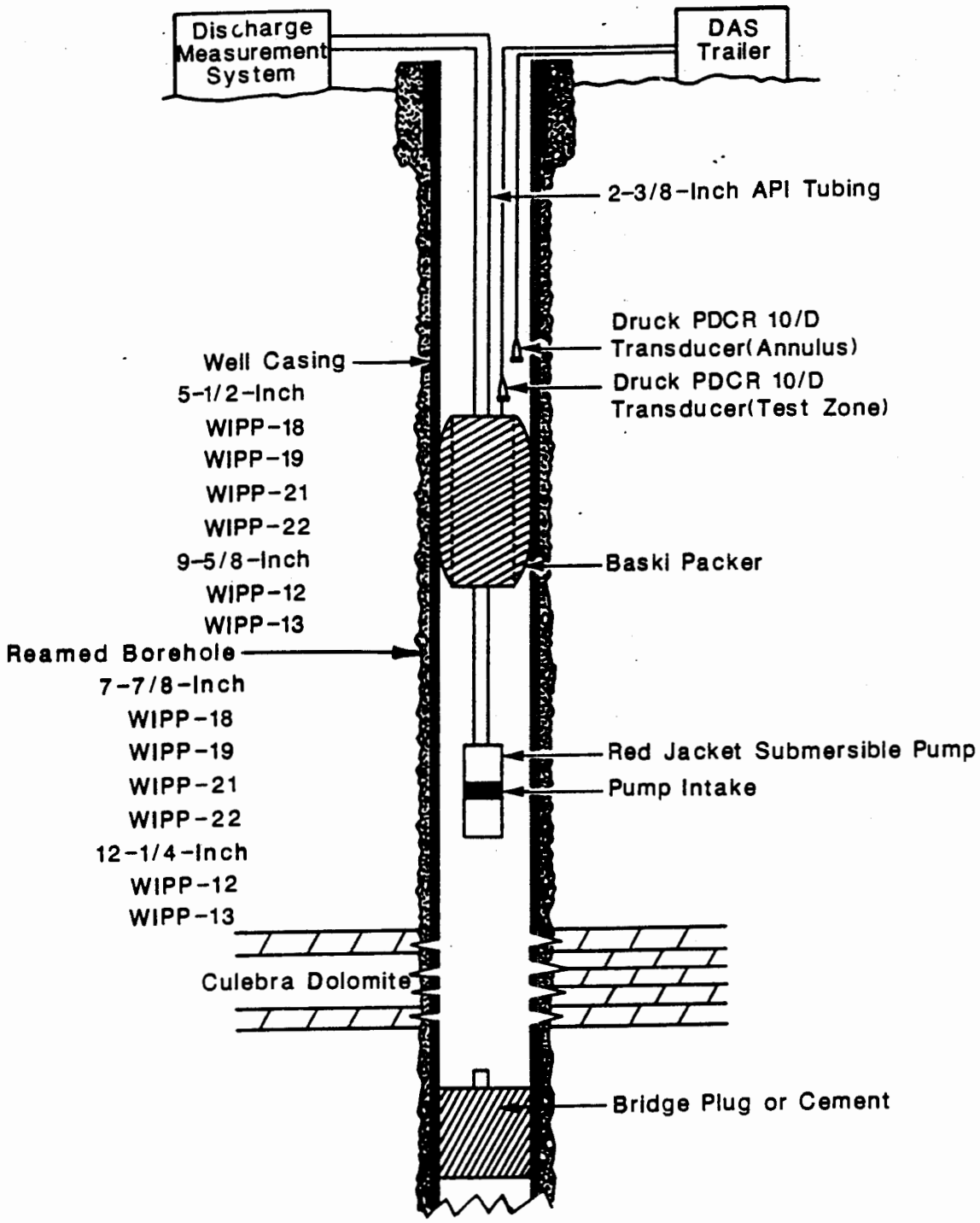
Drawn by	Date	Location of the Tested WIPP-Wells Relative to the WIPP-Site Observation-Well Network
Checked by	Date	
Revisions	Date	

INTERA Technologies

Figure 1.1



Drawn by	Date	Typical Well Configuration for Development Operations at the WIPP Wells.
Checked by	Date	
Revisions	Date	
INTERA Technologies		Figure 1.2



Drawn by	Date	Typical Downhole Assembly for Slug and Pumping Tests at the WIPP Wells.
Checked by	Date	
Revisions	Date	
INTERA Technologies		Figure 1.3

Appendix G

Compiled Information for SWMU 001af (H-16)

Basic Data Report for Drillhole H-16 (Waste Isolation Pilot Plant - WIPP) (SAND89-0203), Appendix B pages 53 through 70, Appendix C pages 71 through 90.

Basic Data Report for Drillhole H-16 (Waste Isolation Pilot Plant - WIPP) (SAND89-0203), Appendix B pages 53 through 70, Appendix C pages 71 through 90.

SANDIA REPORT

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Basic Data Report for Drillhole H-16 (Waste Isolation Pilot Plan – WIPP)

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APPENDIX B

ABRIDGED HOLE HISTORY FOR DRILLHOLE H-16

HYDROLOGIC DRILLHOLE H-16
ABRIDGED HOLE HISTORY

The following hole history was abstracted from Sandia's daily drilling and coring records.

Note: Depths are from ground level unless otherwise reported. Daily reports cover two drilling shifts from 0800 hrs to 1800 hrs and 1800 hrs to 0400 hrs.

7-1-87	Commenced site preparation, cleared area. Drill site is in existing caliche covered parking lot. Drilled 18-inch hole from surface to 36.5 ft using Abbott Bros. dry hole auger. Set and aligned one joint of 10-3/4 inch OD, 40.5 lb/ft (H-40), surface casing. Cemented annulus from 36.5 ft with 35 cubic feet of ready-mix grout.
7-2-87	Set fence posts and roped off drilling area.
7-9-87	Moved in Pennsylvania Drilling Co. Rig # 1. Began rigging up.
7-10-87	Continued to rig up. Excavated mud pits and lined with plastic lining. Built chain-link security fence around drilling site. Secured operation for the weekend.
7-11-87	No activity
7-12-87	No activity
7-13-87	Filled mud pits with saturated brine. Cut off surface casing and rigged up flow line and ancillary equipment. Repaired mud pump. Made up 7-7/8 inch bit and drilling assembly, tripped in hole to 36 ft and broke tower at 1030 hrs. Drilled 7-7/8 inch hole from 36 ft to 90 ft using saturated brine water as circulation fluid. Held safety meeting at 1800 hrs with both crews at crew change. Continued to drill 7-7/8 inch hole to 217 ft. Circulated hole and tripped pipe.
7-14-87	Tripped in hole with drill pipe and bit to continue drilling 7-7/8 inch hole from 217 ft to 380 ft. Tripped out with drill pipe and bit.

7-15-87 Tripped in hole with 7-7/8 inch bit and drilling assembly. Continued drilling 7-7/8 inch hole from 380 ft to logging depth of 470 ft, circulated hole and tripped out pipe and bit. USGS on site at 1500 hrs to run logs. Geophysical logs run include gamma ray, gamma-gamma density, neutron porosity, and caliper. Tripped in hole with drill pipe and bit to circulate hole in preparation for logging by Dresser Atlas. Tripped out drill pipe and bit. Geophysical logs run by Dresser Atlas included neutron-gamma ray, BHC acoustilog, dual laterolog, and compensated densilog.

7-16-87 Continued to run Dresser logs, completed logging at 1700 hrs. Rigged up Star Tool mud pump to ream drill hole. Picked up 9-5/8 inch bit and drilling assembly and tripped in hole to 36 ft to begin reaming 7-7/8 inch hole to 9-5/8 inch. Reamed hole from 36 ft to 440 ft using saturated brine water as circulation fluid.

7-17-87 Continued to ream hole to 9-5/8 inch from 440 ft to original TD of 470 ft. Circulated hole and tripped out drill pipe and bit in preparation for running casing. Rigged up to run casing and ran 14 joints (479.73 ft) of 7-inch OD, J-55, 23 lb/ft, ST&C, casing and set at 469 ft. Ran a combination guide shoe and float collar on the bottom of last joint. Ran centralizers on top of joints # 2, 5, 8, 11, and 14. Made up Dowell circulating head and broke circulation. Commenced cementing operations with 10 barrels of CW-7 chemical wash followed by RFC-Class A Thixotropic cement followed by 70-30 poz mix cement. Slurry mixed at 14.2 to 14.3 lb/gal; pumped at 2.5 bbls/min. Released plug and displaced with fresh water; cement back to surface. Shut-in circulating head at 1656 hrs. Rigged down Dowell and waited on cement. Secured rig for the weekend.

7-18-87 Waited on cement

7-19-87 Waited on cement

7-20-87 Cut off 7-inch casing and retrieved cementing head. Rigged up flow line on 7-inch casing in preparation for coring. Tripped in hole with 6-1/8 inch bit and drilled out cement, float collar, and guide shoe to 474 ft. Circulated hole to clean out cuttings. Tripped out of hole with drill pipe and bit. Ran temporary string of 4-1/2 inch steel casing to accommodate coring operations. Rigged up wire-line coring assembly and picked up 10-foot split-inner tube core barrel with 3-7/8 inch OD diamond core head to cut 2-1/4 inch diameter core. Ran in hole with wire-line pipe and core barrel to 474 ft. Circulated hole.

7-21-87 Cleaned mud pit of cuttings and filled with saturated brine water. Cut core # 1 from 474 ft to 478.5 ft using brine water as circulation fluid. Inner barrel hung up while pulling core so had to trip out wire-line pipe. Recovered 4.5 ft of core. Replaced bad joint and tripped back in hole to 478.5 ft. Cut core # 2 from 478.5 ft to 485.0 ft and recovered 5.6 ft of core. Cut core # 3 from 485.0 ft to 495.0 ft, had some problems with core barrel. Recovered 10.3 ft of core.

7-22-87 Continued coring. Cut core # 4 from 495.0 ft to 505.0 ft and recovered 10.0 ft of core. Cut core # 5 from 505.0 ft to 515.0 ft and recovered 10.0 ft of core. Cut core # 6 from 515.0 ft to 525.1 ft and recovered 10.1 ft of core. Cut core # 7 from 525.1 ft to 531.6 ft where core barrel blocked off, recovered 6.5 ft of core.

7-23-87 Repaired air valve on drilling rig. Continued coring and cut core # 8 from 531.6 ft to 540.7 ft and recovered 9.1 ft of core. Cut core # 9 from 540.7 ft to 550.7 ft and recovered 10.0 ft of core. Cut core # 10 from 550.7 ft to 560.7 ft and recovered 10.1 ft of core. Cut core # 11 from 560.7 ft to 570.7 ft and recovered 8.5 ft of core. Cut core # 12 from 570.7 ft to 580.7 ft and recovered 10.0 ft of core. Reached depth for hydrologic testing, tripped out with wire-line pipe and core barrel.

7-24-87 Pulled temporary 4-1/2 inch casing and rigged up drill pipe and 4-3/4 inch bit assembly to ream core hole. Reamed core hole to 4-3/4 inches from 474 ft to 580.7 ft using saturated brine water as circulation fluid. Circulated hole to clean out cuttings in preparation for hydrologic testing. Tripped out with drill pipe and bit. Rigged up Baker hydrologic test tool on 2-3/8 inch tubing and tripped in hole. DST # 1 to test Forty-niner claystone interval from 563 ft to 580.7 ft (total depth of hole). Inflated packer at 2035 hrs. Conducted series of DST's. Well on test. **

** Note: The test data for these and all subsequent tests on H-16 are included in Stensrud et al. (1988), while the test analyses are included in Beauheim (1987).

7-25-87 Continued well testing.

7-26-87 Continued well testing.

7-27-87 Well on test. Swabbed tubing at 1430 hrs. Continued testing.

7-28-87 Continued test on Forty-niner claystone until 1320 hrs. Concluded test and released packer and tripped out tubing and test tool. Rigged up and ran 4-1/2 inch temporary casing to 470 ft. Rigged up wire-line pipe and coring assembly to take 2-1/4 inch core and tripped in hole to 580.7 ft. Cut core # 13 from 580.7 ft to 590.7 ft using saturated brine as circulation fluid. Recovered 9.7 ft of core. Cut core # 14 from 590.7 ft to 600.7 ft and recovered 7.6 ft of core. Cut core # 15 from 600.7 ft to 610.7 ft and recovered 9.5 ft of core. Cut core # 16 from 610.7 ft to 620.7 ft and recovered 10.0 ft of core.

7-29-87 Circulated hole and tripped out with wire-line pipe and core barrel in preparation for hydrologic testing. Pulled temporary 4-1/2 inch casing and picked up drill pipe and 4-3/4 inch bit and tripped in hole to ream core hole. Reamed core hole to 4-3/4 inches from 580.7 ft to 620.7 ft using brine water. Circulated hole and hooked up air compressor and evacuated hole of drilling fluid down to about 475 ft using air. Tripped out with drill pipe and bit. Laid down drill collars. Rigged up Baker hydrologic test tool on 2-3/8 inch tubing and tripped in hole to run DST # 2 to test the Magenta Dolomite Member. Packer set at 2035 hrs to test interval from 589.2 ft to bottom of the hole at 620.7 ft. Conducted a series of DST's and rising-head slug tests. Well on test.

7-30-87 Continued well tests.

7-31-87 Concluded hydrologic tests at 1620 hrs, released packer and tripped out of hole with test assembly. Rigged up and ran 4-1/2 inch temporary steel casing in preparation for coring. Tripped in hole to bottom of casing at 469 ft with wire-line pipe and core barrel. Secured rig for weekend.

8-1-87 No activity.

8-2-87 No activity.

8-3-87 Finished running in hole with wire-line pipe and core barrel; circulated hole using saturated brine water as drilling fluid. Cut core # 17 from 620.7 ft to 630.7 ft and recovered 10.0 ft of core. Cut core # 18 from 630.7 ft to 640.8 ft and recovered 10.1 ft of core. Cut core # 19 from 640.8 ft to 650.7 ft and recovered 9.9 ft of core. Cut core # 20 from 650.7 ft to 660.9 ft and recovered 10.2 ft of core. Cut core # 21 from 660.9 ft to 670.9 ft and recovered 10.0 ft of core. Cut core # 22 from 670.9 ft to 680.9 ft and recovered 9.9 ft of core. Cut core # 23 from 680.9 ft to 690.9 ft and recovered 9.9 ft of core. Cut core # 24 from 690.9 ft to 697.9 ft (depth for hydrologic testing) and recovered 7.2 ft of core.

8-4-87 Tripped out of hole with wire-line pipe and core barrel and pulled temporary 4-1/2 inch casing in preparation for reaming core hole. Picked up drill pipe and 4-3/4 inch bit and reamed core hole to 4-3/4 inches from 620.7 ft to total depth of 697.9 ft using saturated brine water. Circulated hole and pulled drill pipe and bit back to 475 ft and evacuated hole from 475 ft using air compressor. Finished tripping drill pipe and bit. Rigged up Baker hydrologic test tool on 2-3/8 inch tubing and ran test tool in hole to conduct "squeeze" test with packer set at 620 ft. Conducted test and released packer and tripped out with test tool. Dressed tool and rigged up and ran test tool in hole to conduct DST # 3 on the Tamarisk claystone. Set the packer at 674.5 ft at 0107 hrs to test interval from 674.5 ft to the bottom of the hole at 697.9 ft. Conducted DST. Well on test.

8-5-87 Concluded DST # 3 and released packer at 1140 hrs. Tripped out with tubing and hydrologic test tool. Rigged up and ran temporary 4-1/2 inch steel casing to 470 ft in preparation for coring. Rigged up and ran wire-line pipe and core barrel to take 2-1/4 inch core. Slips did not hold and dropped about 80 ft of wire-line pipe and core barrel. Conducted "fishing" operation and recovered dropped pipe. Replaced inner barrel in coring string and checked wire-line pipe for damage.

8-6-87 Tripped in hole with wire-line pipe and 10 foot split-inner barrel to cut 2-1/4 inch core. Evacuated hole with air, pumped and cleaned out mud pits, and filled pits with fresh water in preparation for coring the Culebra Dolomite Member. Circulated hole and began

cutting core # 25 from 697.9 ft to 703.9 ft using fresh water as circulation fluid. Recovered 6.0 ft of core. Cut core # 26 from 703.9 ft to 709.9 ft and recovered 6.0 ft of core. Cut core # 27 from 709.9 ft to 715.9 ft and recovered 4.5 ft of core. Cut core # 28 from 715.9 ft to 723.9 ft and recovered 4.7 ft of core. Cut core # 29 from 723.9 ft to 733.9 ft and recovered 9.7 ft of core. Completed coring of the Culebra dolomite and tripped out with wire-line pipe and core barrel. Attempted to pull 4-1/2 inch temporary casing but casing would not come free. Worked to free casing finally pulled free and tripped out of hole with casing. Rigged up and ran drill pipe and 4-3/4 inch bit to ream core hole. Reamed core hole to 4-3/4 inches from 697.9 ft to 733.9 ft (bottom of hole) in preparation for running DST # 4. Pulled drill pipe and bit up to 469 ft.

8-7-87 Evacuated hole from 469 ft using compressed air. Finished tripping out with drill pipe and bit. Rigged up and tripped in hole with Baker hydrologic test tool on 2-3/8 inch tubing to test Culebra dolomite. Set packer at 696.5 ft at 1150 hrs to test interval of hole from 696.5 ft to bottom of hole at 733.9 ft. Conducted series of DST's and rising-head slug tests. Tested and swabbed hole to develop Culebra dolomite.

8-8-87 Continued well testing.

8-9-87 Continued well testing.

8-10-87 Continued well testing and swabbing test interval.

8-11-87 Concluded well test after swabbing hole for water sample at 1000 hrs. Tripped out with tubing and test tool. Rigged up and ran in hole with temporary 4-1/2 inch steel casing to begin coring operation. Picked up core barrel and wire-line pipe and tripped in hole to 733.9 ft. Cleaned out mud pits and filled with saturated brine water. Circulated hole and cut core # 30 from 733.9 ft to 740.9 ft and recovered 6.8 ft of core. Cut core # 31 from 740.9 ft to 750.9 ft and recovered 10.0 ft of core. Cut core # 32 from 750.9 ft to 760.9 ft and recovered 8.6 ft of core. Cut core # 33 from 760.9 ft to 770.9 ft and recovered 10.2 ft of core. Cut core # 34 from 770.9 ft to 780.9 ft and recovered 9.9 ft of core. Cut core # 35 from 780.9 ft to 790.0 ft and recovered 9.9 ft of core. Pulled wire-line pipe and core barrel up into casing.

8-12-87 Tripped in core barrel and circulated hole. Cut core # 36 from 790.9 ft to 800.9 ft and recovered 10.1 ft of core. Cut core # 37 from 800.9 ft to 810.9 ft and recovered 9.9 ft of core. Cut core # 38 from 810.9 ft to 820.9 ft and recovered 10.1 ft of core. Cut core # 39 from 820.9 ft to 830.9 ft and recovered 10.0 ft of core. Cut core # 40 from 830.9 ft to 840.9 ft and recovered 10.0 ft of core. Cut core # 41 from 840.9 ft to 850.9 ft and recovered 10.0 ft of core (total depth of hole). Circulated hole and tripped out laying down wire-line pipe and core barrel. Pulled on temporary casing but would not come free. Worked casing and pulled free, tripped out with casing. Picked up drill pipe and 4-3/4 inch bit to ream core hole. Reamed core hole to 4-3/4 inches from 733.9 ft 850.9 ft using saturated brine water. Circulated hole and tripped out with drill pipe and bit in preparation for running DST # 5.

8-13-87 Rigged up Baker hydrologic test tool on 2-3/8 inch tubing and tripped in hole to test lower unnamed member of the Rustler Formation. Set packer at 739.2 ft at 1448 hrs to test the interval from 739.2 ft to the bottom of the hole at 850.9 ft. The test interval included about 9 ft of the underlying Salado Formation. Conducted a series of DST's. Well on test.

8-14-87 Continued well testing.

8-15-87 Continued well testing.

8-16-87 Continued well testing.

8-17-87 Concluded testing at 1000 hrs and released packer and tripped out with test tool. Picked up drill pipe and 6-1/8 inch bit to ream hole from 4-3/4 inch to 6-1/8 inches from 469 ft to 850.9 ft (total depth) using saturated brine water as circulation fluid. After reaching total depth circulated hole and tripped out with drill pipe and bit.

8-18-87 Rigged up Dresser Atlas to run geophysical logs. Ran into hole with tool and hit bridge at 807 ft. Tripped out with logging tool and picked up drill pipe and bit to clear bridge. Reamed hole to 850.9 ft, circulated hole, and tripped out. Dresser ran back in hole to log, still could not get below 817 ft so logged to that depth. Geophysical logs run by Dresser Atlas included neutron-gamma ray, BHC acoustilog, dual

laterolog, and compensated densilog. Dresser finished logging operations at 2100 hrs. USGS on site at 2100 hrs to run logs. Geophysical logs run include gamma ray, gamma-gamma density, neutron porosity, and caliper. USGS finished logging at 2400 hrs. Tripped in hole with drill pipe and bit and circulated hole. Tripped out laying down drill pipe and bit.

8-19-87 Cleaned up location in preparation for running packers and test equipment for final completion of H-16. Unloaded 2-3/8 inch tubing. Secured rig.

8-20-87 Dug and formed 8 ft by 8 ft by 8 ft cellar. Hauled 6 yds of gravel and put in bottom of cellar.

8-21-87 Finished forming cellar walls and poured 8 yds of 3000-lb ready mix cement. Standby.

8-22-87 No activity.

8-23-87 No activity.

8-24-87 Unloaded Baker test tool system. Rigged up to run test system. Picked up drill pipe and 6-1/8 inch bit to condition hole and run drill pipe and bit to bottom of casing.

8-25-87 Finished running drill pipe and bit into hole, hit bridge at 680 ft and drilled out about 30 ft of fill. Ran bit to bottom and circulated hole clean using saturated brine water as circulation fluid. Tripped out with drill pipe and bit. Rigged up to run Baker five-packer test system. Picked up Baker equipment and packers. Spliced in inflation lines and pressure pickups. Began running test system in the hole. Secured rig.

8-26-87 Concluded running Baker system at 1545 hrs. Packers in place. Secured rig.

8-27-87 Attempted to inflate packers but problems with ball seats in packers holding. Finally used nitrogen and packers inflated. Zones appear to be isolated. Inflated all five packers to near 1000 psi. Operation complete.

8-28-87 Demobilized rig and moved off location. Well completed.

References

Beauheim, R. L., 1987, Interpretations of Single-Well Hydraulic Tests Conducted At and Near the Waste Isolation Pilot Plant (WIPP) Site. 1983-1987. SAND87-0039 Sandia National Laboratories, Albuquerque, NM.

Stensrud, W.A., M.A. Bame, K.D. Lantz, J.B. Palmer, and G.J. Saulnier, Jr., 1987. WIPP Hydrology Program, Waste Isolation Pilot Plant, Southeastern New Mexico, Hydrologic Data Report # 7. SAND88-7014. Sandia National Laboratories, Albuquerque, NM.

DRILLING AND WELL COMPLETION RECORD
OF HYDROLOGIC DRILLHOLE H-16

* all depths below ground level

WELL NAME: Hydrologic Drillhole H-16

LOCATION: Section 20, Township 22 South, Range 31 East

SURFACE COORDINATES: Monument (Steel Pipe Cap) is 1109.3 feet From South Line (FSL) and 1234.0 feet from East Line (FEL). Drillhole is 8.0 feet N64 08'W from monument

ELEVATION: Monument (steel pipe cap); 3409.6 feet MSL

DRILLING RECORD:

Start Date: Commenced drilling on July 13, 1987, and completed on August 18, 1987, at a depth of 850.9 feet below ground level (BGL)

Circulation Fluid: Saturated Brine Water until just above Culebra dolomite at a depth of 697.9 feet, changed over drilling fluid to fresh water. Changed back to saturated brine after coring Culebra at 733.9 ft and finished hole using brine.

Rig and Subcontractor: Failing 2000, Pennsylvania Drilling Company, Carlsbad, NM

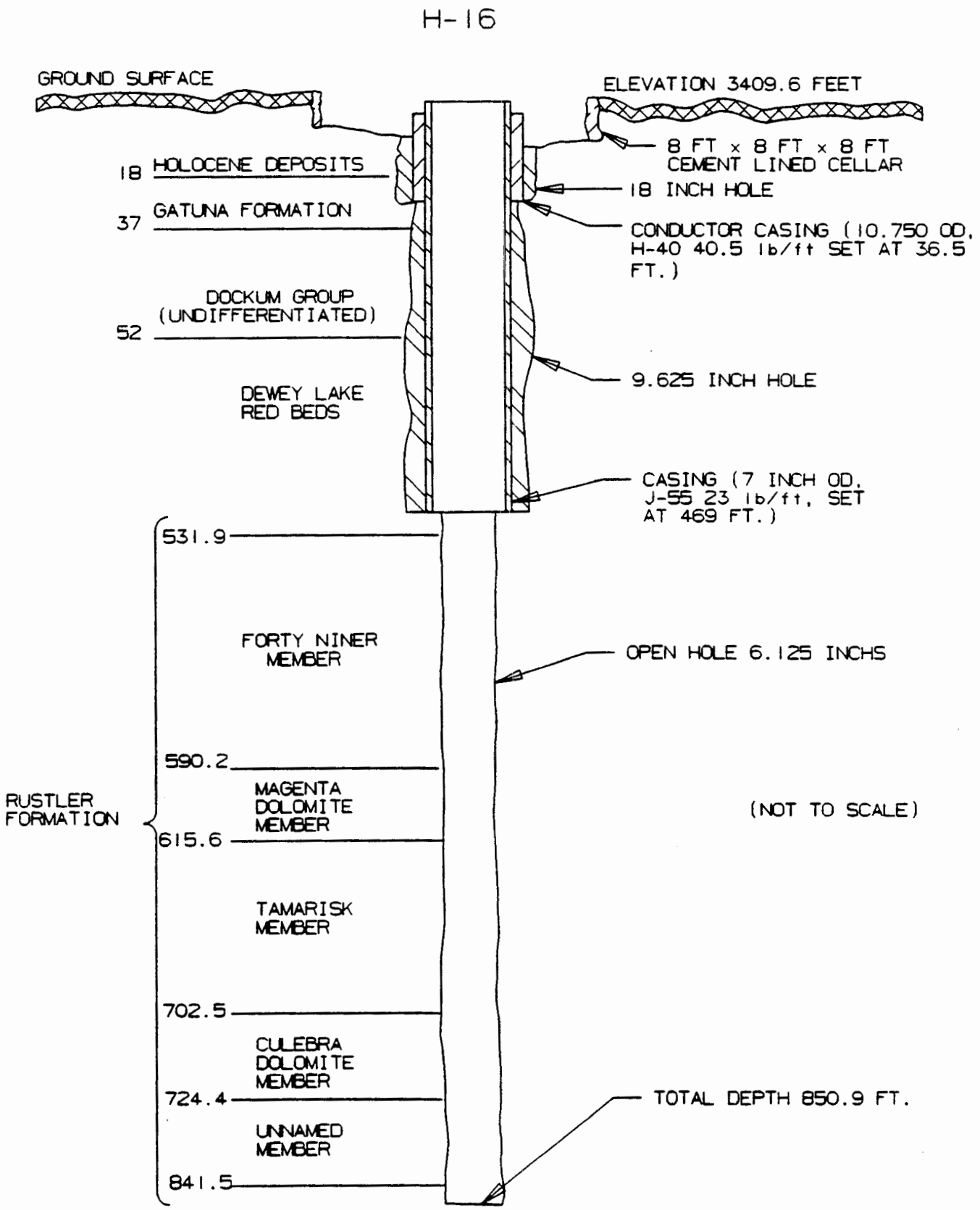
Drillhole Record:

Size (inches)	From (feet)	To (feet)
18	0	36.5
9-5/8	36.5	470.0
6-1/8	470.0	850.9

Casing Record:

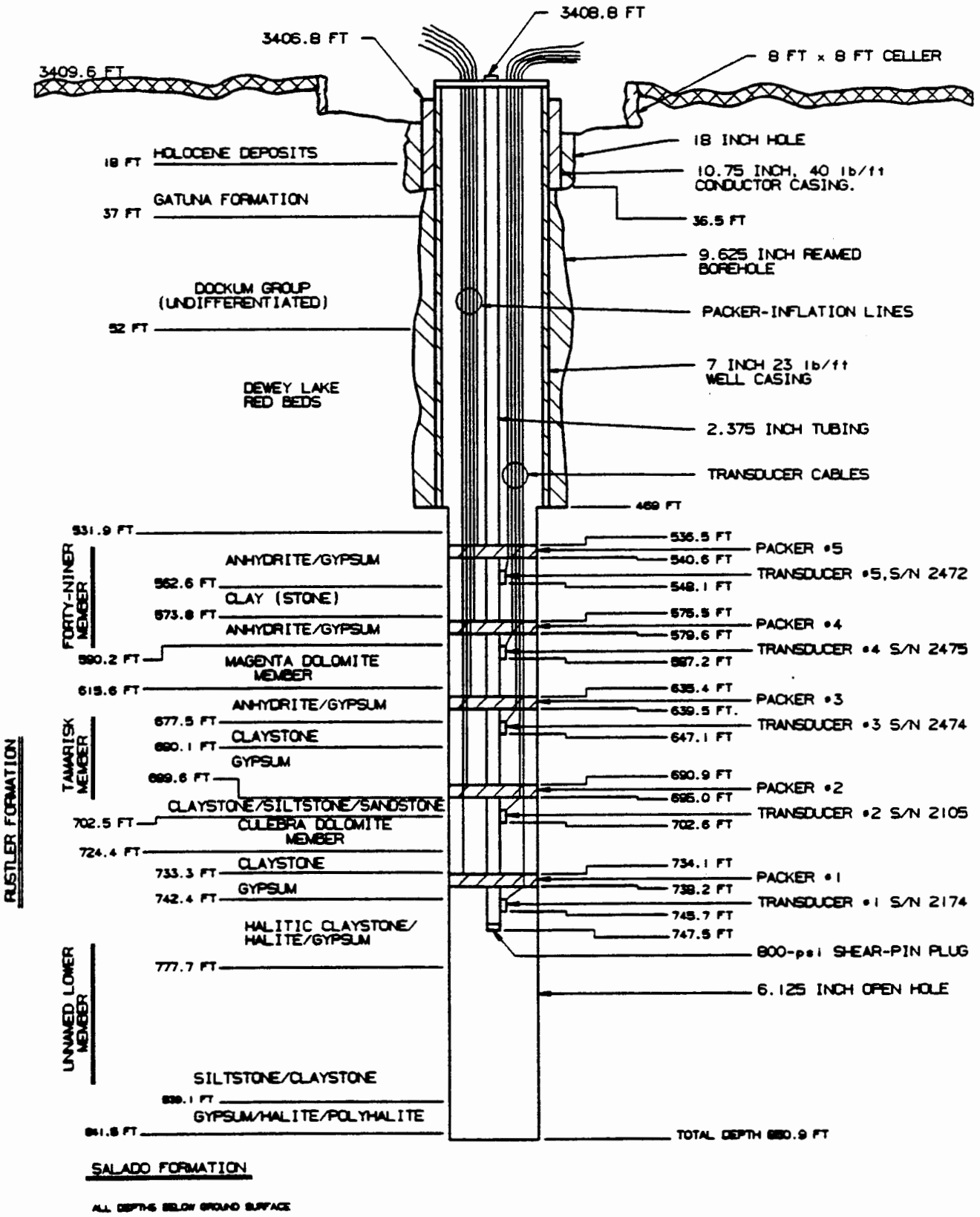
Size (inches)	WT/FT (pounds)	From (feet)	To (feet)
10-3/4	40.5 (H-40)	0	36.5
7	23 (J-55)	0	469*

* 6-1/8 inch open hole from 469 feet to total depth of 850.9 feet



H-16 HYDROLOGIC TEST HOLE AS BUILT CONDITIONS AFTER COMPLETION ON AUGUST 18, 1987.

B-11

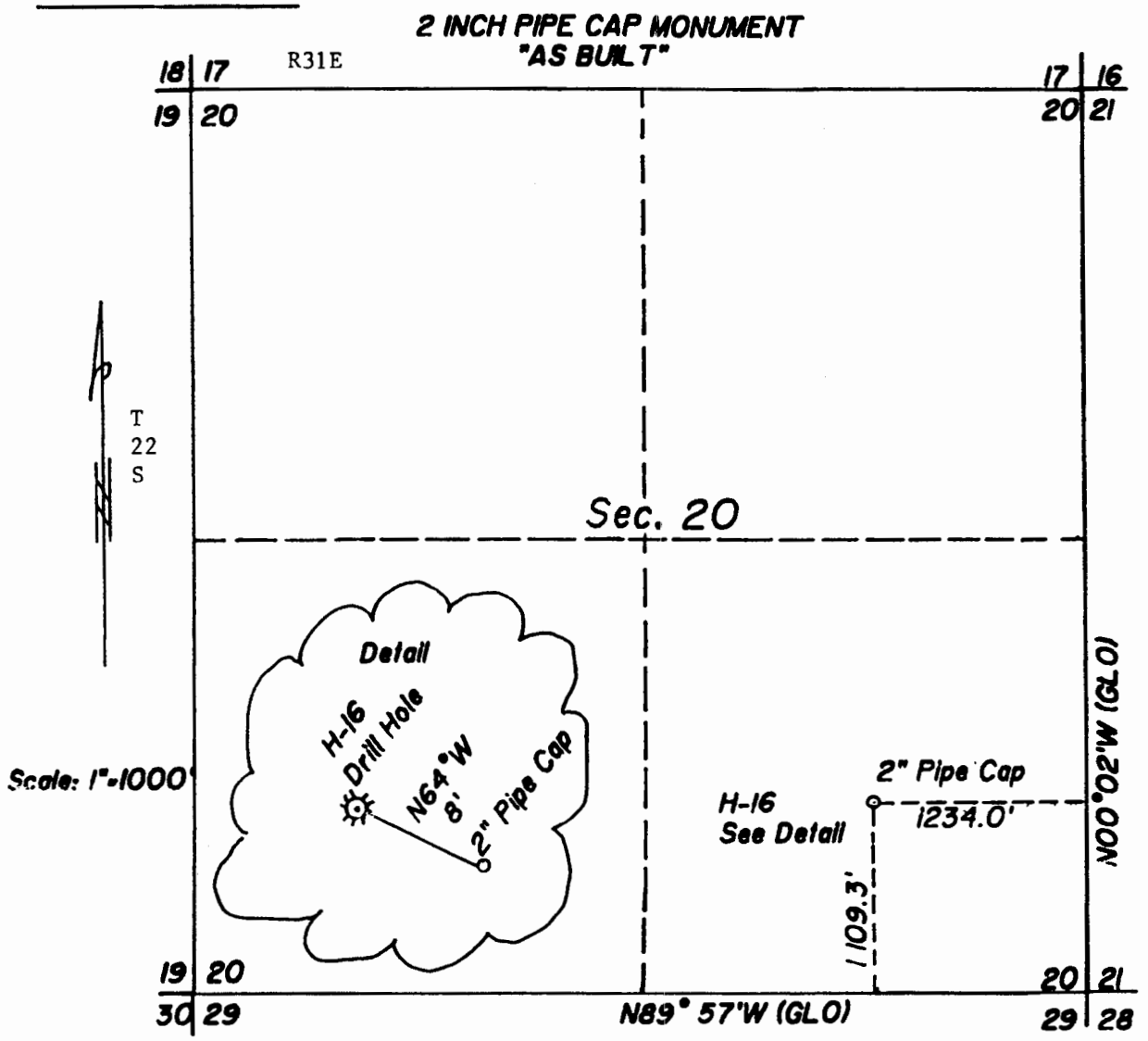


5-PACKER COMPLETION FOR WELL H-16
AS COMPLETED ON AUGUST 26, 1987.

(NOT TO SCALE)

B-12

Plat of Survey



LOCATION: 1109.3 From South Line
1234.0 From East Line
Section 20
Township 22 South
Range 31 East
Eddy County, New Mexico
Elevation 3409.6 MSL

CERTIFICATION:
This is to certify that the foregoing plat was made from field notes of a bona fide survey made by me and is true and correct to the best of my knowledge and belief.

DAN R. REDDY
NEW MEXICO
5412
LAND SURVEYOR
REGISTERED PROFESSIONAL ENGINEER

DATE: AUGUST 12, 1987
PREPARED FOR: SANDIA LABORATORIES

Dan R. Reddy
DAN R. REDDY NM PE&LS 5412

1/5

Wipp Site Survey

H-16

Proposed Drill

hole Near Main Gate

June 30, 1987

Overcast & Pleasant

DRR

WPR

2/5

Sta.	Dist.	Horiz Angle	Comment		
A-B	1000.04				
A-C	187		N 10047.00 E 6270.00		
C-D	359.77				
ACD		90°00'			
ADC		27°31'±	Tall	Rod not accurate	
		~~39°~~			
H-16 DC		35°39'12"			
D-H-16	65.00		E 6232.11 N 9740.05		
E-H-16	8.0'				relocated pt
E-A	358.89'	~~358.89~~			
H-16-E-A		~~38°53'50"~~			
CA~~D~~E		64°15'42"			
A ~~D~~E	358.64				

Sta	B.S.	H.I.	FS	Elev	
S-14	5.21	17.21		3412	
H-16			7.33	3409.88	
S-14	6.19			3412	
Pt E			8.62	340957	2" Pipe cap

Appendix H

Compiled Information for SWMU 001ah (H-19)

H-19 Mudpit Closure and Disposal Correspondence (12 pages total)

Analytical Data for H-19 Mudpit Contents (15 pages total)

H-19 Mudpit Closure and Disposal Correspondence (12 pages total)

ucp # 40800

WD:96:03421
DA:96:01839

Westinghouse Electric Corporation

Government and Environmental Services Company

Waste Isolation Division

Box 2078
Carlsbad New Mexico 88221

August 30, 1996

Ms. M. E. Bennington, Environmental Programs Manager
Office of National Programs Support and Assurance
U.S. Department of Energy
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88221-3090

INFORMATION ONLY

Subject: INSPECTION OF MUDPIT CLOSURE AND SURFACE REPAIR ACTIVITIES ASSOCIATED WITH THE H-19 TRACER TESTING PROGRAM

Dear Ms. Bennington:

The purpose of this letter is to document that Sandia National Laboratories has completed the closure of the mudpits associated with the H-19 Culebra Transport Program in accordance with the requirements of the November 27, 1995 SNL Culebra Transport Program Test Plan. The mudpits associated with this activity were identified as Solid Waste Management Units in the Disposal Phase RCRA Part B Permit Application. Sandia National Laboratories (SNL) has excavated drill cuttings from the mudpit areas and disposed of the cuttings at the Controlled Recovery Disposal facility. After removing drill cuttings SNL recontoured the mudpit areas. Although all of the cuttings have been removed from the mudpit areas, it is important for SNL to understand that if subsequent analytical data indicate that any hazardous wastes or hazardous constituents are identified in the area of the closed mudpits SNL will be responsible for completing further corrective actions at this site.

The lined H-19 evaporation pond is still under evaluation to determine if any hazardous wastes or hazardous constituents are contained in or around the evaporation pond area. Once waste determinations have been completed at this site, corrective actions should be determined and implemented. If no corrective actions are required, the WID will assume custody of the evaporation pond and will incorporate the management of the pond into the WIPP Sewage Lagoon Discharge Permit (DP-831).

Roads used during the H-19 Culebra Transport tests were also inspected to determine if the surface conditions had been adequately repaired after the culmination of the H-19 tracer tests. Drilling rigs, haul trucks and ancillary support services had degraded road surfaces by creating a "washboard" condition, in addition to a number of large potholes. Moreover, the west side of the H-19 hydropad had experienced uncontrolled surface erosion to the degree that several trenches had developed. The combination of these two factors created a significant safety concern for personnel traveling on affected roads or the hydropad. Per agreement, SNL contracted to repair road and hydropad surfaces to preexisting conditions.

INFORMATION ONLY

A final inspection conducted on August 21, 1996, by the WID Land Use Coordinator, indicates that road and hydropad surfaces were repaired adequately to mitigate problems identified in prior inspections. In the event that conditions indicate otherwise, or the road and/or pad surface may be inadequate (e.g. excessive surface degeneration and/or erosion after rainfall events), or, if an anomalous condition exists that is directly attributable to SNL activities, the WID Land Use Coordinator will notify SNL personnel, within 14 working days, in order to schedule the necessary response actions.

If you have further questions or comments, contact Mr. D. R. Kump at Extension 8486.

Sincerely,

K. S. Donovan, Manager
Environment, Safety, and Health

DCL:DCR:mw

cc: E. K. Hunter, CAO MS-570
P. Jones, SNL MS-300
L. Shephard, SNL MS-300

COPY

CERTIFICATE OF WASTE STATUS

EXEMPT WASTE MATERIAL

ORIGINATING LOCATION: H-19 Hydropad - WIPP site, Carlsbad, NM. 88220

SOURCE: Drill cuttings generated during drilling of boreholes H-1960, H-1961, H-1962, H-1963, H-1964, H-1965, H-1966, H-1967

DISPOSAL LOCATION: Controlled Recovery Inc.
35 miles west of Hobbs, NM. - Highway 62-180

As a condition of acceptance for disposal, I hearby certify that this waste is an exempt waste as defined by the Environmental Protection Agency's (EPA) July 1988 Regulatory Determination and that non-exempt waste that is a "hazardous waste" pursuant to the provisions of 40 CFR Part 261, Subparts C & D, has not been added or mixed with the exempt waste in such a manner so as to make the resultant mixture a "hazardous waste", pursuant to the provisions of 40 CFR, Section 261.3 (b).

I, the undersigned as the agent for SANDIA NATIONAL LABS concur with the status of the waste from the subject site.

Name: PERRY JONES

Title: ES&H COORDINATORS

Address: 115 N. MAIN

Signature: [signature]

Date: 6-2-96

PURCHASE REQUISITION

SF 6430-RD(8-93)

PURCHASING USE ONLY

Date (mo - da - yr)	PR Number	Ch.Req.No.	Ch. No.	Page	Pages
06-02-96					

SUGGESTED SOURCE
Osborn Drilling & Pump Co. Floyd.
1908 South First Street
Artesia, NM. Zip: 88210-9700
Phone: 505 746-6247 FAX: 505 746 969

Contact:

SOURCE

Zip:

Phone:

COPY

Government Priority: ☐ DO-E2 ☐ DX-E2 ☒ NONE

Security Classification: Material ✓ Information ✓

☐ Weapon/Weapon-Related ☒ Non-Weapon Related

SHIP TO — Sandia National Laboratories (Include words: "FOR US/DOE")

Location	Commercial Carrier Address (Not Valid for US Mail)	Parcel Post/Mail Address
☐ Bldg. 867 ☐ Bldg.	1515 Eubank S.E. Albuquerque, NM 87123	P.O. Box 5800 Albuq., NM 87185-5600
☐ Bldg. 928 ☐ Bldg.	7011 East Avenue Livermore, CA 94551	P.O. Box 969 Liv., CA 94551-0969
☐ Bldg. ☐ STON	Tonopah Test Range Tonopah, NV 89049	P.O. Box 871 Tonopah, NV 89049
☐ SMERC (Warehse. 8) ☐ Bldg.	Mercury, NV 89023	P.O. Box 238 Mercury, NV 89023
☐ See Below	☐ No Shipment	

SHIP VIA: ☐ Contractor Choice & Expense ☐ Sandia Pickup ☐ Prepay & add to invoice by: ☐ Collect by: ☐ Before shipping call

FOB: ☐ Origin ☐ Destination

MO. No.

Terms

CONFIRMING ORDER DATE SENT: ☐ FAX ☐ PRINT ☐ MAIL ☐ Do Not Duplicate

Item	Quantity	Unit	Material or Service Description/Specification	Est. Unit Price	Insp.	Prop.	Unit PR/Tax	Extension	Com. Code
1			Remediate three (3) drill cuttings pits at the H19 well site (WIPP)						
			1. Removal and disposal of approximately 775 cu. yards of drill cuttings to (C.R.I.) Controlled Recovery, Inc.		✓				
			2. Removal and disposal of three (3) 6 mil. plastic liners to Sandpoint Sanitation		✓				
			3. Fill and Grade with red sand to surrounding terrain						
			4. Removal and disposal of fencing and post surrounding pits						
				14,320.00					

Completed on 6-27-97 JR

TOTAL

Date Del/Perf. Req'd. 06-17-96 ☒ CRITICAL

Accounting Classification

Item	Quantity	Cost Seq.	Case/CCO	Tran Type	Organization	ESC	$ Amount
All	All		~~0205-940~~ 0517.905340		6115		14,320.00

Item	Quantity	Delivery Date

SPECIAL INFO. ☐ Radioactive ☐ Nuclear ☐ Precious Materials ☐ Continuing Reqmt. ☐ Sole Source ☐ Sole Make ☐ SNL Prop./Matl. Furnished ☐ SNL Proc. Acquis. Auth'ed.

Brief Description: Remediate 3 drilling cutting Pits

Total Est. $ (this action)

Sandia Contracting Representative: Place Date | Org. | Phone

Requester: Kermit Riley/Perry Young | Requester Soc. Sec. No. 585-12-3217 | Org. 6743 | Phone (505) 234-0005

Deliver to (Required Field) Sandia Employee Only): Kermit Riley | Deliver to Soc. Sec. No. 585-50-2617 | Org. Intera | Bldg. | Room | Phone (505) 885-2754

Price Justification: ☐ AOA/GSA ☐ Published ☐ Competition ☐ Comparison ☐ Judgment

FORECASTS Straight Line? ☐ Yes

Fcst Date (mo - yr)	Fcst Amt.	Fcst Date (mo - yr)	Fcst Amt.

Preliminary or Requesting Supervisor Approval: Susan Bakerman 6-3-96 | Special Approvals: MB | ☐ No Acceptable Equipment Found ☐ Notification Copies Sent | Reqs. Purged | Credit Buyer

Commitment Approval Signature: Vicki Black | Soc. Sec. No. 585-12-2735 | Org. 6802 | ☐ Signing per delegated approval for Org. | Date | Est. Comp. Date | SCR | Supplier

Quotations Requested | Quotations Received | C | H | G.D | Accig. Certification | By

PURCHASE REQUISITION

SF 8430-RD(8-93)

PURCHASING USE ONLY

Date (mo - da)	PR Number	Ch.Req.No.	Ch. No.	Page	Page
06-3-96					

SUGGESTED SOURCE Contact:
Controlled Recovery Inc.
P.O Box 369
Hobbs, NM. Zip: 88240
Phone: (505) 393-1079 FAX: (505) 393-3615

SOURCE
COPY
Zip:
Phone:

Government Priority: ☐ DO-E2 ☐ DX-E2 ☒ NONE

Security Classification: Material / Information

☐ Weapon/Weapon-Related ☒ Non-Weapon Related

SHIP TO Sandia National Laboratories (Include words: "FOR US/DOE")

Location	Commercial Carrier Address (Not Valid for US Mail)	Parcel Post/Mail Address
☐ Bldg. 957	1515 Eubank S.E.	P.O. Box 5800
☐ Bldg.	Albuquerque, NM 87123	Albuq., NM 87185-5800
☐ Bldg. 928	7011 East Avenue	P.O. Box 969
☐ Bldg.	Livermore, CA 94551	Liv., CA 94551-0969
☐ Bldg.	Tonopah Test Range	P.O. Box 871
☐ STON	Tonopah, NV 89049	Tonopah, NV 89049
☐ SMERC (Warehse. 8)	Mercury, NV 89023	P.O. Box 238
☐ Bldg.		Mercury, NV 89023

☐ See Below ☐ No Shipment

SHIP VIA ☐ Contractor Choice & Expense ☐ Sandia Pickup ☐ Prepay & add to invoice by: ☐ Collect by: ☐ Before shipping call

FOB ☐ Origin ☐ Destination

MO. No.

Terms

CONFIRMING ORDER DATE SENT ☐ FAX ☐ PRINT ☐ MAIL ☐ Do Not Duplicate

Item	Quantity	Unit	Material or Service Description/Specification	Est.Unit Price $	Insp.	Prop.	Unit PR/Tax	Extension	Com. Code
1			Disposal of drill cuttings from H-19 hydropad near the WIPP site	13500.00					

TOTAL

Date Del/Perf. Req'd. 06/17/96 ☒ CRITICAL

Accounting Classification

Item	Quantity	Cost Seq.	Case/CCO	Tran Type	Organization	ESC	$ Amount
ALL	ALL		0517-105310		6115		13,500.00

Item	Quantity	Delivery Date

SPECIAL INFO. ☐ Radioactive ☐ Nuclear ☐ Precious Materials ☐ Continuing Reqmt. ☐ Sole Source ☐ Sole Make ☐ SNL Prop./Mat'l. Furnished ☐ SNL Prop. Acquis. Auth'ed.

Brief Description: Disposal of Drill cuttings

Total Est. $ (this action)

Sandia Contracting Representative: Place Date: Org.: Phone:

Requester: Kermit Riley / Perry Jones. Requester Soc. Sec. No.: 585-12-3217 Org.: 6743 Phone: 505 294-0095

Deliver to (Required Field) Sandia Employee Only): Kermit Riley Deliver to Soc. Sec. No.: 486-50-2617 Org.: 6743 Bldg.: Room: Phone: 845-2754

Price Justification ☐ AO A/GSA ☐ Published ☐ Competition ☐ Comparison ☐ Judgment

FORECASTS Straight Line? ☐ Yes

Fcst Date (mo - yr)	Fcst Amt.	Fcst Date (mo - yr)	Fcst Amt.

Preliminary or Requisition Supervisor Approval: Susan Tidwell 6-3-96 Special Approvals: ☐ No Acceptable Equipment Found ☐ Notification Copies Sent

Commitment Approval Signature: K. Vern Clark Soc. Sec. No.: 585-12-2035 Org.: 6802 ☐ Signing per delegated approval for Org. Date: Reqs. Purged: Credit Buyer: Est. Comp. Date: SCR: Supplier:

Quotations Requested: Quotations Received: C: LR: CCD: Acctg. Certification: Log Desk:

COPY

OSBOURN DRILLING & PUMP CO.

Floyd M. Osbourn
Drilling Contractor
1905 South First Street
Artesia, New Mexico 88210-9700

Telephone (505) 746-9247
Fax (505) 746-9696

Fax To: 505-887-3606 Bid # 96335

May 3/1996

SANDIA NATIONAL LABORATORIES
115 North Main
Carlsbad, NM 88220

Att: Kermit Riley:

We are pleased to submit this bid for your consideration, for the removal of Drill Cuttings to C R I and Plastic to SAND POINT SANITATION From the 3 Pits at H19 Hydropad at WIPP Site. Fill Grade to Surrounding Terrain in the amount of $14,320.00 .

C R I & Sandpoint charges not included.

Time required to complete Job 4 1/2 working days.
Equipment 5 Dump Trucks and Loader.

Sign: Floyd M. Osbourn

Floyd M. Osbourn

COPY

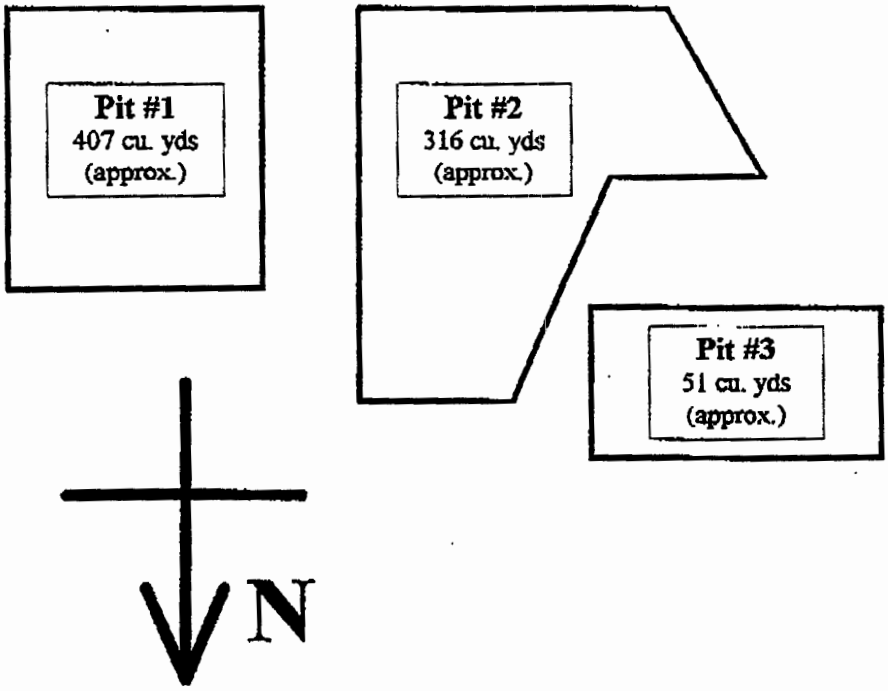
Resubmittal of bid requested using the following criteria:

1. Removal and disposal of approximately 775 cu. yards of drill cuttings to CRI (approximately 18 mi. one way).

2. Removal and disposal of 3 (three) 6 mil. plastic liners to Sandpoint Sanitation (approximately 30 mi. one way).

3. Fill and Grade with red sand to surrounding terrain.

4. Removal and disposal of fencing and posts surrounding pits.



Kermit Riley

CRI

CONTROLLED RECOVERY INC.

P.O. BOX 369, HOBBS, NM 88241 (505) 393-1079

May 25, 1995

Mr. Daniel C. Robertson
Senior Environmental Scientist
Waste Isolation Division
P.O. Box 2078
Carlsbad, NM 88221

VIA FAX: (505) 885-4562

RE: Drill cuttings (75 yds.)

Dear Dan,

I have submitted all test results to Clint Marshall of the NMED in Santa Fe.

I have visited with Clint by telephone and he did give CRI verbal approval to accept the WIPP site drill cuttings.

At your convenience CRI can accept the drill cuttings. Please call ahead and notify our office of delivery. If I can assist you in any way, feel free to call me.

Thank You,

Micheal Patterson as.

Micheal Patterson
General Manager

MP/as

Westinghouse
Electric Corporation

Government Operations

WZ:95:03309
DA:95:02310
Waste Isolation Division

Box 2078
Carlsbad New Mexico 88221

April 12, 1995

Mr. Michael Patterson
Controlled Recovery Incorporated
P.O. Box 369
Hobbs, NM 88241

Subject: REQUEST FOR A VARIANCE FOR THE DISPOSAL OF WIPP NON-OILFIELD GENERATED DRILLING WASTES AT THE CONTROLLED RECOVERY FACILITY

Dear Mr. Patterson:

Per discussions with Mr. Dan Robertson of my staff, enclosed is the information required by the New Mexico Oil Conservation Division to support a variance request to dispose of non-oilfield wastes at the Controlled Recovery Incorporated disposal facility on the Hobbs Highway. This variance request is being submitted so that drilling wastes generated by Sandia National Laboratories at the WIPP can be disposed of at your facility. If you have any questions, or require any additional information, please contact Mr. D. C. Robertson at (505) 234-8240. Thank you for your assistance with this request.

Sincerely,

L. R. Fitch, Manager
Environment, Safety, Health and Regulatory Compliance

DCR:saj

Enclosures

cc: M. E. Bennington, CAO MS-564
R. D. Kaiser, CAO MS-570

Sandia National Laboratories

P.O. Box 5800
Albuquerque, New Mexico 87185-1033

April 4, 1995

Mike Patterson
Controlled Recovery, Inc.
P. O. Box 369
Hobbs, NM 88241

Dear Mike:

Per discussions with Dan Robertson, Westinghouse Waste Isolation Division, I am providing information required to develop a request for a variance from the State of New Mexico Oil Conservation Division. This variance would be for the disposal of brine water, returned drilling fluids, and cuttings generated by non-oil and gas activities. Sandia National Laboratories requests permission to dispose of effluent from the Sandia Culebra Transport Program at the Controlled Recovery, Inc. disposal facility on the Hobbs Highway. This program is being done in support of the WIPP Performance Assessment, and is being conducted in the vicinity of the WIPP site.

The material to be disposed of will consist of approximately 1,000,000 gallons of brine from the Culebra member of the Rustler formation (brine analysis included), 50,000 gallons of returned drilling fluid (a saturated brine with fines that could not be removed by the shale shaker), and approximately 75 cubic yards of cuttings cored with compressed air or drilled with saturated brine. Thus, the major part of the material to be disposed is the relatively clean brine from the Culebra. All the material discussed above does not contain RCRA-regulated constituents or AEA-regualted radiological constituents.

There will be two operational phases. The first phase consists of drilling and coring of seven wells producing returned drilling fluid and cuttings and brine from the development of the wells. This phase will last about six months. The second phase will entail the pumping tests, generating the Culebra brine. In addition there will be trace amounts of certain tracers. This phase could last about a year. The Culebra brine will be produced uniformly over this period of time. Actually there will be a three month overlap of these phases. The material from each operational phase will be tested according to the protocols outlined in SW 846 utilizing the Westinghouse effluent sampling plan.

Request for approval of each phase will be done separately with attendant test data submitted. The test data will be submitted promptly as each phase occurs so as not to delay the program.

Enclosed are analyses for drill fluids and drill cuttings. Analytical data from the second phase, results from sampling brine from the tracer test, will be provided once that phase of the program is initiated. However, Sandia National Laboratories requests a variance for disposal of drill cuttings and drilling fluids resulting from the first phase of the program. Moreover, tracer brine analyses will be submitted for approval prior to any shipments resulting from the second phase.

The New Mexico Environment Department has reviewed the proposed project, including the proposed tracers, and has determined that a discharge plan is not required for this acitivity. Thier letter is enclosed.

I enclose process descriptions for generating the saturated brine, generating the cuttings from brine drilling, and generating the cuttings from coring with compresssed air. The brine from the Culebra will result from hydrologic and hydraulic testing in the Culebra with attendant pumping tests of the Culebra. I hope you will be able to receive the Culebra brine, returned drilling fluid, and cuttings. In the event that you are unable to recieve all three forms of material, I request that you consider material from each operational phase individually.

Sincerely,

Allan R Sattler by drr

Allan R. Sattler
Geothermal Research Department, 6111

ARS:drr
Enclosures

Copy to:
D. Robertson, Westinghouse
M. Whatley, Westinghouse
MS-1395 C. Mewhinney, 6700
MS-0141 T. Vandenberg, 11300

BCC:
MS-1033 J. Dunn, 6111
MS-1156 J. Mercer, 9333
MS-1324 R. Beauheim, 6115
MS-1324 C. Chocas, 6115
MS-1324 A. Lappin, 6115
MS-1324 P. Davies, 6115
MS-1324 L. Meigs, 6115
MS-1335 W. Weart, 6303
MS-1395 L. Shephard, 6701
MS-1495 D. Cole, 6743
MS-1495 W. Stensrud (INTERA), 6743
MS-1033 A. Sattler
SWCFF-A WBS1.1.5.3.4 - TD (2)

PROCESS DESCRIPTION

DRILLING SOLIDS (CUTTINGS) FROM AIR DRILLING

Compressed air is pumped down the center coring rods. The compressed air cools the coring bit and returns to the surface through the narrow annular spacing between the coring rods and the formation. The compressed air brings the cuttings generated from the coring operation up through the annulus. The compressed air passes through a cyclone which removes the cuttings. Occasionally brine is injected in the compressed stream producing a brine mist rather than ordinary compressed air. The process of collecting the cuttings is basically the same.

RETURNED DRILLING FLUIDS AND SOLIDS (CUTTINGS) FROM DRILLING AND REAMING WITH SATURATED BRINE

For drilling and reaming, saturated sodium chloride brine is pumped from an "active mud tank" down the center of the center of the drill pipe. The fluid cools the bit and is returned through the annulus back through the shale shaker into the mud tank. The brine will bring the cuttings the annulus. Returned cuttings are removed by the shale shaker. The drilling fluid will be reused in this cycle for a number of trips through the hole. When the fluid is too badly silted up to be used in the operation, the fluids must be disposed of.

Analytical Data for H-19 Mudpit Contents (15 pages total)

CHAIN-OF-CUSTODY RECORD

WASTE ISOLATION PILOT PLANT
WESTINGHOUSE ELECTRIC CORP.
P.O. BOX 2078
CARLSBAD, NM 88221-2078

C/C Control № 023

R/A Control No. _____

SAMPLING PROGRAM E.C. 75 WASTE CHARACTERIZATION

LAB DESTINATION HALIBURTON NUS

SAMPLE TEAM MEMBERS P. COUGHMINOUR / D. ROBERTSON

CARRIER/WAYBILL NO. _____

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.
WST-95-077	Frac Tank 141 Well H19 Drill Pad	3-23-95 1145	Sludge	1L Glass		
WST-95-078	Frac Tank 141 Well H19 Drill Pad	3-23-95 1150	Sludge	1L Glass		
WST-95-079	Drill Mud Pit ~~Well H19 Drill Pad~~ pl	3-23-95 1222	Sludge	1L Glass		
WST-95-080	Drill Mud Pit	3-23-95 1224	Sludge	1L Glass		
WST-95-081	HWD Area 474	3-23-95	Liquid	1L Glass		
WST-95-082	HWD Area 474	3-23-95	Liquid	1L Glass		
WST-95-083 RG 6/21/95 B2B	Frac Tank 141 Well H19 Drill Pad	3-23-95 1200	Sludge	(2) 40 ml. glass vials		

Special Instructions: None

Possible Sample Hazards: None

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: [signature] 3/23/95 2:10
   Received By: [signature] FED-X 3/28/95 1415
2. Relinquished By: _____
   Received By: [signature] 3-24-95 0400
3. Relinquished By: _____
   Received By: _____
4. Relinquished By: _____
   Received By: _____

WP Form 1178; 11/3/89

WHITE - To accompany samples
YELLOW - Field copy
PINK - Other

REQUEST FOR ANALYSIS

R/A Control № 018

C/C Control No. _____

WASTE ISOLATION PILOT PLANT
WESTINGHOUSE ELECTRIC CORP.
P.O. BOX 2078
CARLSBAD, NM 88221-2078

DATE SAMPLES SHIPPED 3/23/95

LAB DESTINATION _____

LABORATORY CONTACT JIM LIEB

SEND LAB REPORT TO KAIZEN CARGNEL
WESTINGHOUSE/WIPP MS/180
P.O. 2078 CARLSBAD, NM 88221

SAMPLING PROGRAM EC 75 WASTE CHARACTERIZATION

PURCHASE ORDER NO. 67763

DATE REPORT REQUIRED 3-31-95

PROJECT CONTACT KAREN CARGNEL

PROJECT CONTACT PHONE NO. (505) 234 8342

Sample Number	Sample Type	Sample Quantity	Preservative	Req't. Testing Program	Special Instructions
WST-95-077	SLUDGE	1L.	NONE	TCLP METAL	
WST-95-078	SLUDGE	1L.	NONE	TCLP ORGANICS	
WST-95-079	SLUDGE	1L	NONE	TCLP METAL	
WST-95-080	SLUDGE	1L.	NONE	TCLP ORGANICS	
WST-95-081	LIQUID	1L.	NONE	TCLP METAL	
WST-95-082	LIQUID	1L	NONE	TCLP ORGANICS	
WST-95-083 KG 6/21/95 28	SLUDGE	2-40ml	5 DROPS HCl 1:1	VOC's	

TURNAROUND TIME REQUIRED: (Rush must be approved by appropriate Manager) NORMAL ✓ RUSH _____ (Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)

NONHAZARD ✓ FLAMMABLE _____ SKIN IRRITANT _____ HIGHLY TOXIC _____ BIOLOGICAL _____ OTHER _____ (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis.) RETURN TO CLIENT _____ DISPOSAL BY LAB ✓

FOR LAB USE ONLY

RECEIVED BY J Chem ( ) DATE/TIME 3-24 ( ) 0940

WP Form 1177; 11/3/89

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401
Section A Page 1

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN CARGNEL

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-077 TCLP
NUS SAMPLE NO: P0305136
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNIT
1	S903	TCLP Bottle Extraction		
		Begin Date/Time	03/27(1240)	
		End Date/Time	03/28(0535)	
		Extraction Fluid	1	
		Final Leachate pH	5.5	
2	AAGL	Silver, Leachable (Ag)	< 0.01	mg/L
3	AASL	Arsenic, Leachable (As)	0.4	mg/L
4	ABAL	Barium, Leachable (Ba)	0.10	mg/L
5	ACDL	Cadmium, Leachable (Cd)	< 0.005	mg/L
6	ACRL	Chromium, Leachable (Cr)	< 0.01	mg/L
7	AHGL	Mercury, Leachable (Hg)	< 0.0002	mg/L
8	APBL	Lead, Leachable (Pb)	< 0.05	mg/L
9	ASEL	Selenium, Leachable (Se)	< 0.1	mg/L

COMMENTS:

Halliburton NUS
CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

May 14, 1995
Report No.: 00025899
Section A Page 1

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN GAYDOSH

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-077 (P305136)
NUS SAMPLE NO: P0309775
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNIT
1	S090	Flash Point (Pensky-Martens)	> 200	F
2	S088	Bulk Density on Waste	1.40	g/cc

COMMENTS:

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN CARGNEL

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-078 TCLP
NUS SAMPLE NO: P0305137
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S903	TCLP Bottle Extraction		
		Begin Date/Time	03/27(1240)	
		End Date/Time	03/28(0535)	
		Extraction Fluid	1	
		Final Leachate pH	5.4	
2	OTCLP	SEMIVOLATILES - TCLP		
		1,4-dichlorobenzene [p-dichlorobenzene]	< 0.10	mg/L
		2,4,5-trichlorophenol	< 0.50	mg/L
		2,4,6-trichlorophenol	< 0.10	mg/L
		2,4-dinitrotoluene	< 0.10	mg/L
		2-methylphenol [o-cresol]	< 0.10	mg/L
		3-methylphenol [m-cresol]	< 0.10	mg/L
		4-methylphenol [p-cresol]	< 0.10	mg/L
		hexachlorobenzene	< 0.10	mg/L
		hexachlorobutadiene	< 0.10	mg/L
		hexachloroethane	< 0.10	mg/L
		nitrobenzene	< 0.10	mg/L
		pentachlorophenol	< 0.50	mg/L
		pyridine	< 0.10	mg/L
4	G130L	CHLORINATED HERBICIDES - TCLP		
		2,4,5-TP [silvex]	< 0.5	ug/L
		2,4-D	< 5	ug/L
6	G121L	ORGANOCHLORINE PESTICIDES - TCLP		
		chlordane	< 0.1	ug/L
		endrin	< 0.05	ug/L
		gamma-BHC [lindane]	< 0.02	ug/L
		heptachlor	< 0.02	ug/L
		methoxychlor	< 0.5	ug/L
		toxaphene	< 1.0	ug/L
8	S904	Zero Headspace Extraction [ZHE]		
		Begin Date/Time	03/28(1300)	

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
SAMPLE ID: WST-95-078 TCLP
NUS SAMPLE NO: P0305137

LN	TEST CODE	DETERMINATION	RESULT	UNITS
		End Date/Time	03/29(0530)	
9	OVZHE	VOLATILES - TCLP/ZHE		
		1,1-dichloroethene [1,1-dichloroethylene]	< 0.05	mg/L
		1,2-dichloroethane	< 0.05	mg/L
		2-butanone [methylethyl ketone] [MEK]	< 0.50	mg/L
		benzene	< 0.05	mg/L
		carbon tetrachloride	< 0.05	mg/L
		chlorobenzene	< 0.05	mg/L
		chloroform	< 0.05	mg/L
		tetrachloroethene [tetrachloroethylene]	< 0.05	mg/L
		trichloroethene [trichloroethylene]	< 0.05	mg/L
		vinyl chloride	< 0.10	mg/L

COMMENTS:

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

May 14, 1995
Report No.: 00025899

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN GAYDOSH

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-078 (P305137)
NUS SAMPLE NO: P0309776
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S090	Flash Point (Pensky-Martens)	> 200	F
2	S088	Bulk Density on Waste	1.56	g/cc

COMMENTS:

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN CARGNEL

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-079 TCLP
NUS SAMPLE NO: P0305138
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S903	TCLP Bottle Extraction		
		Begin Date/Time	03/27(1240)	
		End Date/Time	03/28(0535)	
		Extraction Fluid	1	
		Final Leachate pH	5.4	
2	AAGL	Silver, Leachable (Ag)	< 0.01	mg/L
3	AASL	Arsenic, Leachable (As)	0.3	mg/L
4	ABAL	Barium, Leachable (Ba)	0.20	mg/L
5	ACDL	Cadmium, Leachable (Cd)	< 0.005	mg/L
6	ACRL	Chromium, Leachable (Cr)	< 0.01	mg/L
7	AHGL	Mercury, Leachable (Hg)	< 0.0002	mg/L
8	APBL	Lead, Leachable (Pb)	< 0.05	mg/L
9	ASEL	Selenium, Leachable (Se)	< 0.1	mg/L

COMMENTS:

7 This sample was analyzed as a matrix spike. Recovery of the spike was outside established acceptance limits indicating the presence of a possible matrix interference.

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

May 14, 1995
Report No.: 00025899

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN GAYDOSH

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-079 (P305138)
NUS SAMPLE NO: P0309777
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S090	Flash Point (Pensky-Martens)	> 200	F
2	S088	Bulk Density on Waste	1.95	g/cc

COMMENTS:

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN CARGNEL

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-080 TCLP
NUS SAMPLE NO: P0305139
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S903	TCLP Bottle Extraction		
		Begin Date/Time	03/27(1240)	
		End Date/Time	03/28(0535)	
		Extraction Fluid	1	
		Final Leachate pH	5.4	
2	OTCLP	SEMIVOLATILES - TCLP		
		1,4-dichlorobenzene [p-dichlorobenzene]	< 0.10	mg/L
		2,4,5-trichlorophenol	< 0.50	mg/L
		2,4,6-trichlorophenol	< 0.10	mg/L
		2,4-dinitrotoluene	< 0.10	mg/L
		2-methylphenol [o-cresol]	< 0.10	mg/L
		3-methylphenol [m-cresol]	< 0.10	mg/L
		4-methylphenol [p-cresol]	< 0.10	mg/L
		hexachlorobenzene	< 0.10	mg/L
		hexachlorobutadiene	< 0.10	mg/L
		hexachloroethane	< 0.10	mg/L
		nitrobenzene	< 0.10	mg/L
		pentachlorophenol	< 0.50	mg/L
		pyridine	< 0.10	mg/L
4	G130L	CHLORINATED HERBICIDES - TCLP		
		2,4,5-TP [silvex]	< 0.5	ug/L
		2,4-D	< 5	ug/L
6	G121L	ORGANOCHLORINE PESTICIDES - TCLP		
		chlordane	< 0.1	ug/L
		endrin	< 0.05	ug/L
		gamma-BHC [lindane]	< 0.02	ug/L
		heptachlor	< 0.02	ug/L
		methoxychlor	< 0.5	ug/L
		toxaphene	< 1.0	ug/L
8	S904	Zero Headspace Extraction [ZHE]		
		Begin Date/Time	03/28(1300)	

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

TEL: (412) 747-2500
FAX: (412) 747-2559

April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
SAMPLE ID: WST-95-080 TCLP
NUS SAMPLE NO: P0305139

LN	TEST CODE	DETERMINATION	RESULT	UNITS
		End Date/Time	03/29(0530)	
9	OVZHE	VOLATILES - TCLP/ZHE		
		1,1-dichloroethene [1,1-dichloroethylene]	< 0.05	mg/L
		1,2-dichloroethane	< 0.05	mg/L
		2-butanone [methylethyl ketone] [MEK]	< 0.50	mg/L
		benzene	< 0.05	mg/L
		carbon tetrachloride	< 0.05	mg/L
		chlorobenzene	< 0.05	mg/L
		chloroform	< 0.05	mg/L
		tetrachloroethene [tetrachloroethylene]	< 0.05	mg/L
		trichloroethene [trichloroethylene]	< 0.05	mg/L
		vinyl chloride	< 0.10	mg/L

COMMENTS:

Halliburton NUS
CORPORATION

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May 14, 1995
Report No.: 00025899
Section A Page 4

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN GAYDOSH

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

SAMPLE ID: WST-95-080 (P305139)
NUS SAMPLE NO: P0309778
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S090	Flash Point (Pensky-Martens)	> 200	F
2	S088	Bulk Density on Waste	1.82	g/cc

COMMENTS:

Halliburton NUS CORPORATION

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April 08, 1995
Report No.: 00025401
Section A Page 10

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN CARGNEL

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

KG 6/21/95

SAMPLE ID: WST-95-08~~3~~2B
NUS SAMPLE NO: P0305142
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	OVTCS	TCL - VOLATILES		
		1,1,1-trichloroethane	< 5	ug/kg
		1,1,2,2-tetrachloroethane	< 5	ug/kg
		1,1,2-trichloroethane	< 5	ug/kg
		1,1-dichloroethane	< 5	ug/kg
		1,1-dichloroethene [1,1-dichloroethylene]	< 5	ug/kg
		1,2-dichloroethane	< 5	ug/kg
		1,2-dichloroethene (total)	< 5	ug/kg
		1,2-dichloropropane	< 5	ug/kg
		2-butanone [methylethyl ketone] [MEK]	< 50	ug/kg
		2-hexanone	< 50	ug/kg
		4-methyl-2-pentanone [methyl isobutyl ketone] [MIBK]	< 50	ug/kg
		acetone	< 50	ug/kg
		benzene	< 5	ug/kg
		bromodichloromethane [dichlorobromomethane]	< 5	ug/kg
		bromomethane [methyl bromide]	< 10	ug/kg
		carbon disulfide	< 5	ug/kg
		carbon tetrachloride	< 5	ug/kg
		chlorobenzene	< 5	ug/kg
		chloroethane	< 10	ug/kg
		chloroform	< 5	ug/kg
		chloromethane [methyl chloride]	< 10	ug/kg
		cis-1,3-dichloropropene	< 5	ug/kg
		dibromochloromethane	< 5	ug/kg
		dichloromethane [methylene chloride]	< 5	ug/kg
		ethylbenzene	< 5	ug/kg
		methylbenzene [toluene]	< 5	ug/kg
		styrene	< 5	ug/kg
		tetrachloroethene [tetrachloroethylene]	< 5	ug/kg
		trans-1,3-dichloropropene	< 5	ug/kg
		tribromomethane [bromoform]	< 5	ug/kg

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April 08, 1995
Report No.: 00025401

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
SAMPLE ID: WST-95-083 2B KG 6/21/95
NUS SAMPLE NO: P0305142

LN	TEST CODE	DETERMINATION	RESULT	UNITS
		trichloroethene [trichloroethylene]	< 5	ug/kg
		vinyl chloride	< 10	ug/kg
		xylenes (total)	< 5	ug/kg

COMMENTS:

Halliburton NUS CORPORATION

NUS LABORATORY
5350 Campbells Run Road
Pittsburgh, Pennsylvania 15205

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May 14, 1995
Report No.: 00025899
Section A Page 5

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION, WID/WIPP
ADDRESS: P.O. BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: MS. KAREN GAYDOSH

NUS CLIENT NO: 1783 0001
WORK ORDER NO: 55830
VENDOR NO: 01830727

Carbon Copy:

KG 6/21/95 2B

SAMPLE ID: WST-95-08~~3~~ (P305142)
NUS SAMPLE NO: P0309779
P.O. NO.: 67763

DATE SAMPLED: 23-MAR-95
DATE RECEIVED: 24-MAR-95
APPROVED BY: Kieda, Chuck

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S090	Flash Point (Pensky-Martens)	> 200	F
2	S088	Bulk Density on Waste	1.43	g/cc

COMMENTS:

Appendix I

Compiled Information for SWMUs 001ai through 001an (WQSP-1 through WQSP-6/6a)

Basic Data Report for WQSP-1, WQSP-2, WQSP-3, WQSP-4, WQSP-5, WQSP-6 and WQSP-6a (DOE/WIPP 95-2154), complete document except for geophysical logs (152 pages total).

Hole History Data for WQSP-6a (2 pages total).

Basic Data Report for WQSP-1, WQSP-2, WQSP-3, WQSP-4, WQSP-5, WQSP-6 and WQSP-6a (DOE/WIPP 95-2154), complete document except for geophysical logs (152 pages total).

[redacted] Bound copy of
Oil Conservation Division Rules/Regulations

DOE/WIPP-95-2154

BASIC DATA REPORT

For

WQSP 1

WQSP 2

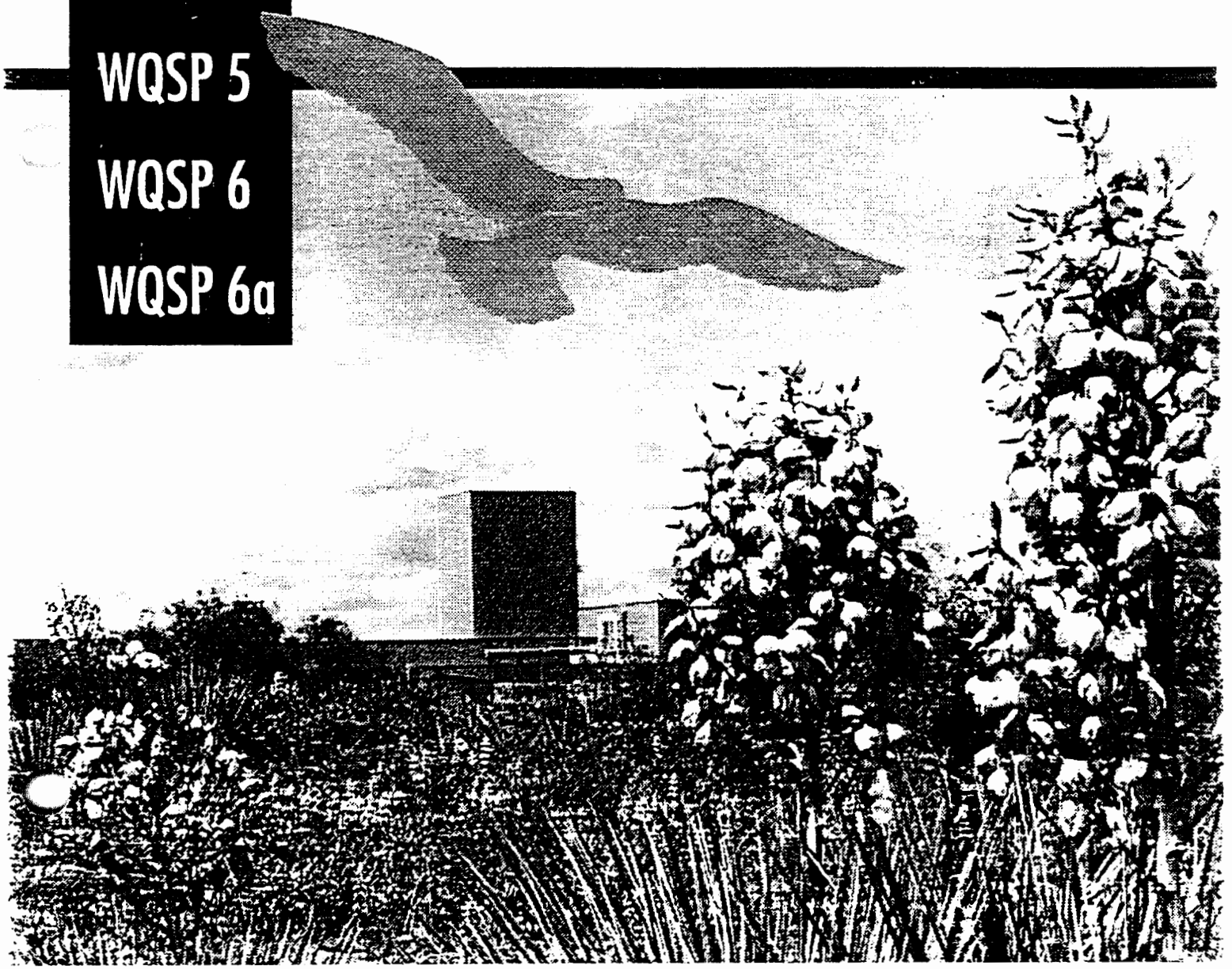
WQSP 3

WQSP 4

WQSP 5

WQSP 6

WQSP 6a



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Processing and final preparation of this report was performed by the Waste Isolation Pilot Plant Management and Operating Contractor for the U.S. Department of Energy under Contract No. DE-AC04-86AL31950.

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- 3.3 WQSP#3
- 3.4 WQSP#4
- 3.5 WQSP#5
- 3.6 WQSP#6
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Attachments

WQSP#1
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#2
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#3
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#4
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#5
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#6
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Culebra Core Description
- Hole History
- Geophysical Logs

WQSP#6a
- Condensed Well Summary
- Stratigraphic Summary
- Cuttings Description
- Dewey Lake Core Description
- Hole History
- Geophysical Logs

1.0 Introduction

The Waste Isolation Pilot Plant (WIPP) is located in southeastern New Mexico about 30 miles east of Carlsbad, New Mexico. The WIPP was authorized by Congress in 1979 (Public Law 96-194) and given the mission to provide "...a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." The WIPP is intended to receive, handle, and permanently dispose of transuranic waste. To fulfill this mission, the U.S. Department of Energy is constructing a full scale facility to demonstrate both technical and operational principles of the permanent storage/disposal of transuranic waste. Technical aspects are those concerned with the design, construction, and performance of subsurface structures. Operational aspects refer to the receiving, handling, and emplacement of transuranic waste in salt. The facility is also designed for in situ studies and experiments in salt. The Water Quality Sampling Program (WQSP) evaluates the physical and chemical properties of the groundwater above the repository horizon that are part of the technical performance aspects.

2.0 Purpose of the Water Quality Sampling Program Wells

The objective of the WQSP is to collect representative groundwater samples from water-bearing zones in the area of the WIPP site. These data assist in meeting the requirements of site characterization. The WQSP wells drilled in 1994 are intended to provide representative, reproducible, and defendable quality data that are free of well construction bias. These seven wells were drilled along the boundary of the Off Limits Area under an U.S. Environmental Protection Agency (EPA) directive and enhance the current groundwater monitoring network.

3.0 Description of Drilling Program

Wells WQSP#1 through WQSP#6a are located (Figure 3-1) in east-central Eddy County, New Mexico in the T22S, R31E (Table 3-1). This drilling program was initiated by Westinghouse Electric Corporation and involved a number of subcontractors. Each of their contributions to the program are provided below.

An archeological survey was performed at the locations of the new monitoring wells by Pecos Archeological Consultants. This survey was conducted on May 26 and June 16, 1994 for the six drill pads and new access roads constructed for this program. One archeological site was recorded with significant cultural remains within the impact zone. This site was avoided by rerouting one of the access roads to a drill pad. The description is intentionally vague to protect

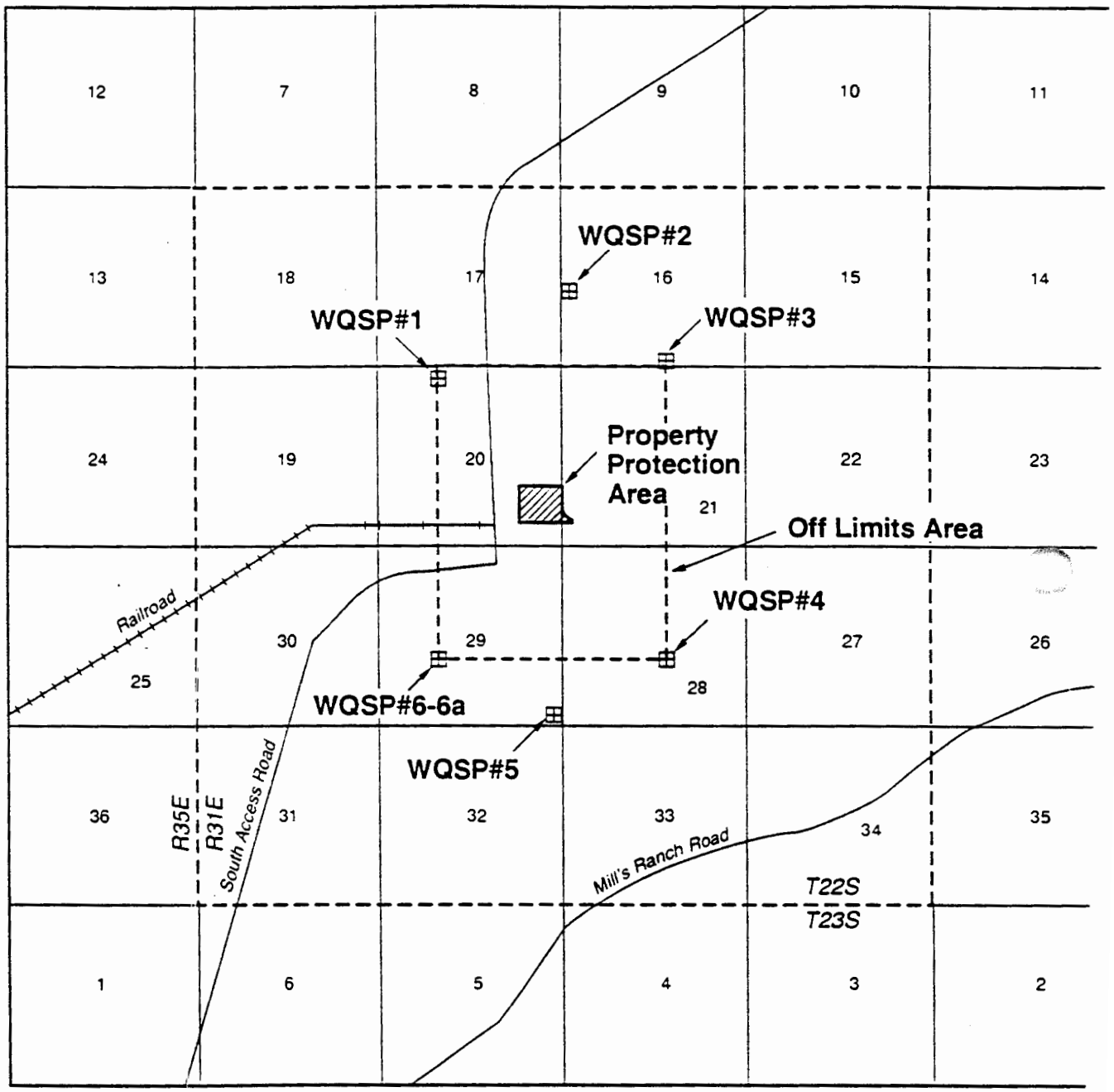


Figure 3-1
Location of WQSP Wells 1 to 6a

the location of this site. Unauthorized collection, vandalism, or excavation of cultural remains is prohibited under the Archeological Resources Protection Act (ARPA) (16 USC §470aa et seq).

The access roads to the drill locations, the drill pads, and the pits were constructed by MMP Construction. The drill pads are 100 ft by 100 ft, topped with construction grade caliche, and occupy approximately 2.29 acres. At each location, two pits were constructed approximately 30 ft by 15 ft and approximately 10 ft deep and lined with high density polyethylene plastic. One pit contained the discharged cuttings and fluids from the drilling; the other pit was divided into two sections, with one side containing the drilling mud, and the other side containing non-potable water. WQSP#6 and WQSP#6a occupy the same drill pad; however, four discharge pits were constructed at this location. After drilling and well development, these pits were filled with soil.

The wells were drilled by West Texas Water Well Service from September to November of 1994 (Table 3-2). Grab samples of the cuttings were taken by IT Corporation every 20 ft to track formations penetrated and to stop open-hole drilling in time to core the Culebra Member of the Rustler Formation. The core was described by INTERA. A condensed well summary, stratigraphic summary, cuttings description, Culebra core description (Dewey Lake core description for WQSP#6a), hole history, and geophysical logs (Century Geophysical Corporation) are presented as appendices in this report.

The drilling plan for the six new monitoring wells provided an option for additional wells to be drilled should water be encountered in the Dewey Lake Formation. Water in the Dewey Lake Formation was encountered in only one well, WQSP#6. WQSP#6a, located approximately 100 ft west of WQSP#6, was terminated within the upper portion of the Dewey Lake Formation for further investigation.

3.1 WQSP#1

WQSP #1 is located 101 ft from the north line and 1422 ft from the west line in Section 20, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 13 through 16, 1994, and encountered 40 ft of Santa Rosa Formation, 482 ft of Dewey Lake Formation, and 174 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 696 ft to 737 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs

Table 3-1
Location Information for the
1994 Water Quality Sampling Program (WQSP) Boreholes

Borehole ID	State Plane Coordinate		Elevation amsl	Location T22S R31E	Coordinates (feet)	
	East	North				
WQSP#1	663600	503774	3416.6	Section 20	101 FNL	1422 FWL
WQSP#2	667598	505542	3461.4	Section 16	1646 FSL	142 FWL
WQSP#3	670576	504030	3477.5	Section 16	96 FSL	2162 FEL
WQSP#4	670658	495000	3430.5	Section 28	1632 FSL	2136 FEL
WQSP#5	667170	493666	3381.6	Section 29	330 FSL	340 FEL
WQSP#6	663691	494942	3361.8	Section 29	1626 FSL	1461 FWL
WQSP#6a	663625	494969	3361.2	Section 29	1653 FSL	1395 FWL

- FNL - feet from north line
- FSL - feet from south line
- FWL - feet from west line
- FEL - feet from east line
- amsl - above mean sea level

were run in the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity. The geophysical logs were run in this hole before it was reamed, therefore, approximately 40 ft of slough prevented the logging tool from reaching the bottom of the hole. The rest of the wells were reamed before they were logged.

3.2 WQSP#2

WQSP #2 is located 1646 ft from the south line and 142 ft from the west line in Section 16, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 6 through 10, 1994, and encountered 147 ft of Santa Rosa Formation, 486 ft of Dewey Lake Formation, and 215 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 800 ft to 846 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.3 WQSP#3

WQSP #3 is located 96 ft from the south line and 2162 ft from the east line in Section 16, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 20 through 26, 1994, and encountered 155 ft of Santa Rosa Formation, 513 ft of Dewey Lake Formation, and 212 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 833 ft to 879 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.4 WQSP#4

WQSP #4 is located 1632 ft from the south line and 2136 ft from the east line in Section 28, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 5 through 7, 1994, and encountered 78 ft of Santa Rosa Formation, 510 ft of Dewey Lake Formation, and 212 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 740 ft to 798 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

Table 3-2
Drilling Information for the
1994 Water Quality Sampling Program (WQSP) Boreholes

Borehole ID	Drill Dates	Total depth (feet)	Cored Interval (feet)	Unit
WQSP#1	September 13-16, 1994	737	696-737	Culebra
WQSP#2	September 6-10, 1994	846	800-846	Culebra
WQSP#3	October 20-26, 1994	879	833-879	Culebra
WQSP#4	October 5-7, 1994	800	740-798	Culebra
WQSP#5	October 12-13, 1994	681	648-676	Culebra
WQSP#6	September 22-30, 1994	617	568-617	Culebra
WQSP#6a	October 28-31, 1994	225	160-220	Dewey Lake

- SPC_NAD27 - State plane coordinates _ North American Datum Model 27

3.5 WQSP#5

WQSP #5 is located 330 ft from the south line and 340 ft from the east line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 12 through 13, 1994, and encountered 25 ft of Santa Rosa Formation, 450 ft of Dewey Lake Formation, and 206 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 648 ft to 676 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: spontaneous potential resistivity, natural gamma, density, and neutron porosity.

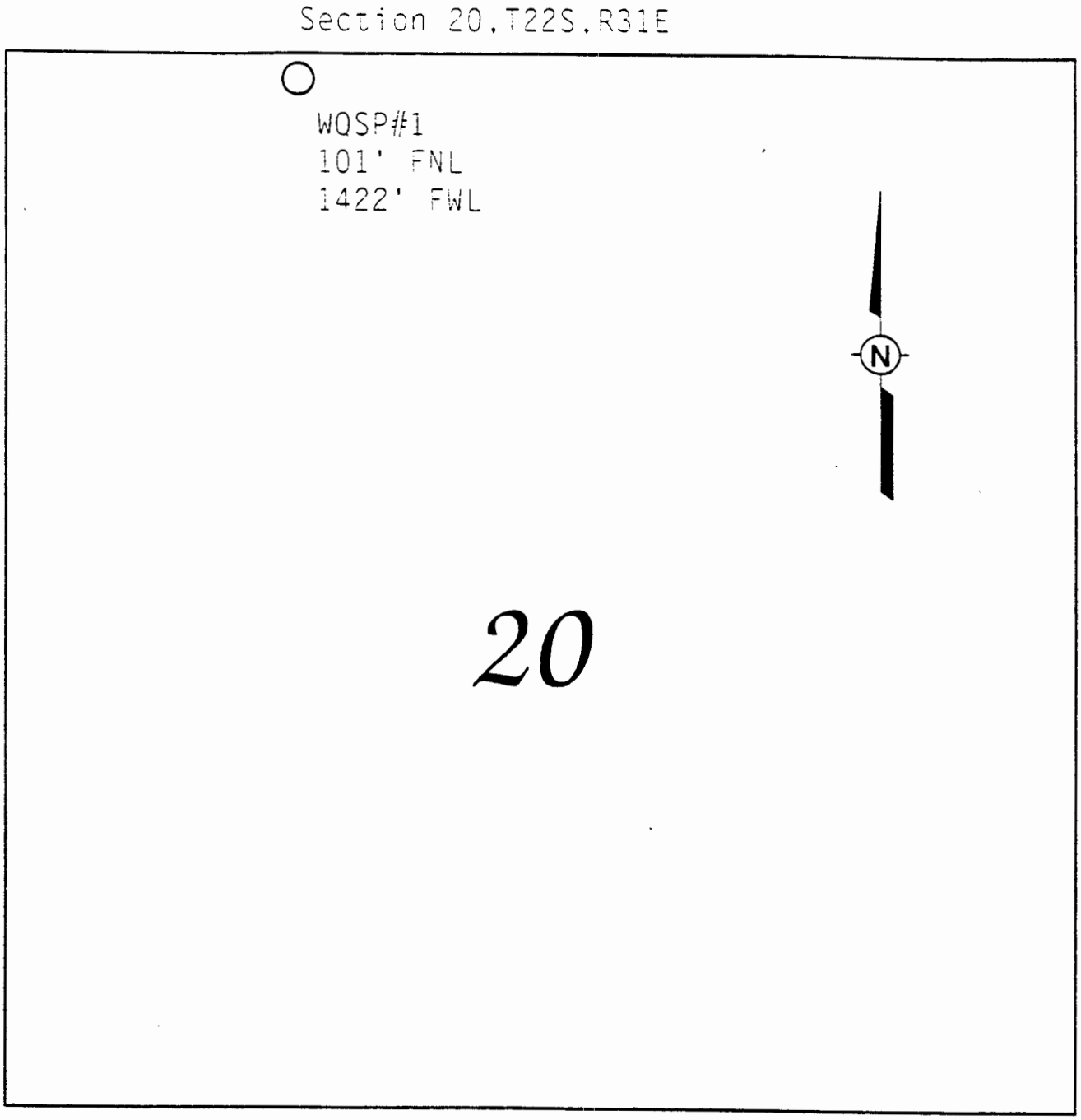
3.6 WQSP#6

WQSP #6 is located 1626 ft from the south line and 1461 ft from the west line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 22, through October 4, 1994, and encountered 68 ft of Santa Rosa Formation, 341 ft of Dewey Lake Formation, and 208 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 568 ft to 617 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: deviation, caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.7 WQSP#6a

WQSP #6a is located 1653 ft from the south line and 1395 ft from the west line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 28, through November 1, 1994, and encountered 35 ft of Santa Rosa Formation and 185 ft of Dewey Lake Formation. Cuttings were collected every 20 ft and the well was cored from 160 ft to 220 ft for detailed description of the Dewey Lake Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

WQSP#1



Location of WQSP #1

WQSP #1
Condensed Well Summary

Location:	Section 20, T22S, R31E 101 ft from the north line 1422 ft from the west line	
Elevation: (Top of Casing)	3419.2 ft above mean sea level	
Cuttings Description:	D.S. Belski	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 13 to 16, 1994 737 ft below land surface 696 to 737 ft every 20 ft

WQSP #1
Stratigraphic Summary

Stratigraphic Unit	Depth Interval Natural Gamma Log (feet)	Core Description
Surficial Deposits/Santa Rosa	0-40	
Dewey Lake Redbeds	40-522	
Rustler Formation	522-689 partial	
• Forty Niner Member	522-591	
• Magenta Member	591-612	
• Tamarisk Member	612-689?	695.6-699 partial
• Culebra Member	NA	699-722
• Partial lower unnamed member	NA	722-737 partial
Maximum Recorded Depth	689	

* Geophysical logs were run before the hole was reamed. Sloughing in the hole prevented the loggers from reaching bottom.

WQSP #1
CUTTINGS DESCRIPTION

WQSP #1
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
08/31/94	1120	1**	6	Surficial deposits
	1125	2**	25	Surficial deposits
09/13/94	1309	1	45	Mudstone, clay, siltstone and sandstone
	1324	2	65	Siltstone and sandstone
	1353	3	85	Sandstone, siltstone, and mudstone
	1423	4	105	Siltstone and mudstone
	1433	5	125	Sandstone, siltstone, and mudstone
	1520	6	145	Siltstone, mudstone, and clay
	1546	7	165	Sandstone, siltstone, and gypsum
	1610	8	185	Siltstone, mudstone, sandstone, and gypsum
	1638	9	205	Siltstone, mudstone, and gypsum
	1707	10	225	Mudstone, siltstone, and gypsum
	1718	11	245	Siltstone, mudstone, and gypsum
09/14/94	0746	12	265	Sandstone, siltstone, and gypsum
	0759	13	285	Sandstone, siltstone, and gypsum
	0825	14	305	Sandstone, mudstone, and gypsum
	0845	15	325	Sandstone, trace gypsum
	0904	16	345	Siltstone, gypsum, and sand
	0919	17	365	Siltstone and gypsum
	0945	18	385	Sandstone, siltstone, and mudstone
	1009	19	405	Siltstone, mudstone, and sandstone
	1021	20	425	Siltstone, mudstone, and gypsum
	1040	21	445	Siltstone and mudstone
	1102	22	465	Siltstone with selenite, claystone with green reduction spots
	1112	23	485	Siltstone with selenite, claystone with green reduction spots

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #1
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1131	24	505	Siltstone with selenite and fibrous gypsum
	1154	25	525	Anhydrite and gypsum
09/14/94	1219	26	545	Anhydrite and gypsum
	1235	27	565	Mud
	1306	28	585	Anhydrite and siltstone
	1318	29	605	Anhydrite
	1351	30	625	Anhydrite, selenite, and siltstone
	1413	31	645	Anhydrite
	1502	32	665	Anhydrite
	1536	33	685	Anhydrite with mud

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #1
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94
DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		695.0					
		695.6					
09/15 11:25	1	696.0	87			695.6 - 699.0 ft: upper 0.2 ft of unit: red-brown mudstone with numerous subrounded-subangular pebble-sized anhydrite clasts underlain by light to dark gray mottled anhydrite with 2-3 mm gypsum laminae. Lower 0.2 ft of unit: light-brown and black interbedded clays. Sharp contact between anhydrite, clay, and underlying Culebra Member.	Tamarisk Member of Rustler Formation
		697.0					
		698.0					
		699.0				699.0 - 700.6 ft: reddish gray-brown microcrystalline dolomite with numerous open vugs (1 mm - 0.25 cm). Fractures occurring along horizontal, thin (< 1 mm) clay seams.	Culebra Member of Rustler Formation
		700.0			CF		
		701.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

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COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15	1	701.0 702.0 703.0 704.0 705.0 706.0 707.0	8 7	OV OV OV OV OV OV OV	GF CF	700.6 - 706.0 ft: light olive-gray microcrystalline dolomite. Upper 2 ft of unit contains infrequent open vugs up to 1.5 cm. Vugs decrease in size and increase in frequency toward base of unit (~1 mm). In lower 2.5 ft open vugs form in bands 0.1 to 0.3 ft in width. Horizontal fractures occur toward base of unit along thin (<1 mm) clay seams. In upper 2 ft of unit horizontal fractures occur along gypsum seams. Unit contains infrequent high-angle gypsum veins (2-3 mm).	Culebra Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

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ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94
DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15 11:30	1	707.0	8 7	OV OV		706.0 - 710.5 ft: same dolomite as previous unit. Upper 1.5 ft highly fractured and clayey. Small (1-2 mm) vugs, open, and of moderate intensity. Vugs decrease in frequency and increase in size (0.5 - 3 cm) toward base of unit. Lower 3 ft of unit highly fractured with thin (<1 mm) clay seams and small blebs of clay.	Culebra Member of Rustler Formation ~1.5 feet of core loss
		708.0					
		709.0		OV OV			
		710.0			CF		
		711.0					
		712.0					
		713.0					

PAGE 1 OF 1

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		710.0					
		710.5					
09/15 14:31	2		27	OV		710.5 - 722.0 ft: light olive-gray microcrystalline dolomite, highly fractured. Numerous moderately-sized (5-10 mm) open vugs toward top of unit decreasing in frequency and size with depth. Toward base of unit vugs are sparse and gypsum filled. Evidence of infrequent gypsum filled fractures throughout unit. Contact between the Culebra Member and underlying unnamed member not visible.	Culebra Member of Rustler Formation 8.5 feet of core loss
		712.0		OV	GF		
				OV			
		714.0		OV			
		716.0		OV	GF		
		718.0					
		720.0					
		722.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/16/94
DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15 17:04	3	722.0	100			722.0 - 724.5 ft: black, plastic clay with infrequent 1-2 mm gypsum stringers.	Unnamed Member of Rustler Formation
		723.0					
		724.0					
		725.0				724.5 - 726.5 ft: very dark red-brown clay with 0.1 - 0.2 ft white to pinkish white gypsum bands. Infrequent gypsum stringers up to 2 mm in width.	
		726.0					
		727.0					
		728.0					

WIPP CORE-LOG INVENTORY

INTERA -
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/16/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15	3	728.0 729.0 730.0 731.0 732.0 733.0 734.0	100			726.5 - 732.0 ft: lighter red-brown clay with numerous gypsum veins up to 0.3 ft in width. White to pinkish-white crystalline (lath-like interlocking crystals) gypsum fill. Veins are horizontal to high angle and increase in frequency toward base of unit as clay grades into anhydrite. 732.0 - 737.0 ft: light to dark gray mottled anhydrite with abundant 1-2 mm gypsum laminae.	Unnamed Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/16/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

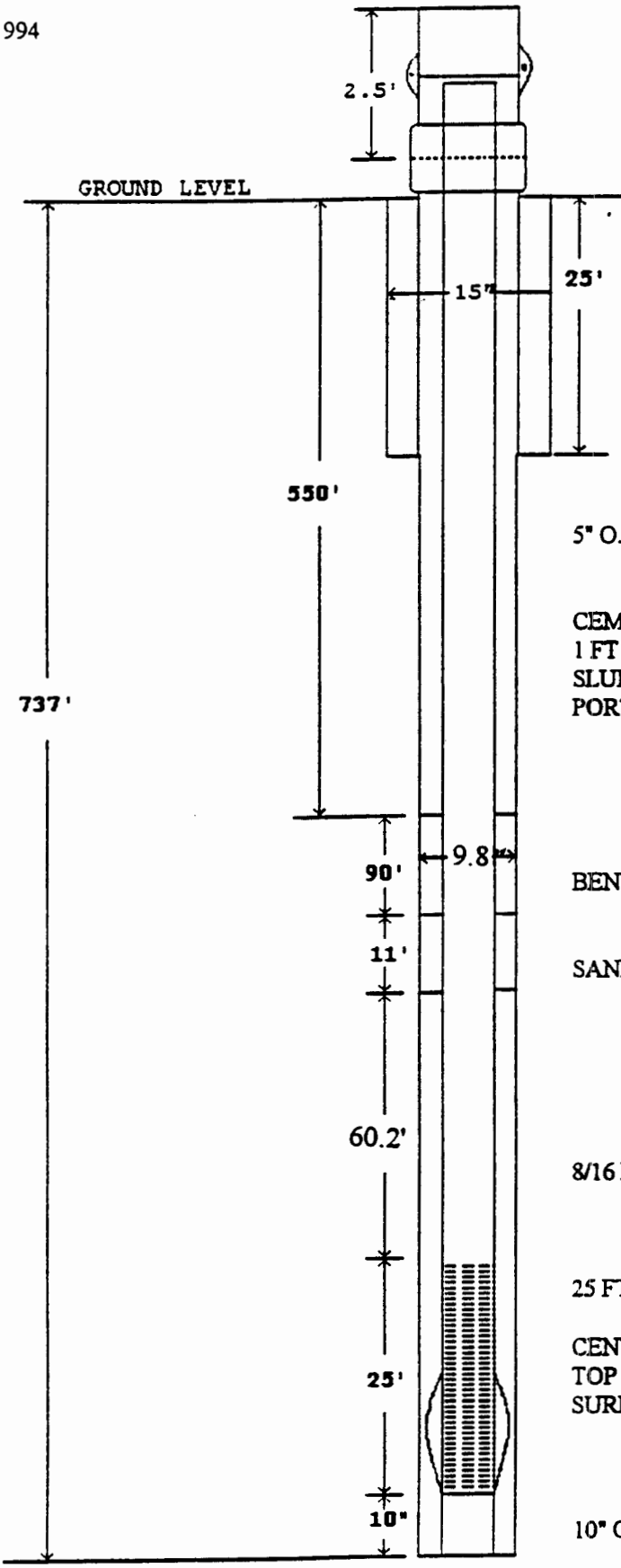
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15 17:40	3	734.0 735.0 736.0 737.0	100			732.0 - 737.0 ft: light to dark gray mottled anhydrite with abundant 1-2 mm gypsum laminae.	Unnamed Member of Rustler Formation
		738.0 739.0 740.0					

WQSP #1
HOLE HISTORY

VIPP Project
VOSP #1
E 'ounty, New Mexico

September 13-16, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 550 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 640 TO 550 FT

SAND PACK FROM 651 TO 640 FT

8/16 BRADY GRAVEL FROM 651 TO 712 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 13, 1994

WQSP # 1

6:30 AM - 8:00 AM - Rig down on WQSP # 2 and move to WQSP # 1
8:00 AM - 11:30 AM - Rigging up on WQSP # 1
11:30 AM - 5:00 PM - Drilling 9 7/8" hole from 25′ - 245′
5:00 PM - 5:20 PM - Come out of hole & secure rig for day

September 14, 1994

WQSP # 1

6:00 AM - 6:35 AM - Carlsbad to WQSP # 1
6:35 AM - 6:45 AM - Check fluid levels
6:45 AM - 7:25 AM - Fix rotating head & T.I.H.
7:25 AM - 4:00 PM - Drill 9 7/8" hole from 245′ - 693′
4:00 PM - 4:15 PM - Trip pipe out of hole
4:15 PM - 4:30 PM - Shut down rig and secure for day
4:30 PM - 5:15 PM - WQSP # 1 to Carlsbad

September 15, 1995 is missing from the drillers log. see WQSP#1 core description.

WEST TEXAS WATER WELL SERVICE

September 16, 1994

WQSP # 1

6:30 AM -	6:35 AM -	Carlsbad to WQSP # 1
6:35 AM -	6:50 AM -	Check & service rig
6:50 AM -	7:50 AM -	Finish tripping out of hole with 3rd core run
7:50 AM -	8:30 AM -	Retrieve core
8:30 AM -	9:00 AM -	Breakdown core tools
9:00 AM -	12:45 PM -	Rig up logger & log well
12:45 PM -	1:00 PM -	Secured rig for weekend

September 20, 1994

WQSP # 1

6:00 AM -	6:30 AM -	Carlsbad to WQSP # 1
6:30 AM -	6:40 AM -	Check fluid levels in equipment
6:40 AM -	7:00 AM -	Run bailer in casing
7:00 AM -	11:30 AM -	Run 1" pipe inside 2" trimmie line to check gravel depth and remove bridge, added gravel to depth of 650′ below ground surface, placed sand pack from 650′-640′
11:30 AM -	12:40 PM -	Pulled 1" pipe, mixed bentonite slurry to pump for bentonite seal from 640′-550′ - approximately 275 gallons.
12:40 PM -	1:30 PM -	Rigged up to pump cement
1:30 PM -	3:00 PM -	Waited on cement trucks
3:00 PM -	4:30 PM -	Pump cement from 550′ to surface, circulating out to reserve pit
4:30 PM -	5:00 PM -	Washout cement from lines, shut down operations for the day
5:00 PM -	5:30 PM -	WQSP # 1 to Carlsbad

WEST TEXAS WATER WELL SERVICE

September 21, 1994

WQSP # 1 & 2

6:10 AM - 6:40 AM - Carlsbad to WQSP # 1
6:40 AM - 6:55 AM - Service rig
6:55 AM - 8:00 AM - Clean up location & rig down

September 22, 1994

WQSP # 1

8:50 AM - 5:30 PM - Bailed well to develop and clean up

September 28, 1994

WQSP # 1

7:25 AM - 9:30 AM - Make 24 trips with bailer, rig down, & go to get pipe trailer & pump
9:30 AM - 10:00 AM - Getting pipe trailer & pump
10:00 AM - 10:45 AM - Rig up to run pump
10:45 AM - 11:15 AM - Lunch
11:15 AM - 12:30 PM - Run pump
12:30 PM - 12:40 PM - Hook up to generator & start pumping - pump rate 13 GPM
12:40 PM - 3:30 PM - Pump well - average 10.9 GPM
Pump was set on 714' 1" gal. pipe
3:30 PM - 4:00 PM - Rig down & go to WQSP # 6

September 29, 1994

WQSP # 1

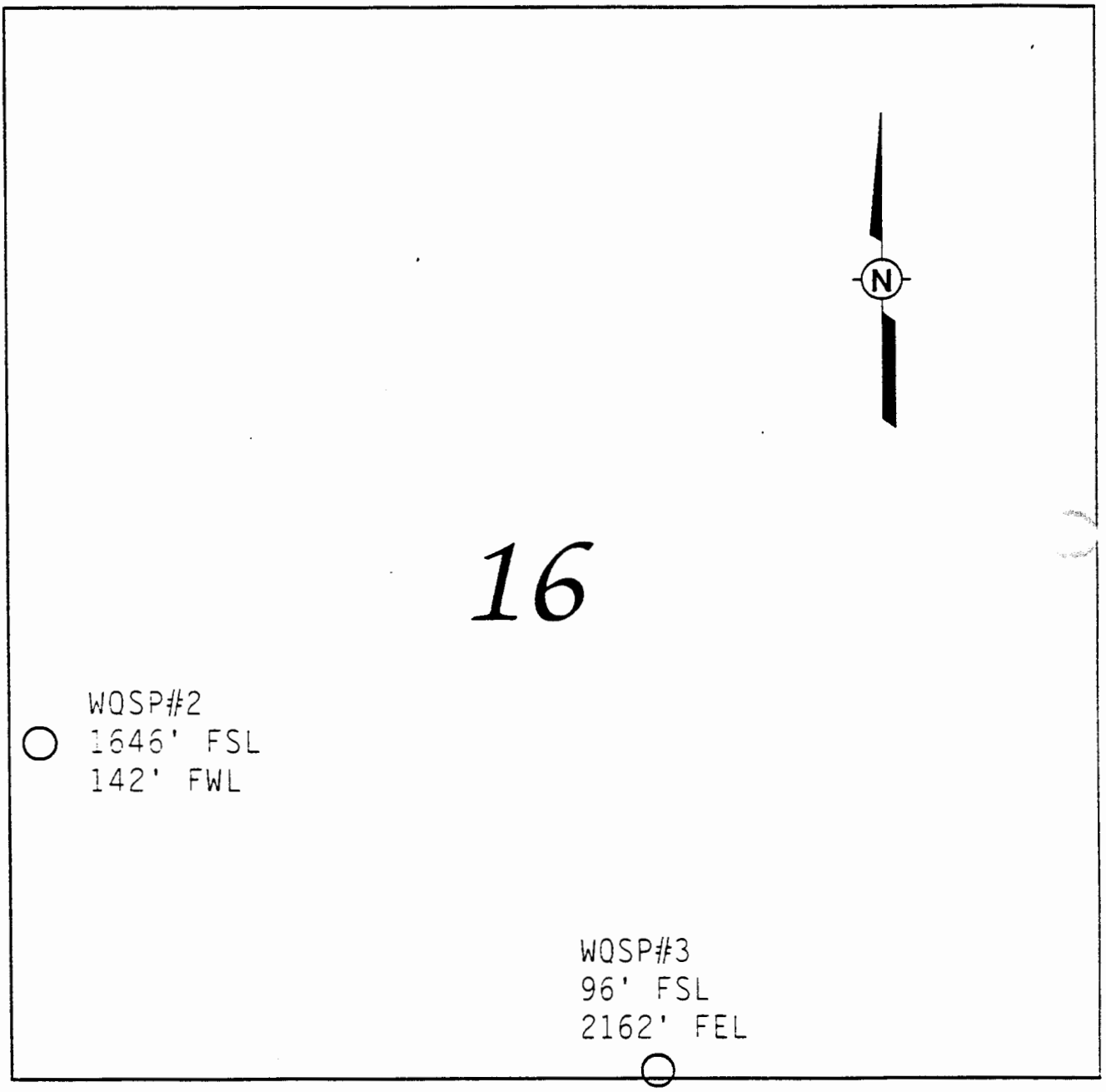
6:30 AM - 6:45 AM - Rig up to pull pump
6:45 AM - 8:00 AM - Pulled pump & rigged down
8:00 AM - 9:45 AM - Load up, straighten sand line
9:45 AM - 10:00 AM - WQSP # 1 to WQSP # 6

WQSP #1
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#2

Section 16, T22S, R31E



Location of WQSP #2

WQSP #2
Condensed Well Summary

Location:	Section 16, T22S, R31E 1646 ft from the south line 142 ft from the west line	
Elevation: (Top of Casing)	3463.9 ft above mean sea level	
Cuttings Description:	D.S. Belski	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 6 to 10, 1994 848 ft below land surface 800 to 846 ft every 20 ft

WQSP #2
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-143	
Dewey Lake Redbeds	143-629	
Rustler Formation	629-844 partial	
• Forty Niner Member	629-692	
• Magenta Member	692-714	
• Tamarisk Member	714-811	800-810 partial
• Culebra Member	811-833	810-834
• Partial lower unnamed member	833-844	834-846
Maximum Recorded Depth	844	

WQSP #2
CUTTINGS DESCRIPTION

WQSP #2
Cuttings Description*

Date	Time	Sample Number	Depth (feet)	Description
08/31/94	0920	1**	6	Surficial deposits
	0928	2**	25	Surficial deposits
09/06/94	0845	1	45	Sandstone, clay, and sand
	0900	2	65	Clay, sandy siltstone, and mudstone
	0927	3	85	Clay
	1035	4	105	Sandy mudstone, clay, and sandstone
	1102	5	125	Sandstone, clay, and interbedded siltstone and sandstone
09/07/94	0824	6	145	Sandstone with minor gypsum
	1101	7	165	Mudstone
	1239	8	185	Mudstone, trace sandstone
	1259	9	205	Sandstone, clay, minor gypsum
	1323	10	215	Sandstone, clay, minor gypsum and sandstone
	1330	11	225	Sandstone
	1341	12	245	Claystone and gypsum
	1407	13	265	Sandstone and minor fibrous gypsum
	1423	14	285	Sandstone with green reduction spots
	1447	15	305	Sandstone
	1523	16	325	Sandstone
	1550	17	345	Siltstone and sandstone
	1610	18	365	Sandstone, minor fibrous gypsum
	1643	19	385	Siltstone with interbedded sandstone
	1715	20	405	Siltstone with green reduction spots, minor fibrous gypsum and clay
	1729	21	425	Siltstone with interbedded mudstone and sandstone
	1749	22	445	Sandstone, trace gypsum
09/08/94	0833	23	465	Siltstone, trace gypsum

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #2
Cuttings Description (Continued)*

Date	Time	Sample Number	Depth (feet)	Description
	0854	24	485	Siltstone, sandstone, trace gypsum
	0922	25	505	Siltstone, clay, trace gypsum
	0946	26	525	Mudstone, siltstone, sand, and clay
	1003	27	545	Mudstone, siltstone, sand, and clay
	1030	28	565	Sandy siltstone
	1048	29	585	Siltstone with minor gypsum
	1103	30	605	Sandy siltstone with mudstone
	1152	31	625	Siltstone, mudstone, and sand
	1154	32	630	Sandstone
09/08/94	1216	33	645	Anhydrite and clay
	1243	34	665	Siltstone, mudstone, and sand
	1313	35	685	Anhydrite with gypsum
	1326	36	705	Dolomite, damp
	1350	37	725	Anhydrite with gypsum
	1431	38	745	Gypsum and anhydrite
	1450	39	765	Gypsum and anhydrite
	1530	40	785	Gypsum
	1538	41	798	Mudstone, minor gypsum and anhydrite

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #2
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA-
FORM 1400

BOREHOLE: WQSP#2 DIA.: 4"

LOG BY: JBD

LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

DATE: 09/09/94
DRILL DATE: 09/09/94

ORIENTATION: Vertical Down

COORDINATES: 1646'FSL 142'FWL

DRILLER: Ronnie Keith

ELEVATION: 3463.9 feet amsl

DRILL: Gardner Denver 1500

DRILL METHOD(S): Air Rotary

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09 11:29	1	800.0 801.0 802.0 803.0 804.0 805.0 806.0	9 1			800.0 - 810.1 ft: light to dark gray mottled anhydrite with gypsum laminae (1-2 mm). Upper 0.2 ft of unit is red-brown mudstone with subrounded to subangular pebble-sized anhydrite clasts. Lens of similar material from 804.3 - 804.5 ft with bladed selenite crystals.	Tamarisk Member o Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#2 DIA.: 4"

LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1646' FSL 142' FWL

ELEVATION: 3463.9 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/09/94
DRILL DATE: 09/09/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09	1	806.0 807.0 808.0 809.0 810.0 811.0 812.0	9 1			800.0 - 810.1 ft: light to dark gray mottled anhydrite with gypsum laminae (1-2 mm). Upper 0.2 ft of unit is red-brown mudstone with subrounded to subangular pebble-sized anhydrite clasts. Lens of similar material from 804.3 - 804.5 ft with bladed selenite crystals. Contact with underlying dolomite unclear.	Tamarisk Member of Rustler Formation
				OV OV		810.1 - 816.0 ft: highly fractured light olive gray microcrystalline dolomite, appears clayey. Small open vugs increasing in size and decreasing in frequency with depth. Toward base gypsum-filled vugs (~ 4 cm).	Culebra Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

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LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1646'FSL 142'FWL

ELEVATION: 3463.9 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/09/94

DRILL DATE: 09/09/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09	1	812.0	9 1	OY		810.1 - 816.0 ft: highly fractured light olive gray microcrystalline dolomite. Small open vugs increasing in size and decreasing in frequency with depth. Toward base of unit vugs are sparse (5 mm - 4.5 cm) and gypsum filled. Fractures toward base appear to have been gypsum filled.	Culebra Member of Rustler Formation 1.5 feet of core loss
		813.0					
		814.0		Φy			
				Φy			
12:30		815.0			GF		
		816.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

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LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1646' FSL 142' FWL

ELEVATION: 3463.9 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/10/94
DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		816.0					
09/10 16:42	2		75		F	816.0 - 830.0 ft: light olive gray dolomite, highly fractured. Upper portion of unit contains numerous small, open vugs and infrequent gypsum filled fractures. Vugs increase in size and decrease in frequency with depth. Some vugs up to 3 cm in size, many are gypsum filled. Clay lined fractures are present toward base of unit.	Culebra Member of Rustler Formation 3.5 feet of core loss
		819.0			GF		
					F		
		822.0					
		825.0					
					F		
		828.0			CF		
17:15							
		830.0					
		831.0					

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

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DATE: 09/10/94

DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/10 9:55	3	830.0	75		GF GF	830.0 - 833.7 ft: light olive gray microcrystalline dolomite with numerous small vugs (open) with gypsum lined fractures. Vugs decrease in frequency toward base of unit.	Culebra Member of Rustler Formation
		832.0					
		834.0				833.7 - 837.6 ft: transition between Culebra Member and underlying unnamed member . Upper 1.0 ft very rubbly clayey dolomite and claystone with numerous gypsum crystals. Lower portion dark black plastic clay.	Unnamed Member of Rustler Formation
		836.0					
		838.0				837.6 - 846.0 ft: dark black rubbly claystone in upper portion turning to red-brown clay with white, pinkish-white gypsum bands. Gypsum and anhydrite percent increases toward base of unit.	
		840.0					
		842.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

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LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1646' FSL 142' FWL

ELEVATION: 3463.9 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/10/94
DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

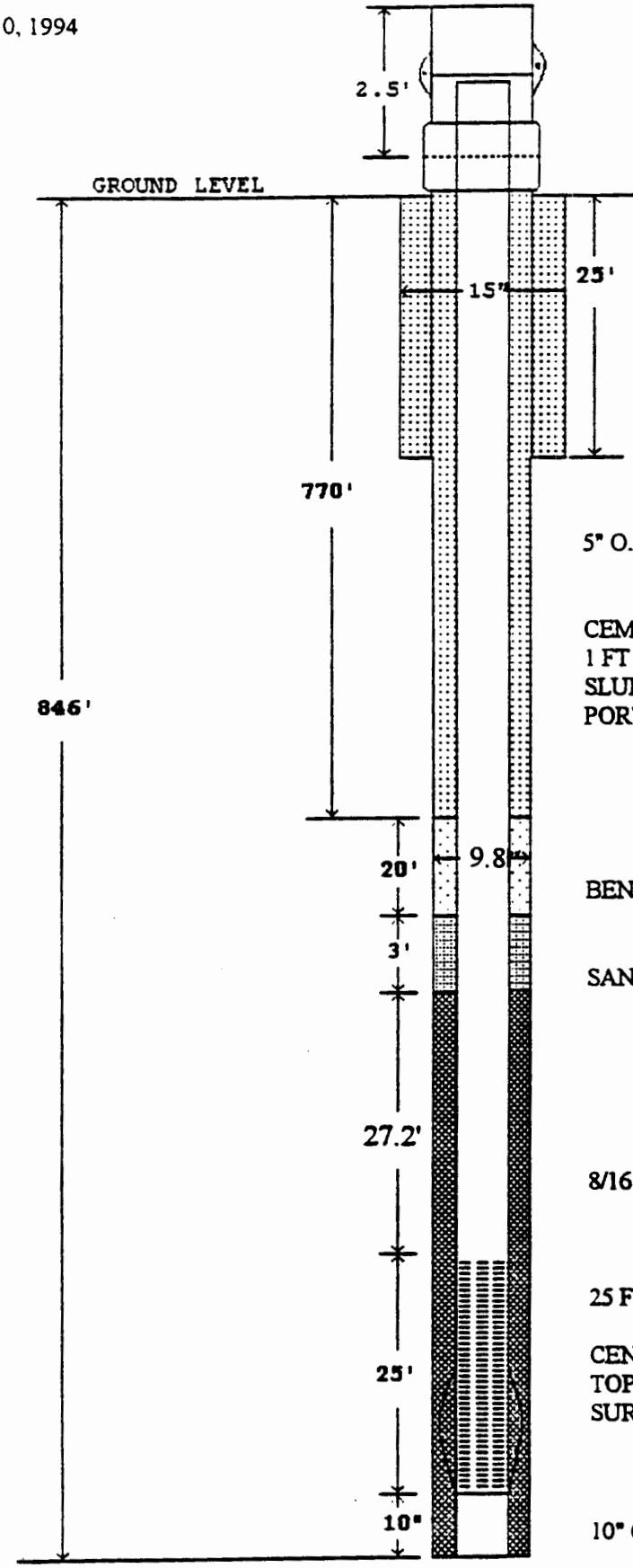
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/10 10:35	3	842.0				837.6 - 846.0 ft: dark black rubbly claystone in upper portion turning to red-brown clay with white-pink gypsum bands. Gypsum and anhydrite percentages increase toward base of unit.	Unnamed Member of Rustler Formation 4 ft of core lost
		844.0	75				
		846.0					

WQSP #2
HOLE HISTORY

WIPP Project
WQSP #2
Eddy County, New Mexico

September 6-10, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 770 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 770 TO 790 FT

SAND PACK FROM 790 TO 793 FT

8/16 BRADY GRAVEL FROM 846 TO 793 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 6, 1994

WQSP # 2

7:30 AM - 8:15 AM - Put rotating head back together and serviced rig
8:15 AM -11:15 AM - Drilled 9 7/8" hole from 25'-125', tripped out of hole
11:30 AM - 1:10 PM - Worked on rotating head
1:10 PM - 1:30 PM - Trip drill collars, remove rotating head, & take in to machine shop
1:30 PM - 2:00 PM - Service rig and secure for the day

September 7, 1994

WQSP # 2

7:20 AM - 8:00 AM Put on rotating head & trip in hole
8:00 AM - 8:40 AM Drill 9 7/8" hole from 125' - 147'
8:40 AM - 10:10 AM Work on rotating head
10:10 AM - 7:00 PM Drill 9 7/8" hole from 147' - 461'
7:00 PM - 7:15 PM T.O.O.H. 150' shut down, secure rig for the day

September 8, 1994

WQSP # 2

6:20 AM - 6:50 AM - Carlsbad to WQSP # 2
6:50 AM - 7:15 AM - Service rig & auxiliary air compressor
7:15 AM - 8:10 AM - Work on air compressor
8:10 AM - 8:15 AM - T.I.H.
8:30 AM - 11:15 AM - Drilling 9 7/8" hole from 461'-616'
11:15 AM - 11:35 AM - Change out batteries & alternator on air compressor
11:35 AM - 4:00 PM - Drilling 9 7/8" hole from 616'-800'. Stopped drilling at this point to come out of hole & prepare for coring 9-9-94
4:00 PM - 5:30 PM - Finished blowing on well to remove cuttings, had several tight spots due to anhydrite chunks falling in hole & catching bit on trip out
5:30 PM - 6:30 PM - Serviced rig and secured for the day. Talked with company man providing core tools for job

WEST TEXAS WATER WELL SERVICE

September 9, 1994

WQSP # 2

5:40 AM -	6:15 AM -	Carlsbad to WQSP # 2
6:15 AM -	6:30 AM -	Check fluid levels on equipment
6:30 AM -	8:40 AM -	Trip in the hole, had two feet of fill in overnight. Had t mist with foam to clean out hole
8:40 AM -	10:30 AM -	Rig up core barrel
10:30 AM -	11:20 AM -	Going in the hole
11:20 AM -	11:35 AM -	Coring 15′
11:35 AM -	11:55 AM -	Cleaning out hole
11:55 AM -	12:15 PM -	Waiting on orders to core deeper
12:15 PM -	12:35 PM -	Coring 1′
12:35 PM -	3:15 PM -	Coming out of hole with 1st core, recovered 15′, laid core barrel, broke it down, & pump into core troughs
3:15 PM -	3:45 PM -	Make up core barrel & start back in hole for second run
3:45 PM -	4:40 PM -	Tripping in the hole
4:40 PM -	5:15 PM -	Coring 2nd run 14′ - Depth 830′
5:15 PM -	6:20 PM -	Come out of the hole, lay down core barrel
6:20 PM -	7:05 PM -	Push out core
7:05 PM -	7:30 PM -	Secure rig for day, leave location
7:30 PM -	8:10 PM -	WSQP @ 2 to Carlsbad

September 10, 1994

WQSP # 2

7:00 AM -	7:40 AM -	Carlsbad to WQSP # 2
7:40 AM -	7:55 AM -	Service rig
7:55 AM -	8:40 AM -	Trip in the hole for 3rd core run, had 55′ of fill in, plug bit
8:40 AM -	9:00 AM -	Come out of hole 150′ & try to unload hole
9:00 AM -	9:10 AM -	Run 2 jts. back in well and unload hole. Possible bridge @ 55′ off bottom, back to bottom @ 10:00 AM
10:00 AM -	10:35 AM -	Coring 3rd run, cut 16′
10:35 AM -	11:35 AM -	Coming out of the hole w/3rd core
11:35 AM -	12:35 PM -	Lay down core barrel and pump out
12:35 PM -	1:30 PM -	Break down tool joints on core barrel & load on trailer
1:30 PM -	2:00 PM -	Shut down rig and secure rig for week end

WEST TEXAS WATER WELL SERVICE

September 12, 1994

WQSP # 2

5:45 AM	7:35 AM	Odessa to WIPP WQSP # 2
7:35 AM	9:00 AM	Line pits for brine water
9:00 AM	10:10 AM	Trip pipe in hole
10:10 AM	11:00 AM	Mix 30 sacks sw gel to sweep hole with and remove cuttings
11:00 AM	11:45 AM	Circulate and condition
11:45 AM	1:05 PM	Ream 8 1/2" core hole to 9 7/8"
1:05 PM	3:55 PM	TD 846' circulating
3:55 PM	4:40 PM	Trip out of hole
4:40 PM	4:55 PM	Rig up to log well
4:45 PM	6:45 PM	Log hole

September 21, 1994

WQSP # 1 & 2

6:10 AM	6:40 AM	Carlsbad to WQSP # 1
6:40 AM	6:55 AM	Service rig
6:55 AM	8:00 AM	Clean up location & rig down
8:00 AM	10:10 AM	Replace cable on blocks
10:10 AM	11:30 AM	Picked up well casing for WQSP # 2 and filled pits at WQSP # 2
11:30 AM	12:00 PM	Rigged up drilling rig on WQSP # 2
12:00 PM	1:30 PM	Trip in the hole and tag fill in
1:30 PM	2:10 PM	Mix mud to circulate down hole
2:10 PM	3:00 PM	Clean out bottom of hole
3:00 PM	3:30 PM	Circulate
3:30 PM	4:00 PM	Trip out of hole 200' and shut down rig
3:00 PM	4:30 PM	Spot surface hole on WQSP #'s 5 & 6
4:30 PM	5:00 PM	Back to Carlsbad

WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 2

6:00 AM -	6:35 AM -	Carlsbad to WQSP # 2
6:35 AM -	6:45 AM -	Check fluid level in equipment
6:45 AM -	7:05 AM -	Trip pipe in hole to check TD
7:05 AM -	7:30 AM -	Circulate
7:30 AM -	8:30 AM -	Trip pipe out of hole
8:30 AM -	9:10 AM -	Water meter locked up - waiting on key
9:10 AM -	10:20 AM -	Run 2" trimmie line
10:20 AM -	12:35 PM -	Run 5" fiberglass casing, screen, & centralizers
12:35 PM -	1:00 PM -	Rig up gravel hopper to gravel pack well
1:00 PM -	3:00 PM -	Gravel pack well
3:00 PM -	4:00 PM -	Mix bentonite slurry and spot above gravel for seal
4:00 PM -	5:30 PM -	Pump cement grout to surface
5:30 PM -	6:00 PM -	Pull trimmie pipe, wash up and secure rig for the day

September 23, 1994

WQSP #'s 2 & 6

6:00 AM -	6:40 AM -	Carlsbad to WQSP # 2
6:40 AM -	8:15 AM -	Rigged down on WQSP # 2, cleaned up location & moved to WQSP # 6
8:15 AM -	12:00 PM -	Rigged up on WQSP # 6, lined pit, put rotating head on, and shut down for weekend
12:00 PM -	2:00 PM -	WQSP # 6 to Odessa

September 26, 1994

WQSP # 2

8:45 AM -	12:15 PM -	Bail & develop well - water level @ start of day - 351'
12:15 PM -	12:45 PM -	Water level recovered from bail down point of 500' back to 400'
12:45 PM -	3:45 PM -	Continued bailing to develop well - water level @ end of day - 400'
3:45 PM -	4:00 PM -	Shut down unit & secured for day

WEST TEXAS WATER WELL SERVICE

September 27, 1994

WQSP # 2

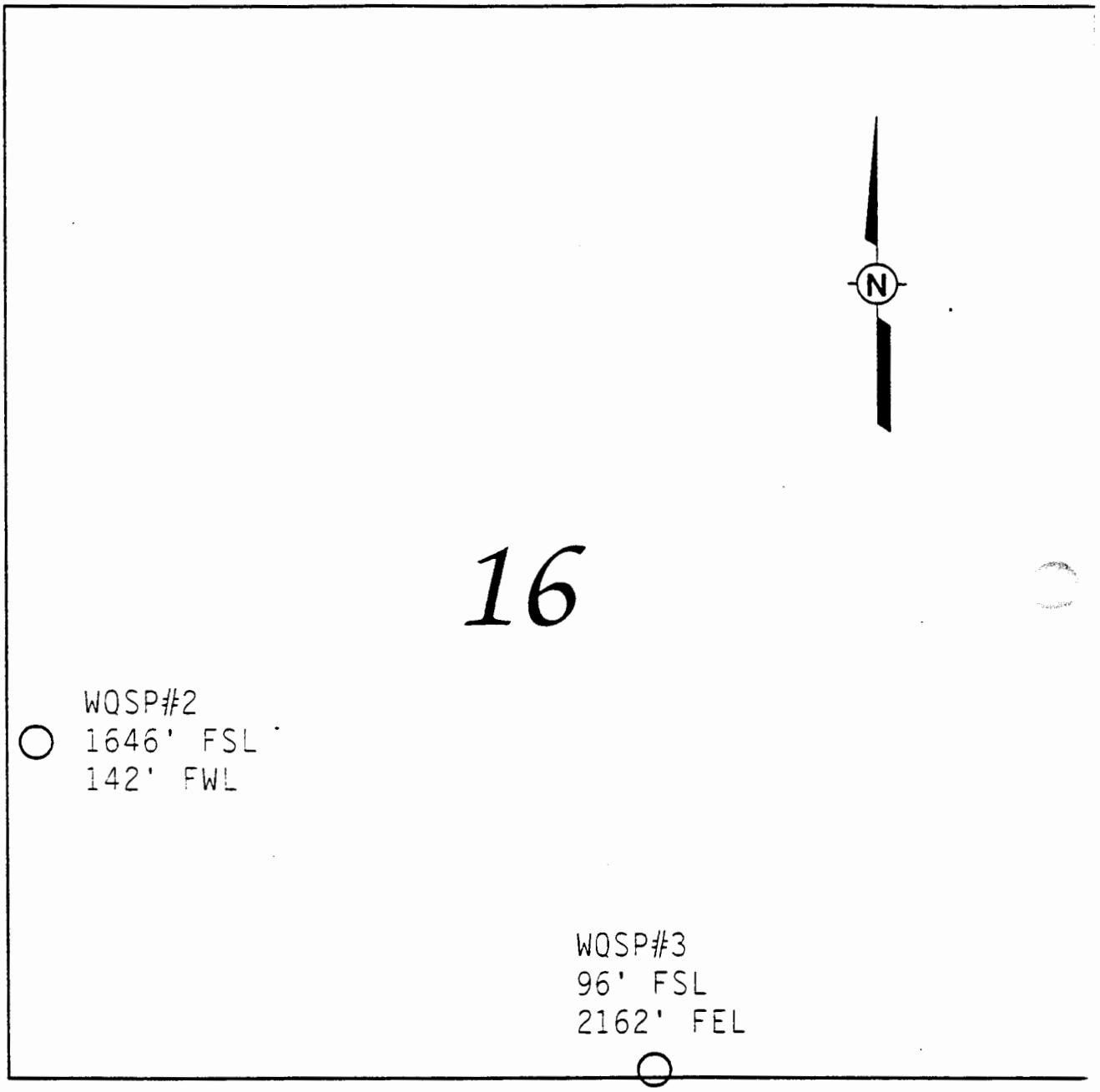
8:00 AM -	8:30 AM -	Ran bailer - water level @ 400' TD 849' from top of casing
8:30 AM -	10:30 AM -	Make splice on pump and ran 3 HP 230V 3 Ph 10 GPM pump in hole, start pumping @ 13 GPM
10:30 AM -	2:30 PM -	Pump well to develop - avg. 10.33 gpm over 4 hours
2:30 PM -	4:00 PM -	Pull pump from well
4:00 PM -	5:00 PM -	WQSP # 6

WQSP #2
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#3

Section 16, T22S, R31E



Location of WQSP #3

WQSP #3
Condensed Well Summary

Location:	Section 16, T22S, R31E 96 ft from the south line 2162 ft from the east line	
Elevation: (Top of Casing)	3480.3 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 20 to 26, 1994 880 ft below land surface 833 to 879 ft every 20 ft

WQSP #3
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-156	
Dewey Lake Redbeds	156-669	
Rustler Formation	669-881 partial	
• Forty Niner Member	669-727	
• Magenta Member	727-749	
• Tamarisk Member	749-848	833-844 partial
• Culebra Member	848-871	844-870
• Partial lower unnamed member	871-881 partial	870-879 partial
Maximum Recorded Depth	881	

WQSP #3
CUTTINGS DESCRIPTION

WQSP #3
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
10/03/94	1045	1**	5	Caliche
	1120	2**	25	Surficial deposits
10/20/94	0825	3	45	Sandstone
	0840	4	65	Sandstone
	0903	5	85	Sandstone
	0922	6	105	Sandstone
	0937	7	125	Mudstone
	0945	8	145	Siltstone
	1005	9	165	Siltstone and mudstone
	1020	10	185	Sandstone with minor carbonate
	1033	11	205	Mudstone interbedded with siltstone
	1055	12	225	Sandstone and siltstone
	1117	13	245	Sandstone
	1147	14	265	Mudstone, sandstone, and minor gypsum
	1242	15	285	Gypsiferous mudstone
	1255	16	305	Sandstone, carbonate, and fibrous gypsum
	1336	17	325	Mudstone interbedded with siltstone, green reduction spots, fibrous gypsum
	1414	18	345	Sandstone with carbonate
	1445	19	365	Sandstone, siltstone interbedded with mudstone, fibrous gypsum
	1515	20	385	Sandstone, mudstone, siltstone, and fibrous gypsum
10/21/94	0730	21	405	Mudstone and sandstone, limited sample, slightly damp
	0805	22	425	Sandstone, minor gypsum and mudstone, mud balls
	0839	23	445	Sandstone with minor gypsum
	0855	24	465	Siltstone and fibrous gypsum filled fractures in the sandstone

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #3
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	0915	25	485	Sandstone, trace carbonate and gypsum
	0935	26	505	Mudstone, selenite gypsum and siltstone interbedded with mudstone
10/21/94	0952	27	525	Mudstone and selenite
	1007	28	545	Gypsiferous sand, sandstone, and selenite
	1021	29	565	Sandstone and mudstone with green reduction spots, trace gypsum,
	1034	30	585	Gypsiferous mudstone with green reduction spots, trace selenite
	1048	31	605	Mudstone, sandstone, and fibrous gypsum
	1110	32	625	Siltstone, sandstone, and selenite
	1120	33	645	Siltstone, sandstone, and gypsum
	1142	34	665	Siltstone and sandstone
10/24/94	1031	35	705	Anhydrite, mudstone, and selenite
	1113	36	725	Anhydrite with minor gypsum and mudstone
	1120	37	745	Anhydrite, minor selenite, trace mudstone
	1210	38	765	Anhydrite, minor selenite, trace claystone
	1255	39	785	Anhydrite, trace claystone
	1335	40	805	Anhydrite, limited sample
	1350	41	825	Anhydrite

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #3
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA-
FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94
DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		832.0					
10/25 09:35	1	834.0 836.0 838.0 840.0 842.0 844.0	97		GF	833.0 - 844.0 ft: light to dark gray mottled anhydrite with wavy (1-3 mm) gypsum laminae. Gypsum filled fracture 0.5 cm wide from 841.2 - 844.0 ft with minor displacement.	Tamarisk Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94

DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/25	1	844.0 846.0 848.0 850.0 852.0 854.0	97		GF GF	844.0 - 855.6 ft: light olive gray microcrystalline dolomite. Upper 0.2 ft red-gray dolomite with small (1-2 mm) elongate gypsum filled vugs grading to gray dolomite. Wavy discontinuous clay filled fractures (0.5 - 1 mm). Vugs increase in size, variety, and intensity with depth becoming large (up to 2 cm), gypsum filled, small (1 - 2 mm), and open. 853 - 855.6 ft: vugs decrease in intensity, are mainly large and some gypsum filled. Few thin, wavy discontinuous gypsum filled fractures. 853.9 - 854.5 ft: broken, rubbly, silty interval.	Culebra Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94

DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		856.0					
10/25 10:40	1	858.0	97		GF	855.6 - 861.3 ft: light olive gray microcrystalline dolomite interbedded with brown/tan silty dolomite (laminated) with moderate open vugs some gypsum filled. Moderate gypsum filled fractures with minor displacement. Base of unit is transition to extremely vuggy non-silty dolomite.	Culebra Member of Rustler Formation
		860.0			GF		
		862.0			GF	861.3 - 864.0 ft: extremely vuggy light olive gray microcrystalline dolomite. 2-3 mm open vugs, some ≥ 2 cm, minor gypsum filled vugs. Rare thin horizontal gypsum filled fractures.	1' core loss
13:40		864.0				864.0 - 870.4 ft: same dolomite as above, majority of vugs gypsum filled. Vugs increase in size and decrease in frequency with depth becoming rare to nonexistent at base of unit. Large, opaque, gypsum-filled inclusions from 867-870.4 ft. (continued on next page)	1' core loss
		866.0					
		868.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94
DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

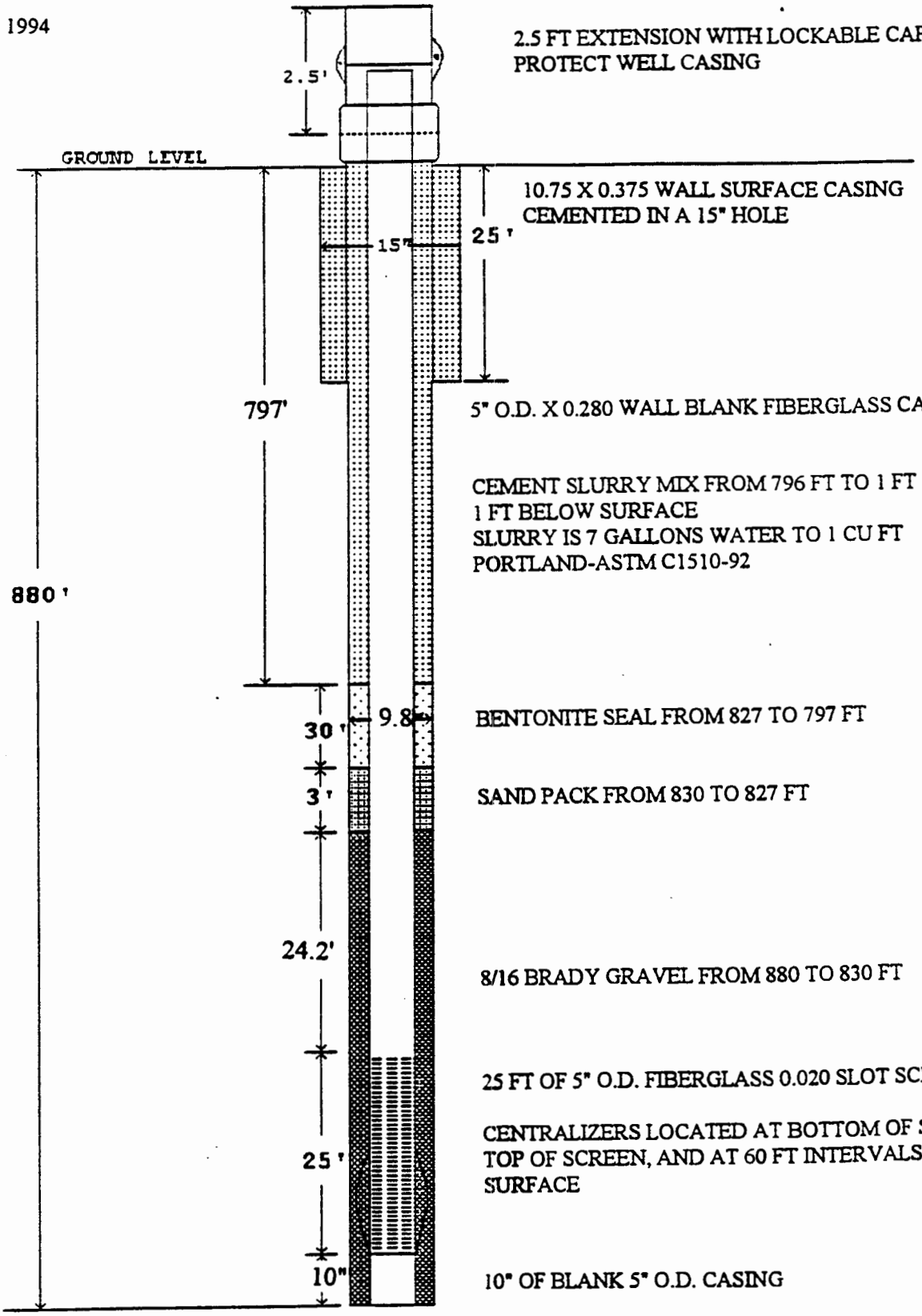
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/25 14:40	2	868.0	9 7			Wavy, discontinuous, vertical gypsum-filled fractures (1-2 mm) contact between Culebra and underlying unnamed member is sharp. ~1 ft of core loss.	Culebra Member of Rustler Formation
		870.0				870.4 - 873.0 ft: upper 0.9 ft black plastic clay with minor gypsum stringers grading to dark red/brown clay with minor red-pink/gray anhydrite beds.	Unnamed member of Rustler Formation
		872.0					
		874.0				873.0 - 877.4 ft: red/light brown mud-clay with frequent light-gray/pink anhydrite beds and high angle veins and stringers. Anhydrite decreases in frequency with depth. Rare light gray clay inclusions. Base of unit contains subrounded anhydrite pebbles (0.25 - 1 cm) and thin (5 - 6 mm) anhydrite beds.	
		876.0					
		878.0				877.4 - 879.0 ft: dark-light gray microcrystalline anhydrite with thin (2-4 mm) wavy gypsum laminae.	
		880.0					

WQSP #3
HOLE HISTORY

WIPP Project
WQSP #3
Eddy County, New Mexico

October 20-26, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 796 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 827 TO 797 FT

SAND PACK FROM 830 TO 827 FT

8/16 BRADY GRAVEL FROM 880 TO 830 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

October 20, 1994

WQSP # 3

6:00 AM -	6:35 AM -	Carlsbad to WQSP # 3
6:35 AM -	6:45 AM -	Check fluid levels
6:45 AM -	7:50 AM -	Finish rigging up and line pits
7:50 AM -	12:00 PM -	Started drilling 9 7/8" hole from 25'. 10.75" .375W surface in place
12:00 PM -	12:30 PM -	Work on air compressor
12:30 PM -	3:30 PM -	Continued drilling
3:30 PM -	4:15 PM -	Pulled 60' of drill pipe, service air filters on rig
4:15 PM -	5:15 PM -	Secure rig & go to Carlsbad

October 21, 1994

WQSP # 3

5:50 AM -	6:30 AM -	Carlsbad to WQSP # 3
6:30 AM -	6:45 AM -	Check fluid levels
6:45 AM -	7:10 AM -	Work on air compressor
7:10 AM -	12:30 PM -	Drilling 9 7/8" from 400' on air
12:30 PM -	12:45 PM -	Trip out 200' of drill pipe
12:45 PM -	3:00 PM -	Replace cable on blocks
3:00 PM -	5:00 PM -	Carlsbad to Odessa

October 24, 1994

WQSP # 3

6:00 AM -	8:40 AM -	Odessa to WQSP # 3 (had flat in route)
8:40 AM -	8:50 AM -	Check fluid levels
8:50 AM -	9:30 AM -	Trip pipe in the hole
9:30 AM -	2:00 PM -	Drill 9 7/8" hole from 680' to 833' on mist pump
2:00 PM -	2:30 PM -	Clean out hole
2:30 PM -	3:30 PM -	Trip drill pipe and collars out of hole, prepare to core
3:30 PM -	4:45 PM -	Get load of water, secure rig
4:45 PM -	5:30 PM -	WQSP # 3 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 25, 1994

WQSP # 3

6:00 AM -	6:30 AM -	Carlsbad to WQSP # 3
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	7:10 AM -	Wait on Weatherford
7:10 AM -	8:10 AM -	Rig up core tools
8:10 AM -	9:20 AM -	Trip in hole for 1st core run
9:20 AM -	10:40 AM -	Coring from 833' - 864', top of Culebra @ 844'
10:40 AM -	10:50 AM -	Clean out hole
10:50 AM -	11:50 AM -	Trip out of the hole
11:50 AM -	12:30 PM -	Breakout core barrel and lay down inner barrel
12:30 PM -	1:00 PM -	Pick up inner barrel & go back in hole
1:00 PM -	2:00 PM -	Tripping in hole
2:00 PM -	2:30 PM -	Coring from 844' - 859'
2:30 PM -	2:40 PM -	Clean out hole
2:40 PM -	3:45 PM -	Tripping out of the hole, pull inner barrel & lay out on ground
3:45 PM -	4:30 PM -	Pump out core, load core tools & secure rig
4:30 PM -	5:15 PM -	WQSP # 3 to Carlsbad

October 26, 1994

WQSP # 3

6:00 AM -	6:40 AM -	Carlsbad to WQSP # 3
6:40 AM -	6:55 AM -	Check fluid levels
6:55 AM -	8:35 AM -	Trip pipe in the hole
8:35 AM -	10:30 AM -	Ream hole from 8 1/2" to 9 7/8" to receive logging tools - hole reamed from 833' - 880'
10:30 AM -	11:00 AM -	Clean out hole with foaming agents
11:00 AM -	12:05 PM -	Trip out of the hole
12:05 PM -	2:30 PM -	Wait on logging unit
2:30 PM -	5:00 PM -	Run logs
5:00 PM -	5:35 PM -	WQSP # 3 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 27, 1994

WQSP # 3

6:00 AM -	6:40 AM -	Carlsbad to WQSP # 3
6:40 AM -	6:50 AM -	Check fluid levels
6:50 AM -	7:35 AM -	Run bailer to check if hole is open, had 40′ of fill
7:35 AM -	8:40 AM -	Trip pipe in the hole
8:40 AM -	9:45 AM -	Clean out hole, hit bridge at 840′. Hole was bridged over from 840′ - 860′, open from 860′ - 880′
9:45 AM -	10:35 AM -	Trip out of the hole
10:35 AM -	11:15 AM -	Prepare to run 2" trimmie line
11:15 AM -	12:00 PM -	Run 2" trimmie line
12:00 PM -	12:15 PM -	Prepare to run fiberglass screen & casing - 29 jts blank, 1 - 10′ blank bottom, 1 jt screen
12:15 PM -	2:10 PM -	Running casing
2:10 PM -	2:45 PM -	Rig up to gravel pack (work on mud pump)
2:45 PM -	3:45 PM -	Gravel packing well with 8/16 Brady gravel from 880′
3:45 PM -	4:15 PM -	Mix bentonite slurry for plug above gravel pack
4:15 PM -	4:40 PM -	Rig up to cement (wait on truck)
4:40 PM -	5:20 PM -	Cementing from 800′
5:20 PM -	6:10 PM -	Pull 2: trimmie line
6:10 PM -	6:20 PM -	Secure rig
6:20 PM -	7:00 PM -	WQSP # 3 to Carlsbad

October 31, 1994

WQSP # 3

Unit # 2

7:55 AM -	9:10 AM -	Arrive on location, pour 4 gallons of bleach into well, check & service unit, rig up & prepare to bail well, surge well with bailer to allow solution to work through screened interval
9:10 AM -	12:25 PM -	Start bailing, water level @ 448′, TD from top of casing 803′. Made 20 trips
12:25 PM -	1:25 PM -	Made 10 more trips with bailer
1:25 PM -	3:10 PM -	Run test pump in well, pump set on 1" pipe @ 866′
3:10 PM -	-	Start pump - 7.5 GPM
3:30 PM -	-	Pumping 6.2 gpm
3:55 PM -	-	Well pumped off, shut down for the day
4:00 PM -	-	Left location

WEST TEXAS WATER WELL SERVICE

November 1, 1994

WQSP # 3

Unit # 2

6:40 AM -	7:00 AM -	Arrive on location, check unit
7:00 AM -	8:40 AM -	Start surging well, pumping 9 GPM
8:40 AM -	-	Start continuous test w/2 GPM choke in line, 65# backpressure
9:20 AM -	-	Change to 3 GPM choke, 40# backpressure
9:25 AM -	-	Pumped off well, change back to 2 GPM choke
9:35 AM -	-	1.2 GPM @ 60# backpressure
9:55 AM -	-	.75 GPM @ 60# backpressure
10:15 AM -	-	.8 GPM @ 60# backpressure
10:30 AM -	-	.8 GPM @ 60# backpressure
10:45 AM -	-	.8 GPM @ 60# backpressure
11:00 AM -	-	.8 GPM @ 60# backpressure
11:15 AM -	-	.8 GPM @ 60# backpressure
11:30 AM -	-	.8 GPM @ 60# backpressure
11:45 AM -	-	.8 GPM @ 60# backpressure
12:00 PM -	-	.8 GPM @ 60# backpressure - shut down test
12:05 PM -	1:30 PM -	Rig up, pull pump
1:30 PM -	2:55 PM -	Set up to log
2:55 PM -	4:10 PM -	Finish logging and wait on cement truck
4:10 PM -	4:35 PM -	Cement from 147' to surface
4:35 PM -	4:45 PM -	Clean up & leave location

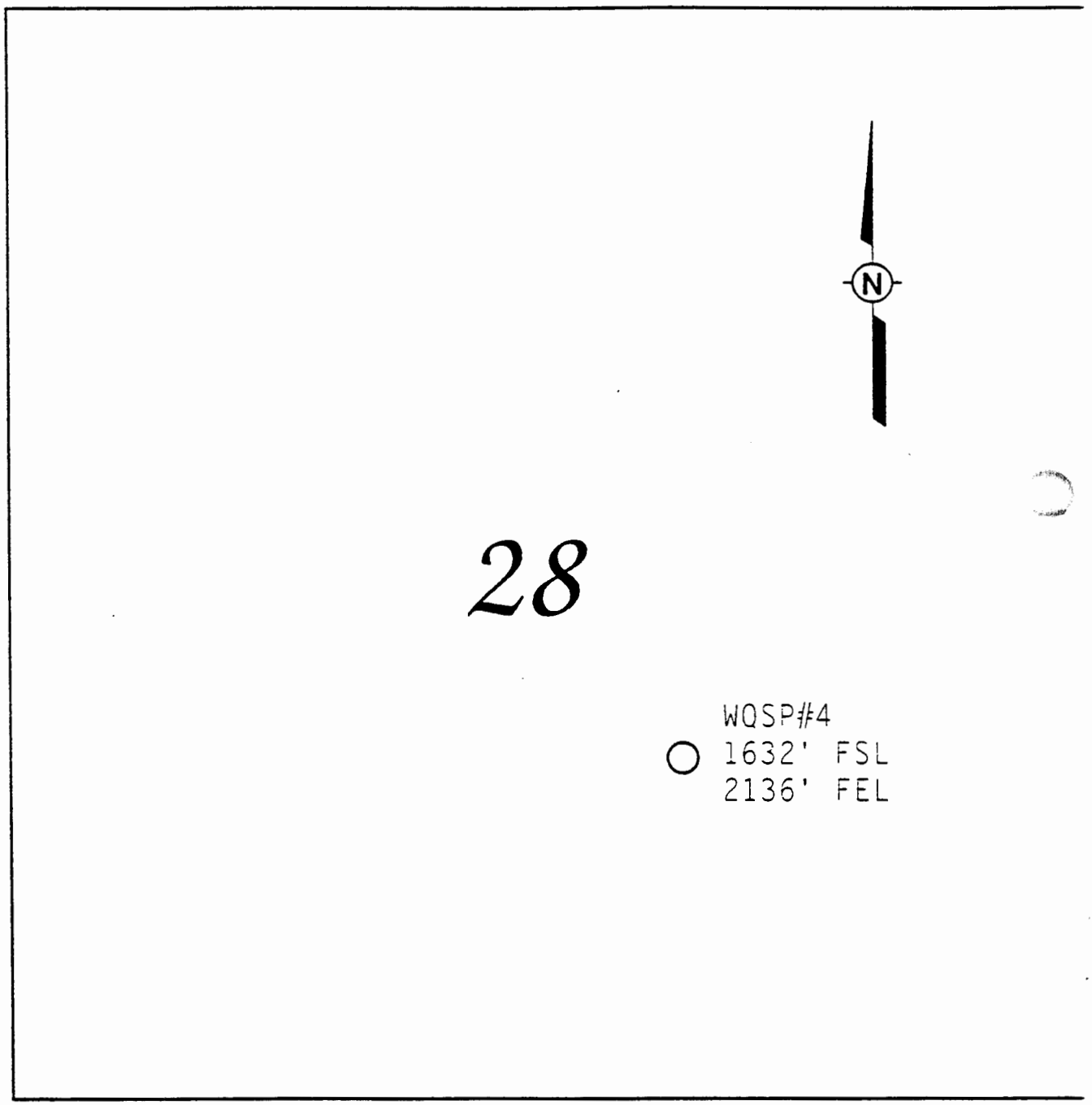
WQSP #3
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#4

Section 28, T22S, R31E



Location of WQSP #4

WQSP #4
Condensed Well Summary

Location:	Section 28, T22S, R31E 1632 ft from the south line 2136 ft from the east line	
Elevation: (Top of Casing)	3433.0 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record:	Date: Bottom of hole: Cored interval: Cuttings:	October 5 to 7, 1994 800 ft below land surface 740 to 798 ft every 20 ft

WQSP #4
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-78	
Dewey Lake Redbeds	78-588	
Rustler Formation	588-802 partial	
• Forty Niner Member	588-652	
• Magenta Member	652-672	
• Tamarisk Member	672-770	740-765.6 partial
• Culebra Member	770-790	765.6-790.8
• Partial lower unnamed member	790-802 partial	790.8-798 partial
Maximum Recorded Depth	802	

•

WQSP #4
CUTTINGS DESCRIPTION

WQSP #4
Cuttings Description*

Date	Time	Sample Number	Depth (feet)	Description
10/03/94	0930	1**	5	Caliche
	0955	2**	25	Surficial deposits
10/05/94	0820	1	45	Siltstone, mudstone, and clay
	0834	2	65	Sandstone, siltstone, mudstone, and mud
	0903	3	85	Siltstone and mudstone
	0923	4	105	Mudstone and siltstone
	0939	5	125	Mudstone and Siltstone
	1003	6	145	Sandstone and mudstone
	1025	7	165	Siltstone, mudstone, trace gypsum
	1043	8	185	Siltstone and sandstone
	1104	9	205	Mudstone, trace fibrous gypsum and sandstone
	1130	10	225	Sandstone and fibrous gypsum
	1157	11	245	Siltstone and sandstone with green reduction spots, fibrous gypsum
	1225	12	265	Sandstone with green reduction spots, minor carbonate
	1258	13	285	Siltstone, sandstone, trace gypsum
	1327	14	305	Siltstone, sandstone, trace gypsum
	1402	15	325	Siltstone and sandstone
	1432	16	345	Mudstone and sandstone with green reduction spots
	1451	17	365	Mudstone and sandstone with green reduction spots, minor carbonate, and trace gypsum
	1510	18	385	Silt and sandstone with green reduction spots, minor fibrous gypsum
	1538	19	405	Sandstone, mudstone, minor gypsum, and silt, damp
	1547	20	425	Silt with gypsum, mudstone, and sandstone
10/06/64	0735	21	445	Silt, sand, and gypsum
	0804	22	465	Silt and sandstone with gypsum filled fractures

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #4
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	0821	23	485	Silt with gypsum, sandstone with green reduction spots, damp
	0850	24	505	Mudstone, silt, and gypsum
10/06/94	0910	25	525	Mudstone with selenite
	0922	26	545	Sandstone with green reduction spots, selenite and fibrous gypsum
	0945	27	565	Mudstone, trace selenite
	1001	28	585	Sandy mudstone with green reduction spots, selenite
	1045	29	605	Anhydrite
	1114	30	625	Sandy gypsiferous siltstone, damp
	1136	31	645	Anhydrite
	1225	32	665	Anhydrite, claystone, trace dolomite
	1310	33	685	Anhydrite, claystone, minor dolomite, trace gypsum
	1350	34	705	Anhydrite, gypsum, claystone, trace dolomite
	1445	35	725	Anhydrite, gypsum, and clay
	1515	36	740	Anhydrite, selenite, and clay

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #4
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07 09:30	1	740.0	100			740.47 - 746.0 ft: red-brown muddy clay with angular anhydrite clasts (≤ 0.25 cm), isolated gypsum crystals (~ 4-5 mm), and light gray clay inclusions. Some rare fibrous gypsum fragments (~ 0.25 cm).	Tamarisk Member of Rustler Formation
		742.0					
		744.0					
		746.0				746.0 - 765.4 ft: light-dark gray mottled microcrystalline anhydrite with thin (~1 mm) wavy gypsum laminae grading to coarsely crystalline light-dark gray mottled anhydrite at 749.0 ft. Anhydrite is coarsely crystalline from 749.0 - 752.3 ft. (continued on next page)	
		748.0					
		750.0					
		752.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07	1	752.0 754.0 756.0 758.0 760.0 762.0 764.0	100			Dark band of gray microcrystalline anhydrite with thin lenses of gypsum, some fibrous from 752.3 - 753.0 ft. Dark brown clay seam (~ 0.10 ft thick) interbedded at 752.5 ft. Remainder of unit light with dark gray mottled microcrystalline anhydrite.	Tamarisk Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/7 11:00	1	764.0	100			765.4 - 765.6 ft: gray-brown clay.	Tamarisk Member of Rustler Formation
		766.0				765.6 - 771.5 ft: upper 0.5 ft red-gray microcrystalline dolomite, laminated with numerous open vugs (< 1 - 5 mm) grading to light olive gray dolomite. 766.1 - 767.1 ft: decrease in frequency of vugs, numerous thin (1-2 mm) vertical gypsum filled fractures, gypsum vein (1-3 cm) from 766.6 - 767.2 isolated large open vugs. Remainder of unit very vuggy (≤ 1 mm), highly fractured - some gypsum healed.	Culebra Member of Rustler Formation lower ~2 ft bro a bagged
		768.0			F GF		
		770.0					
10/7 13:55			73.6			771.47 - 775.47 ft: same dolomite as above. Upper foot is extremely vuggy (1-4 mm). Open vugs decrease in frequency with depth, increase in size and become gypsum filled. Gypsum vein (~4 cm), vertical, extends 4 ft.	
		772.0					
		774.0				See Next Page	
		776.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632' FSL 2136' FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94
DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07	2	776.0	7 3 . 6			775.47 - 784.8 ft: same dolomite as above, highly fractured, clayey, with large (4 cm) lenticular, open vugs. Some fractures gypsum healed.	Culebra Member of Rustler Formation
		778.0		OV	F		broken and bagged (sample bags #1-5) top-bottom
		780.0		OV	F		~7' core loss
		782.0		OV	GF		
		784.0		OV	F		
		786.0		ΦV	CF	784.8 - 790.8 ft: same dolomite as above, thinly laminated horizontal clay lined fractures decreasing in width toward base of unit, large gypsum filled irregular vugs (4-5 cm). (continued on next page)	
		788.0		ΦV			

WIPP CORE-LOG INVENTORY

INTERA
FORM 140(

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

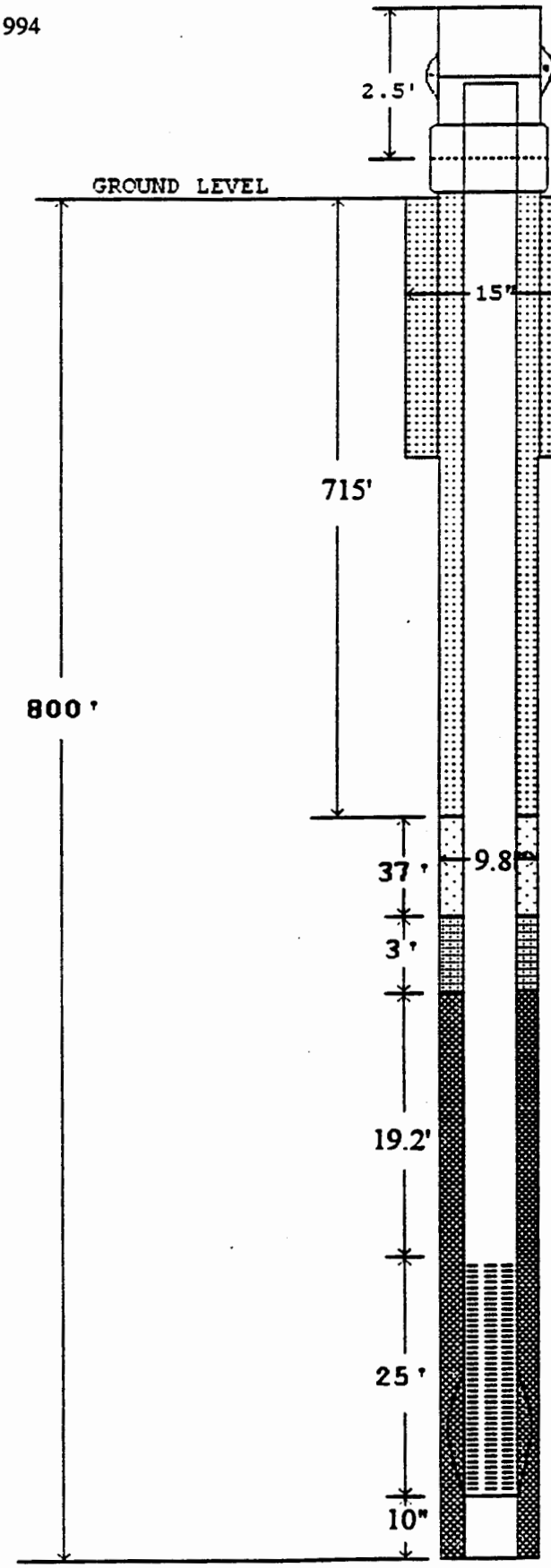
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/7 15:30	2	788.0	73.6			~2 - 4 cm band of intraformational conglomerate at very base of unit. Sharp contact between Culebra Member and unnamed member.	Culebra Member of Rustler Formation
		790.0				790.8 - 795.6 ft: black, plastic clay with thin (1-2 mm) white gypsum stringers (vertical) and isolated lenticular gypsum inclusion. Black clay grades to red-brown muddy clay with minor anhydrite interbeds.	Unnamed Member o Rustler Forma
		792.0					
		794.0					
		796.0				795.6 - 798.0 ft: dark to light gray mottled microcrystalline anhydrite grading to white-pink at depth with red/brown mud-clay interbeds.	
		798.0					

WQSP #4
HOLE HISTORY

WIPP Project
WQSP #4
Eddy County, New Mexico

October 5-7, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP T
PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING
CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CAS

CEMENT SLURRY MIX FROM 715 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 752 TO 715 FT

SAND PACK FROM 755 TO 752 FT

8/16 BRADY GRAVEL FROM 800 TO 755 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCRE

CENTRALIZERS LOCATED AT BOTTOM OF SC
TOP OF SCREEN, AND AT 60 FT INTERVALS TO
SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

October 5, 1994

WQSP # 4

5:55 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	7:40 AM -	Work on rotating head
7:40 AM -		Start drilling operations running 9 7/8" mill tooth bit, 10.75" surface, set & cemented to 25'

October 6, 1994

WQSP # 4

5:55 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	6:50 AM -	Trip pipe back to bottom
6:50 AM -	7:20 AM -	Wait on Ron
7:20 AM -	3:30 PM -	Drilling 9 7/8" hole from 428' to 740'
3:30 PM -	4:00 PM -	Circulate to clean up hole
4:00 PM -	4:50 PM -	Trip out of hole & prepare to core
4:50 PM -	5:30 PM -	WQSP # 4 to Carlsbad

Had to go on mist pump & adding foam @ 648'

WEST TEXAS WATER WELL SERVICE

October 7, 1994

WQSP # 4

5:55 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	7:30 AM -	Rig up core barrel
7:30 AM -	8:30 AM -	Trip core barrel in for 1st run
8:30 AM -	9:15 AM -	Clean out hole of fill in
9:15 AM -	10:40 AM -	Core from 740.47 - 772
10:40 AM -	10:50 AM -	Clean out hole
10:50 AM -	11:35 AM -	Tripping out of hole
11:35 AM -	12:00 PM -	Breakout inner barrel and lay on ground
12:00 PM -	12:30 PM -	Pick up inner barrel
12:30 PM -	12:45 PM -	Pump out core
12:45 PM -	1:30 PM -	Start back hole for 2nd run
1:30 PM -	1:40 PM -	Clean out hole
1:40 PM -	3:30 PM -	Coring
3:30 PM -	4:15 PM -	Tripping out of hole
4:15 PM -	4:50 PM -	Break off jars and pull inner barrel to lay down
4:50 PM -	5:15 PM -	Pump out core
5:15 PM -	6:00 PM -	Load core tools and secure rig
6:00 PM -	8:00 PM -	WQSP # 4 to Odessa

October 10, 1994

WQSP # 4

5:30 AM -	7:30 AM -	Odessa to WQSP # 4
7:30 AM -	8:00 AM -	Service rig
8:00 AM -	9:30 AM -	Trip pipe in the hole
9:30 AM -	12:00 PM -	Ream hole from 8 1/2" to 9 7/8" from 740′ - 800′
12:00 PM -	12:10 PM -	Clean out hole
12:10 PM -	1:10 PM -	Trip out of hole
1:10 PM -	1:30 PM -	Rig up logging unit
1:30 PM -	3:15 PM -	Log well
3:15 PM -	4:20 PM -	Work on rig & load casing
4:20 PM -	5:00 PM -	WQSP # 4 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 11, 1994

WQSP # 4

5:30 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	6:55 AM -	Measure hole depth to check for fill in - TD 800′
6:55 AM -	8:55 AM -	Run 2" trimmie line in hole
8:55 AM -	10:40 AM -	Run 5" fiberglass casing 1 - 10" x 5" bottom 1 - 25′ x 5″ .020 screen 767′ x 5" blank casing Bottom cap, slip cap, centralizers
10:40 AM -	12:00 PM -	Gravel pack w/ 8-16 gravel from 800′ - 755′
12:00 PM -	12:15 PM -	Mix bentonite plug and spot above gravel pack
12:15 PM -	1:35 PM -	Wait on cement
1:35 PM -	2:30 PM -	Pump cement
2:30 PM -	3:00 PM -	Pull 2" trimmie line
3:00 PM -	3:20 PM -	Rig down
3:20 PM -	4:40 PM -	Move and rig up on WQSP # 5
4:40 PM -	5:25 PM -	WQSP # 5 to Carlsbad

October 12, 1994

WQSP # 4

Unit @ 2

8:30 AM -		Arrived on WQSP # 6, rig up pulling unit to pull test pump
9:00 AM -	11:00 AM -	Pulled test pump and moved to WQSP # 4
11:00 AM -	1:30 PM -	Rigged up and waited on cement
1:30 PM -	4:00 PM -	Bailed on well to develop and clean up any fines left by gravel pack TD 800′

WEST TEXAS WATER WELL SERVICE

October 13, 1994

WQSP # 4

Unit # 2

6:45 AM -		- Arrive on location, check & service unit
7:35 AM -	7:50 AM	- Make 5 runs with bailer
7:50 AM -	9:00 AM	- Make splice on test pump, get ready to run
9:00 AM -	10:50 AM	- Run 3 HP 20 GPM test pump
10:50 AM -	11:35 Am	- Make electrical hook up and put on wellhead
11:35 AM -		- Start pump open ended - 12 GPM
11:40 AM -		- 12 GPM
11:45 AM -		- 11.75 GPM
11:50 AM -		- 11.5 GPM
11:55 AM -		- 11 GPM
12:00 PM -		- 9.75 GPM
12:20 PM -		- 9.25 GPM
12.35 PM -		- 8.75 GPM
1:05 PM -		- 8 GPM
1:35 PM -		- 8 GPM
2:05 PM -		- 8 GPM
2:35 PM -		- 8 GPM
3:05 PM -		- 7.75 GPM
3:35 PM -		- 7.75 GPM Stopped pumping
3:35 PM -	4:15 PM	- Surged well and shut down operations for the day
4:15 PM -	4:25 PM	- Back to WQSP # 5
4:25 PM -	5:15 PM	- Help Ronny come out of hole

October 14, 1994

WQSP # 4

Unit # 2

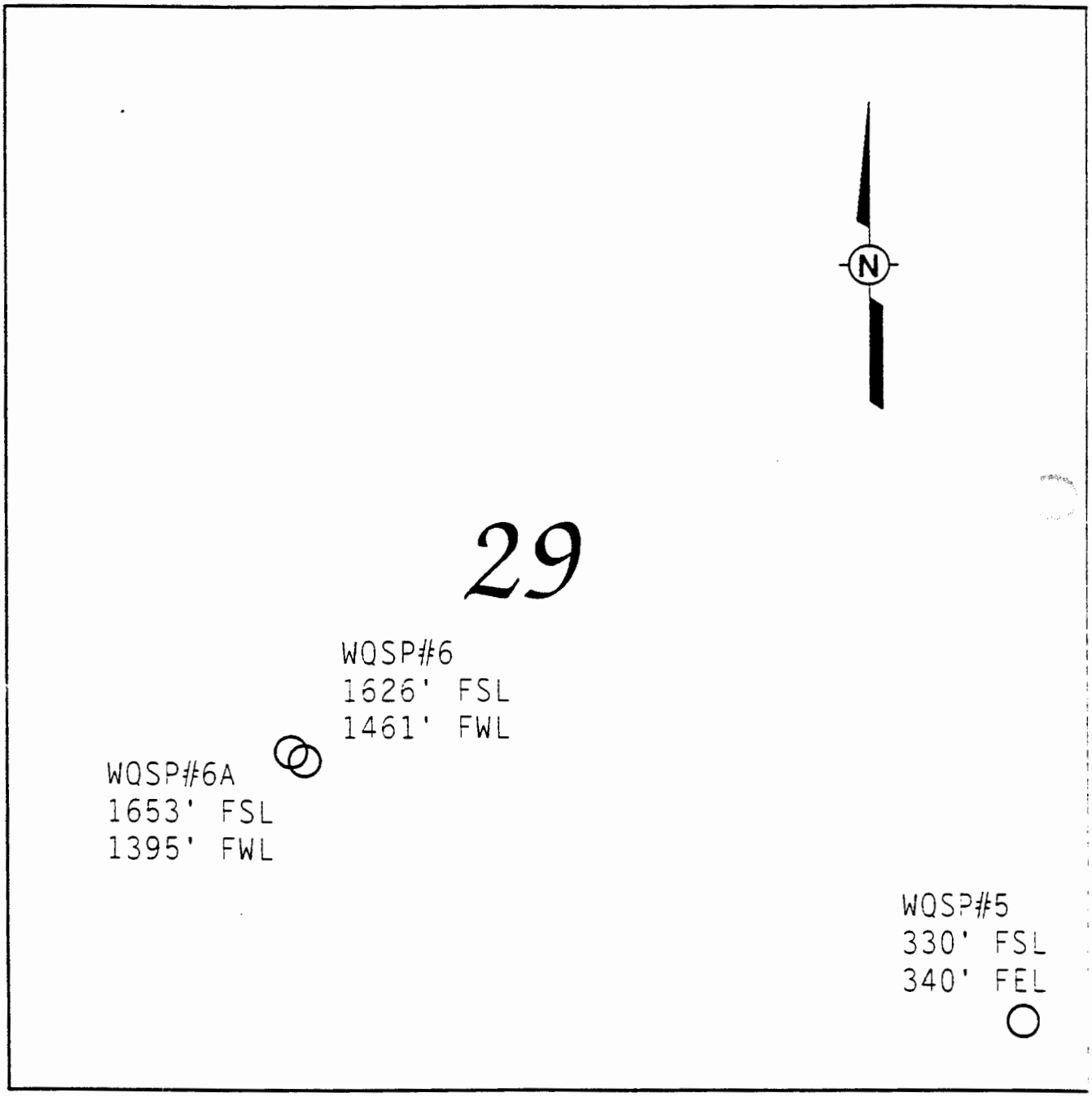
7:15 AM -		- Surged well 20 times in effort to try and dirty up fluid being pumped
8:15 AM -		- Stopped surging well and began pumping constant, open ended discharge
8:20 AM -		- Pumping 12 GPM, clear discharge
8:25 AM -		- Pumping 11.5 GPM, clear discharge
8:30 AM -		- Pumping 10.5 GPM, clear discharge
8:35 AM -		- Pumping 10 GPM, clear discharge
8:40 AM -		- Pumping 9.75 GPM, clear discharge
8:45 AM -		- Pumping 9.5 GPM, clear discharge
8:50 AM -		- Pumping 9.25 GPM, clear discharge
8:55 AM -		- Pumping 9.25 GPM, clear discharge
9:00 AM -		- Pumping 9 GPM, clear discharge
1:00 PM -		- Shut down operations for weekend
1:00 PM -	3:00 PM	- Returned to Odessa

WQSP 4#
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#5

Section 29, T22S, R31E



Location of WQSP #5

WQSP #5
Condensed Well Summary

Location:	Section 29, T22S, R31E 330 ft from the south line 340 ft from the east line	
Elevation: (Top of Casing)	3384.4 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 12 to 13, 1994 683 ft below land surface 648 to 676 ft every 20 ft

WQSP #5
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-25	
Dewey Lake Redbeds	25-475	
Rustler Formation	475-683 partial	
• Forty Niner Member	475-530	
• Magenta Member	530-554	
• Tamarisk Member	554-648	
• Culebra Member	648-669	648-674
• Partial lower unnamed member	669-683	674-676 partial
Maximum Recorded Depth	683	

WQSP #5
CUTTINGS DESCRIPTION

WQSP #5
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
09/22/94	0935	1**	4	Caliche
	0940	2**	25	Mudstone
10/12/94	0825	3	45	Sandstone and mudstone
	0833	4	65	Mudstone and sandstone
	0855	5	85	Sandstone
	0910	6	105	Mudstone with green reduction spots, damp
	0925	7	125	Mudstone, damp
	0936	8	145	Sandy siltstone with gypsum
	0950	9	165	Mudstone, fibrous gypsum
	1014	10	185	Mudstone and sandstone with green reduction spots, minor gypsum
	1025	11	205	Sandstone
	1045	12	225	Sandstone and mudstone with green reduction spots, damp
	1110	13	245	Mudstone and sandstone
	1120	14	265	Mudstone laminated with fibrous gypsum, sandstone, minor gypsum
	1140	15	285	Sandy mudstone, sandstone with minor gypsum
	1153	16	305	Mudstone and sandstone with green reduction spots, fibrous gypsum
	1210	17	325	Mudstone with green reduction spots, minor gypsum
	1233	18	345	Sandstone interbedded with fibrous gypsum
	1245	19	365	Sandstone, trace gypsum
	1308	20	385	Sandy mudstone interbedded with gypsum, trace carbonate
	1335	21	405	Sandstone with green reduction spots and gypsiferous siltstone
10/12/94	1353	22	425	Sandstone with green reduction spots, laminated with fibrous gypsum
	1416	23	445	Gypsiferous mudstone laminated with fibrous gypsum, damp
	1440	24	465	Mudstone with green reduction spots, minor gypsum
	1504	25	485	Anhydrite, minor gypsum, sandstone and carbonate

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #5
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1535	26	505	Gypsiferous siltstone, carbonate
10/13/94	0810	27	545	Anhydrite, mudstone, trace carbonate
10/13/94	0847	28	565	Anhydrite
	0920	29	585	Anhydrite, mudstone, trace dolomite
	1005	30	605	Anhydrite, mudstone, trace dolomite
	1050	31	625	Anhydrite and claystone
	1115	32	645	Anhydrite

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #5
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA FORM 140

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/13 2:20	1	648.0	89		GF	648.0 - 657.0 ft: light olive gray microcrystalline dolomite, thinly laminated, with 1-2 mm wide irregular gypsum healed fractures and rare, small (1-2 mm) open vugs. At 655.0 ft vugs become larger (up to 2 inches), irregular and increase in frequency, rock has a distinct "Swiss cheese" texture. Highly fractured, clayey intervals occur between 649.2-649.9 and 652.6-652.7 ft. Rubbly, clayey, but competent interval occurs between 653.4 - 655.0 ft with rare (≤ 0.25 cm) vugs. Contact between Culebra Member and overlying Tamarisk Member not observed.	Culebra Member of Rustler Formation
		650.0			F		
		652.0			GF		
		654.0			F		
		656.0					
		658.0				657.0 - 666.0 ft: core loss.	9 feet of core loss
		660.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/13	1	660.0	89			657.0 - 666.0 ft: core loss.	Culebra Member of Rustler Formation
		662.0					
		664.0					9 feet of core loss
		666.0			GF	666.0 - 674.4 ft: same dolomite as above, extremely vuggy, most vugs are small and rock has a "sponge-like" texture. Some vugs are interconnected by dissolution and are highly irregular in shape. Vugs tend to form horizontal bands (~0.10 ft thick). Some dissolution pockets are gypsum filled. Vugs decrease in frequency with depth. Short, irregular gypsum-healed fractures and clay lens toward top of units. (continued on next page)	
		668.0					
		670.0					
		672.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 140(

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

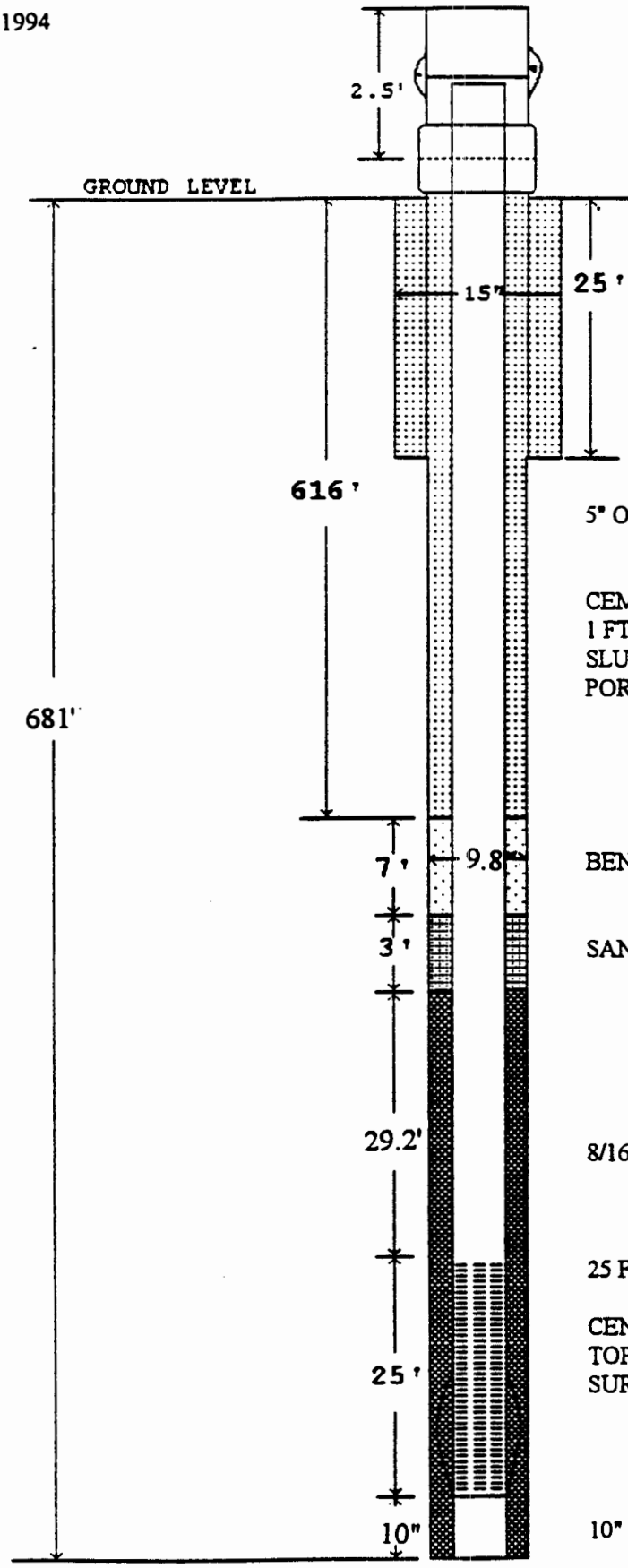
DRILL CO.: West Texas Wate Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		672.0					
10/13						highly fractured interval at 673.5 ft grading to more competent rock at 674.4 ft. Contact between Culebra Member and unnamed member is gradational.	Culebra Member of Rustler Formation
		674.0			F		
	1		68				
						674.4 - 676.0 ft: compact, gypsiferous, black clay grading to red-brown clay with gypsum interbeds and stringers.	Unnamed Mer c Rustler Formation
4:15		676.0					
		678.0					
		680.0					
		682.0					
		684.0					

WIPP Project
WQSP #5
Eddy County, New Mexico

October 12-13, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP
PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING
CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CAS

CEMENT SLURRY MIX FROM 613 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 623 TO 613 FT

SAND PACK FROM 626 TO 623 FT

8/16 BRADY GRAVEL FROM 681 TO 626 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCRE

CENTRALIZERS LOCATED AT BOTTOM OF SC
TOP OF SCREEN, AND AT 60 FT INTERVALS T
SURFACE

10" OF BLANK 5" O.D. CASING

WQSP #5
HOLE HISTORY

WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 5 & WQSP # 6

9:00 AM - 12:00 PM - Drilled, set 10.75" surface casing, cemented

October 12, 1994

WQSP # 5

6:00 AM -	6:35 AM	- Carlsbad to WQSP # 5
6:35 AM -	6:50 AM	- Check fluid levels
6:50 AM -	8:00 AM	- Finish rigging up
8:00 AM -	12:30 PM	- Start drilling from 25'. 10.75" .375W surface nipple pre-set to 25' & cemented to surface
12:30 PM -	3:45 PM	- Drilling 9 7/8" hole, started to get wet at 505', shut down for the day
3:45 PM -	4:00 PM	- Pull out of hole 3 stands & shut down
4:00 PM -	4:35 PM	- WQSP # 5 to Carlsbad

October 13, 1994

WQSP # 5

5:50 AM -	6:30 AM	- Carlsbad to WQSP # 5
6:30 AM -	6:45 AM	- Check fluid levels
6:45 AM -	8:05 AM	- Trip back in hole to start drilling
8:05 AM -	11:15 AM	- Drilling 9 7/8" hole from 505' to 648' on mist pump using foam
11:15 AM -	11:30 AM	- Circulate hole to clean up
11:30 AM -	12:15 PM	- Trip out of hole to set up coring operation.
12:15 PM -	1:45 PM	- Pick up core barrel assembly and go in hole to core
1:45 PM -	2:15 PM	- Pull up and put on 5' pup joint.
2:15 PM -	4:15 PM	- Coring 1st run 8 1/2" bit cutting 4" core
4:15 PM -	4:25 PM	- Circulate foam, clean up before T.O.O.H.
4:25 PM -	5:25 PM	- T.O.O.H.
5:25 PM -	5:45 PM	- Breakout core barrel, lay down inner barrel
5:45 PM -	6:30 PM	- Pump out core, recovered 22'10"
6:30 PM -	7:00 PM	- Load core tools
7:00 PM -	7:40 PM	- WQSP # 5 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 18, 1994

WQSP # 5

5:50 AM -	7:40 AM -	Odessa to WQSP # 5
7:40 AM -	7:50 AM -	Move and spot logging trailer
7:50 AM -	8:10 AM -	Wait on logger
8:10 AM -	11:00 AM -	Run camera in WQSP # 5
11:00 AM -	12:50 PM -	Trip pipe back in well
12:50 PM -	2:00 PM -	Ream hole from 8 1/2" to 9 7/8" from 648' - 683'
2:00 PM -	2:30 PM -	Clean out hole
2:30 PM -	3:05 PM -	Pull 8 jts of drill pipe and secure rig for the day
3:05 PM -	4:00 PM -	Get load of water & pump diesel
4:00 PM -	4:30 PM -	WQSP @ 5 to Carlsbad

11:00 AM - 1:00 PM - Barrett pulled pump out of WQSP # 4

October 19, 1994

WQSP # 5

5:30 AM -	6:30 AM -	Carlsbad to WQSP # 5
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	8:00 AM -	Trip pipe back to bottom & clean out hole
8:00 AM -	8:50 AM -	Trip pipe out of hole
8:50 AM -	9:50 AM -	Run 2" trimmie line
9:50 AM -	11:20 AM -	Run 5" fiberglass casing, screen
11:20 AM -	12:30 PM -	Gravel pack well w/8-16 gravel
12:30 PM -	1:00 PM -	Mix bentonite seal & pumped
1:00 PM -	1:45 PM -	Wait on cement trucks
1:45 PM -	2:30 PM -	Started cementing operations
2:30 PM -	3:00 PM -	Pull 2" trimmie line
3:00 PM -	3:30 PM -	Rig down
3:30 PM -	4:00 PM -	Move to WQSP # 3, start rigging up & get load of water
4:00 PM -	4:30 PM -	Secure rig and equipment
4:30 PM -	5:10 PM -	WQSP # 3 to Carlsbad

October 20, 1994

WQSP # 5

1:30 PM - 5:15 PM - Rigged up on WQSP # 5, started developing well with bailer, made 9 trips. TD of well 683', static water level 394'

WEST TEXAS WATER WELL SERVICE

October 21, 1994

WQSP # 5

Unit # 2

6:35 AM -	7:20 AM -	Arrive on location, check & service unit, prepare to run test pump
7:20 AM -	8:55 AM -	Run 3 HP test pump on 32 joints of 1" galvanized pipe, pump set 672'
8:55 AM -	-	Start pumping well @ 13.25 GPM
9:00 AM -	-	12.75 GPM
9:05 AM -	-	11.75 GPM
9:10 AM -	-	11 GPM
9:15 AM -	-	10.25 GPM
9:20 AM -	-	2.50 GPM with 150# backpressure
9:25 AM -	-	2.75 GPM
9:30 AM -	-	2.50 GPM
9:40 AM -	-	3 GPM
9:45 AM -	-	3 GPM shut down & allow to recover
10:10 AM -	-	Start surging well to further develop
10:55 AM -	-	Start pumping, set rate @ 3:00 PM, 150# backpressure
3:00 PM -	-	Pump was shut off, making .8 GPM

October 24, 1994

WQSP # 5

Unit # 2

9:35 AM -	-	Start surging
11:35 AM -	-	Start test 225 GPM @ 150# back pressure
12:50 PM -	-	1.75 GPM @ 170# back pressure
2:20 PM -	-	2.5 GPM @ 150# back pressure
2:30 PM -	-	2.75 GPM @ 150# back pressure
2:40 PM -	-	1.75 GPM @ 150# back pressure
3:15 PM -	-	1.75 GPM @ 0# back pressure
3:25 PM -	-	1.75 GPM
3:45 PM -	-	1.9 GPM
3:50 PM -	-	1.9 GPM
		Shut down for the day

WEST TEXAS WATER WELL SERVICE

October 25, 1994

WQSP # 5

Unit # 2

6:55 AM -	9:00 AM -	Surge well to further develop, and pump well at intermittent times
9:00 AM -	10:50 AM -	Pump well @ 2.1 GPM down to 1.9 GPM. Shut pump down and add 5 gallons of Clorox bleach to break down any existing polymer left in well between gravel pack & wellbore
10:50 AM -	12:00 PM -	Surge well to help break down and further develop formation
12:00 PM -	4:00 PM -	Install 2 GPM choke and begin pumping well at 2.6 GPM with 170# back pressure
1:00 PM -	-	1.85 GPM @ 70 #
4:00 PM -	-	1.8 GPM @ 50#
		Shut down unit for the day

October 26, 1994

WQSP # 5

Unit # 2

7:00 AM -	7:20 AM -	Arrive on location, service & check unit, rig up and prepare to pull pump
7:20 AM -	9:15 AM -	Pull test pump
9:15 AM -	10:30 AM -	Remain rigged up, load & secure trailer, wait on logging unit
10:30 AM -	2:10 PM -	Run logs on WQSP # 5, rig down, go to WQSP # 3 to log

WQSP # 5

Unit # 2

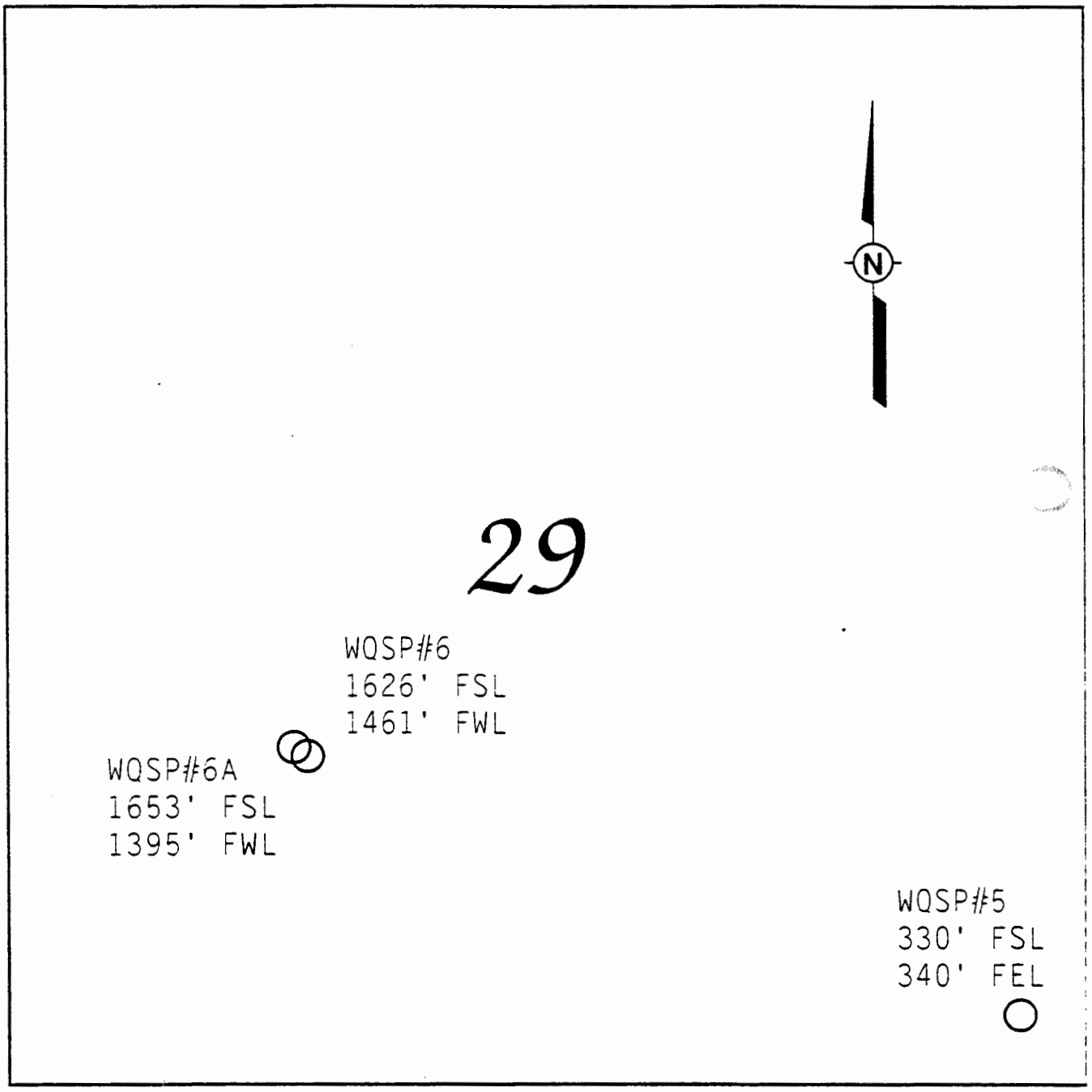
7:00 AM -	-	Arrive on location ,service & check unit, rig up and prepare to pull test pump
7:20 AM -	9:15 AM -	Pull test pump
9:15 AM -	10:00 AM -	Load and secure trailer to move to WQSP # 3
10:00 AM -	10:30 AM -	Wait on logging unit
10:30 AM -	2:10 PM -	Run logs and move to WQSP # 3

WQSP #5
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#6

Section 29, T22S, R31E



Location of WQSP #6

WQSP #6
Condensed Well Summary

Location:	Section 29, T22S, R31E 1626 ft from the south line 1461 ft from the west line	
Elevation: (Top of Casing)	3363.8 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 22, to October 4, 1994 617 ft below land surface 568 to 617 ft every 20 ft

WQSP #6
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-68	
Dewey Lake Redbeds	68-409	
Rustler Formation	409-620	
• Forty Niner Member	409-474	
• Magenta Member	474-497	
• Tamarisk Member	497-588	568-582 partial
• Culebra Member	588-606	582-607
• Partial lower unnamed member	606-620	607-617 partial
Maximum Recorded Depth	620	617

WQSP #6
CUTTINGS DESCRIPTION

WQSP #6
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
09/22/94	1050	1**	5	Surficial deposits
	1110	2**	25	Mudstone, sandstone, and clay
09/26/94	0903	3	45	Mudstone with green reduction spots
	0914	4	65	Sandstone with green reduction spots
	1015	5	85	Sandstone with green reduction spots
	1030	6	105	Siltstone, trace gypsum
	1043	7	125	Siltstone, damp
	1055	8	145	Siltstone and sand, damp
	1112	9	165	Sandy siltstone, damp
	1147	10	185	Mudstone and sand
	1203	11	205	Mudstone and sandstone
	1245	12	225	Sandstone, mudstone with green reduction spots, gypsum
	1325	13	245	Sandstone, siltstone, and selenite
	1340	14	265	Sandstone, selenite, and siltstone, limited sample
	1410	15	285	Sandstone and sandy siltstone with green reduction spots, selenite
	1435	16	305	Sandstone and gypsum
	1515	17	325	Sandy siltstone, sandstone, selenite
	1540	18	345	Sandy siltstone, sandstone, minor gypsum
	1550	19	365	Sandstone and siltstone with green reduction spots
09/27/94	1010	20	385	Sandy siltstone and sandstone with green reduction spots, minor gypsum
	1045	21	405	Gypsum, sandstone, and sandy siltstone
09/28/94	1035	22	425	Anhydrite, gypsum, and sandstone with green reduction spots
	1155	23	445	Anhydrite and gypsum
	1235	24	465	Anhydrite and gypsum

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #6
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1325	25	485	Anhydrite, gypsum, dolomite
	1410	26	505	Anhydrite, trace dolomite
	1520	27	525	Anhydrite
09/28/94	1645	28	545	Anhydrite and gypsum
	1810	29	565	Mud, minor anhydrite and gypsum, limited sample
	1835	30	568	Anhydrite and mud

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #6
CULEBRA CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA
FORM 140

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/9

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Wat
Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29 10:10	1	568.0 570.0 572.0 574.0 576.0 578.0 580.0	93		F	568.0 - 582.0 ft: light to dark gray mottled microcrystalline anhydrite with 1-2 mm wavy gypsum laminae. Horizontal fracture at 569.7 ft overlain by ~0.75 cm thick gypsum band. Interval of sparsely laminated anhydrite from 570.0 - 571.2 ft with numerous 1-2 mm isolated euhedral gypsum crystals. A prominent 2-4 cm thick continuous gypsum vein (vertical) occurs from 576.0 - 580.0 ft. Gradational contact between Tamarisk Member and underlying Culebra Member.	Tamarisk Member c Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29		580.0				See previous page.	Tamarisk Member of Rustler Formation
		582.0				582.0 - 585.0 ft: brown-gray microcrystalline dolomite with (0.25-1 cm) open vugs and moderate horizontal fractures ~2 cm wide band of dolomite with rounded anhydrite clasts (~0.5 cm) at 582.2 ft.	Culebra Member of Rustler Formation
	1	584.0	95				
		586.0				585.0 - 596.6 ft: light olive gray, thinly laminated microcrystalline dolomite with numerous small open vugs (1-2 mm) and moderate horizontal fracturing. Vugs increase in size, decrease in frequency and are sparse and fibrous gypsum filled at 589.9 ft. A continuous 1-2 mm gypsum-filled fracture occurs from 590.3 - 591.1 ft. Highly fractured clayey intervals with bladed gypsum crystals and numerous open vugs from 589.9 - 590.3 ft and 591.1 - 591.2 ft. (continued on next page)	
		588.0					
		590.0			GF CF		
		592.0					

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29	1	592.0	95	OV		Toward base of unit vugs decrease in size and increase in frequency. Clay filled fractures and thin (0.5-1 mm) gypsum healed fractures increase in frequency with depth. Fractures are thin, wavy, and discontinuous.	Culebra Member of Rustler Formation
		594.0		OV			2 feet of core loss
					LF		
				OV	GF		
		596.0		OV			
1:38							
9/30	2		87.5			596.6 - 606.85 ft: same dolomite as above. Upper foot interbedded with vuggy (up to 0.25 cm) dolomite rubble in a red-brown mud/clay matrix. 597.6 - 600.2 ft: dolomite is clayey, highly fractured with numerous (1-2 mm) open vugs. Remainder of unit is competent with numerous small vugs, some connected by dissolution to form vertical and horizontal bands up to 3 cm in length. Thin, discontinuous gypsum-healed fractures (1-2 mm) increase in frequency with depth. (continued on next page)	
		598.0		OV			2.5 feet of core loss
				OV			
					CF		
				OV			
		600.0		OV			
				OV			
		602.0		OV			
					GF		
				OV			
		604.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94
DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/30	2	604.0	87.5	OV, ΦV	GF	Toward base of unit, vugs decrease with some becoming gypsum filled. Contact between Culebra Member and underlying unnamed member is sharp.	Culebra Member of Rustler Formation
		606.0				606.85 - 608.1 ft: black plastic clay with rare isolated gypsum crystals (1-2 mm).	Unnamed Member of Rustler Formation
		608.0				608.1 - 615.2 ft: upper 2 ft black-brown clay interbedded with light gray anhydrite grading to red-brown mudstone with numerous light gray-pinkish anhydrite interbeds, high angle veins, and stringers.	
		610.0					
		612.0					
		614.0					
		616.0				615.2 - 616.6 ft: light-dark gray mottled anhydrite with thin (1-2 mm) wavy gypsum laminae.	

WIPP CORE-LOG INVENTORY

INTERA
FORM 140(

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/9

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

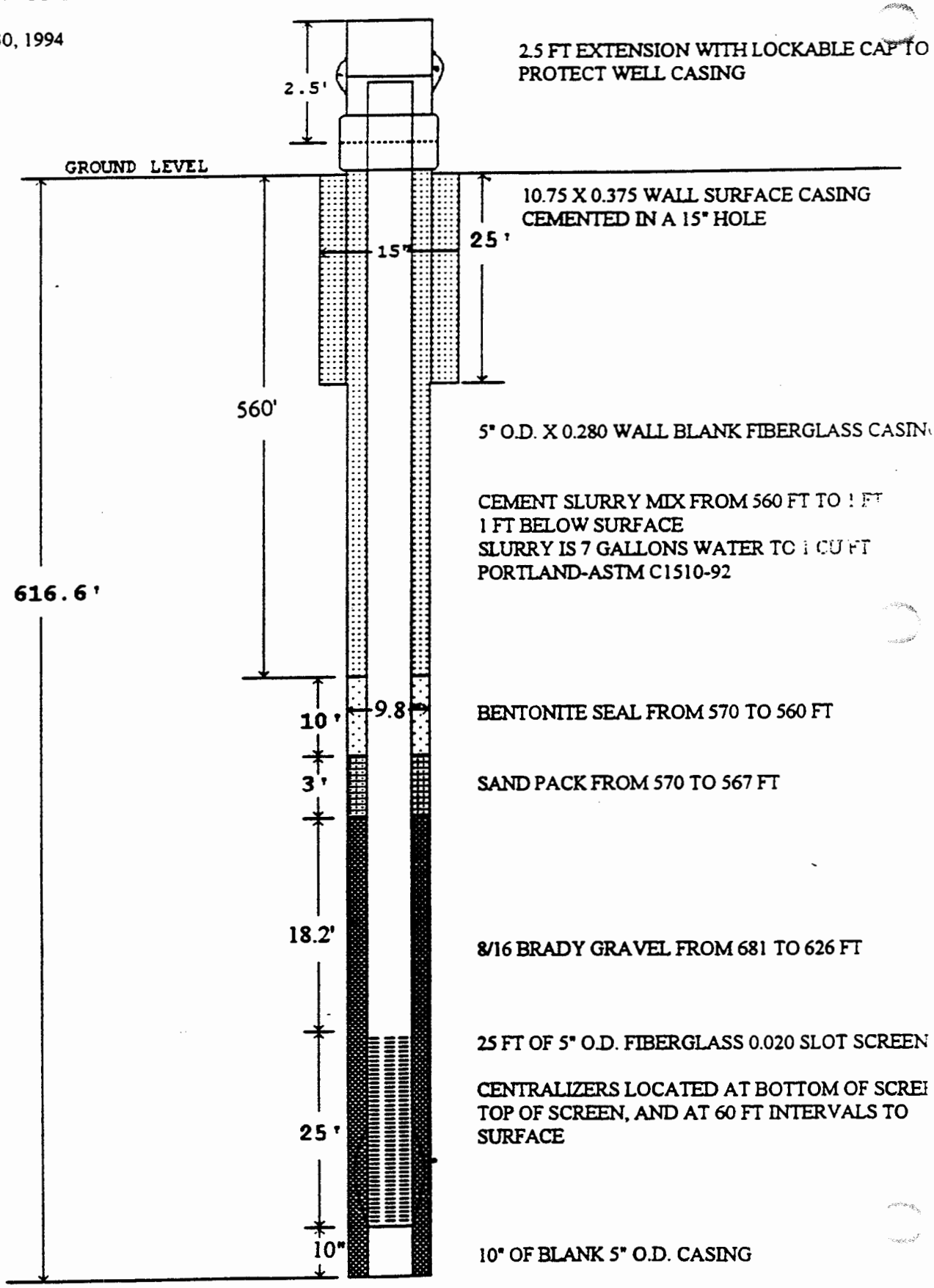
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/30	2	616.0	87.5			See previous page.	Unnamed Member o Rustler Formation
		618.0					
		620.0					

WQSP #6
HOLE HISTORY

WIPP Project
WQSP #6
Eddy County, New Mexico

September 22-30, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 5 & WQSP # 6

9:00 AM - 12:00 PM - Drilled, set 10.75" surface casing, cemented

September 23, 1994

WQSP #'s 2 & 6

6:00 AM - 6:40 AM - Carlsbad to WQSP # 2
6:40 AM - 8:15 AM - Rigged down on WQSP # 2, cleaned up location & moved to WQSP # 6
8:15 AM - 12:00 PM - Rigged up on WQSP # 6, lined pit, put rotating head on, and shut down for weekend
12:00 PM - 2:00 PM - WQSP # 6 to Odessa

September 26, 1994

WQSP # 6

5:40 AM - 7:40 AM - Odessa to WQSP # 6
7:40 AM - 8:00 AM - Service rig
8:00 AM - 11:20 AM - Drilling 9 7/8" hole on air
11:20 AM - 4:00 PM - Started drilling on air/mist pump due to amount of water being made in Dewey Lake formation. Est. 40-50 GPM
4:00 PM - 4:15 PM - Trip pipe out of hole 200'. Total footage for the day 367'
4:15 PM - 4:30 PM - Secure rig for the day

September 27, 1994

WQSP # 6

6:15 AM - 6:50 AM - Carlsbad to WQSP # 6
6:50 AM - 7:00 AM - Service rig
7:00 AM - 8:10 AM - Fill pits with brine water and mix sw gel
8:10 AM - 9:30 AM - Trip in hole, had 15' of fill, cleaned out & circulated 30 minutes
9:30 AM - 11:40 AM - Drilling 9 7/8" hole on fluid from 367'-415'
11:40 AM - 12:30 PM - Take yoke off drive shaft, return to Odessa for parts
12:30 PM - 4:00 PM - Rig down waiting on parts
4:00 PM - 5:00 PM - Replace parts & ready rig for drilling Wednesday morning

WEST TEXAS WATER WELL SERVICE

September 28, 1994

WQSP # 6

6:00 AM	6:35 AM	Carlsbad to WQSP # 6
6:35 AM	6:45 AM	Check fluid levels
6:45 AM	6:50 AM	Trip pipe back to bottom
6:50 AM	7:50 AM	Drilled 4'
7:50 AM	10:10 AM	Make bit trip
10:10 AM	4:00 PM	Drilling 9 7/8" hole
4:00 PM	4:20 PM	Circulate bottoms up, look as samples
4:20 PM	6:50 PM	Continue drilling to core point. Quit drilling @ 568'
6:50 PM	7:00 PM	WQSP # 6 to Carlsbad

September 29, 1994

WQSP # 6

5:45 AM	6:20 AM	Carlsbad to WQSP # 6
6:20 AM	6:30 AM	Check fluid levels
6:30 AM	6:50 AM	Trip back to bottom
6:50 AM	7:00 AM	Circulate
7:00 AM	7:40 AM	Trip out of the hole - 568'
7:40 AM	8:45 AM	Rig up core tools
8:45 AM	10:10 AM	Trip in the 1st run with core barrel
10:10 AM	10:30 AM	Circulate
10:30 AM	2:30 PM	Coring - very slow on fluid
2:30 PM	2:50 PM	Circulating
2:50 PM	3:40 PM	Coming out of hole 28' cut 596'
3:40 PM	4:00 PM	Breakdown core barrel, lay on ground
4:00 PM	4:30 PM	Pick up core barrel T.I.H.
4:30 PM	5:00 PM	Pump core out of first barrel
5:00 PM	5:15 PM	Secure rig for day

WEST TEXAS WATER WELL SERVICE

September 30, 1994

WQSP # 6

5:50 AM -	6:20 AM -	Carlsbad to WQSP # 6
6:20 AM -	6:30 AM -	Check fluid levels
6:30 AM -	7:00 AM -	Trip pipe and core barrel in hole for 2nd run
7:00 AM -	8:30 AM -	Clean out 12' of fill before coring
8:30 AM -	11:30 AM -	Core from 596' - 616.6'
11:30 AM -	11:50 AM -	Circulate
11:50 AM -	1:00 PM -	Trip out of hole
1:00 PM -	1:40 PM -	Lay down core barrel and pump out core
1:40 PM -	2:25 PM -	Breakdown core tools and load on trailer
2:25 PM -	2:50 PM -	Trip collars in hole
2:50 PM -	3:00 PM -	Shut down operations and secure rig for weekend
3:00 PM -	5:00 PM -	WQSP # 6 to Odessa

October 3, 1994

WQSP # 6

5:30 AM -	7:30 AM -	Odessa to WQSP # 6
7:00 AM -	7:40 AM -	Check fluid levels
7:40 AM -	8:40 AM -	Trip in hole with drill pipe
8:40 AM -	11:30 AM -	Ream hole from 8 1/2" to 9 7/8"
11:30 AM -	12:30 PM -	Circulate and condition hole for logging
12:30 PM -	1:30 PM -	Trip out of hole for logs
1:30 PM-	3:30 PM -	Log well - 616.60'
3:30 PM -	4:00 PM -	Shut down operations for day

UNIT 2

5:30 AM -	7:30 AM -	Odessa to WQSP # 6
7:30 AM -	9:00 AM -	Unload screen storage pad south of site, and load surface casing on trailer
9:00 AM -	10:00 AM -	Unload surface casing @ WQSP # 4 and WQSP # 3
10:00 AM -	1:30 PM -	Set & cement surface on WQSP #'s 3 & 4
1:30 PM -	2:00 PM -	Load trimmie line on trailer to take to WQSP # 6
2:00 PM -	4:00 PM -	Help out at WQSP # 6 preparing to run casing 10-4-94

WEST TEXAS WATER WELL SERVICE

October 4, 1994

WQSP # 6

6:00 AM -	6:35 AM -	Carlsbad to WQSP # 6
6:35 AM -	6:45 AM -	Check fluid levels
6:45 AM -	7:00 AM -	Run weighted joint on sandline in well to check for fill - none found
7:00 AM -	7:45 AM -	Move rig and reset, prepare to run 2" trimmie line
7:45 AM -	8:30 AM -	Run 2" trimmie line
8:30 AM -	10:00 AM -	Run 5" OD fiberglass casing & screen. 10' blank, 25' of .020 slot screen, 584.10' of blank casing
10:00 AM -	11:15 Am -	Trimmie lined 2100# of 8/16 gravel pack into well
11:15 AM -	12:00 PM -	Mixed sw gel/water plug to pump on top of gravel pack for bentonite seal
12:00 PM -	1:45 PM -	Wait on cement
1:45 PM -	3:10 PM -	Circulate cement from top of bentonite seal to surface
3:10 PM -	3:30 PM -	Pull trimmie line
3:30 PM -	4:00 PM -	Rig down and move to WQSP # 4
4:00 PM -	5:00 PM -	Rig up and line pit on WQSP # 4
5:00 PM -	5:40 PM -	WQSP # 4 to Carlsbad

October 5, 1994

WQSP # 6 TD 616.6

1:00 PM -		Arrived on location, set up and grease unit Change out bailers and go in the hole
1:45 PM -		Fluid level @ 174' due to mud left inside casing
1:45 PM -	4:00 PM -	Bailed on well to develop, remove mud and fines, made 33 trips with bailer, retrieving 335 gallons of fluid. Shut down for the day, returned to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 6, 1994

WQSP # 6

Unit # 2

6:45 AM	-	Arrive at location, check unit and prepare to bail
6:55 AM	-	Start bailing, water level recovered to 417' overnight
6:55 AM - 10:00 AM	-	Continued bailing well to develop. Bailed water level to 605' in 31 trips, recovering 315 gallons of fluid. Let well set for 10 minutes, fluid level recovered 5 1/2 '
10:00 AM - 10:45 AM	-	Made 5 more runs with bailer, shut down operations to go and get water truck
10:45 AM - 11:45 AM	-	WQSP # 6 to WQSP # 4 to get water truck
11:45 AM - 12:00 PM	-	Dump 20 bbls of fresh water to help break-down mud in form & further develop well
12:00 PM - 12:10 PM	-	Rig up unit to start bailing again
12:10 PM - 3:35 PM	-	Bailed on well - water level 585'
3:35 PM - 4:45 PM	-	Work on hydraulic pump on unit & shut down for the day

October 7, 1994

WQSP # 6

Unit # 2

7:30 AM - 7:45 AM	-	Arrive on location, set up unit & prepare to bail
7:45 AM - 8:00 AM	-	Started bailing well - water level @ 413' made 5 trips with bailer, laid bailer down and prepared to run pump
8:00 AM - 9:50 AM	-	Ran 1 1/2 HP 5 GPM to further develop well, ran air line provided by Ron to determine fluid level, since well is a marginal producer
9:50 AM - 10:30 AM	-	Rig up test equipment, hook up generator to run pump
10:30 AM	-	Start pumping well, meter reading 019393, pumping 7.5 GPM
10:47 AM	-	Stop pumping to let well recover
12:00 PM	-	Start pump @ 6 GPM with 23# back pressure
12:12 PM	-	Stop pump, pressure drop to 0#
1:47 PM	-	Start pump @ 6 GPM 23#
1:51 PM	-	Stop pump
3:00 PM	-	Start pump @ 6 GPM 22#
3:08 PM	-	Stop pump had 4#
3:15 PM	-	Shut down operations

WEST TEXAS WATER WELL SERVICE

October 10, 1994

Unit # 2

8:30 AM - - Arrive @ WQSP # 6, rig up on well to lower pump 10'; top of pump set @ 598'. Airline 99#, swl 364.3'

8:47 AM - - Start pump w/gate valve open - well pumping 7.5 gpm

8:52 AM - - Airline pressure 80#, back pressure 20#, 7.5 gpm, pumping level 408.2'

8:56 AM - - Increased back pressure to 60#, pumping 5.75 gpm

	Airline Pressure	Back Pressure	GPM	Draw-down	Pumping level
8:58 AM	80#	60#	5.5	94.7'	459.1'
9:00 AM -	48#	60#	5.5	117.8'	482.1'
9:02 AM -		80#	5		
9:04 AM -	42#	80#	5	131.7'	496'
9:05 AM -	40#	80#	5	136.3'	500.6
9:10 AM -	30#	75#	4.5	159.4'	
9:15 AM -	23#	100#	3.5	175.6'	
9:20 AM -	18#	97#	3.25	187.1'	539.9'
9:25 AM -	13#	110#	2.75	198.7'	563'
9:30 AM -	11#	120#	2	203.3'	567.6'
9:35 AM -	10#	130#	1.25	205.6'	569.9'
9:40 AM -	9#	130#	1.25	207.9'	572.2'
9:45 AM -	8#	129#	1.25	210.2'	574.5'
9:50 AM -	8#	135#	1	210.2'	574.5'
9:55 AM -	7#	135#	.75	212.5'	576.8'
10:00 AM -	6#	135#	.75	214.8'	579.1'
10:05 AM -	6#	135#	.75	214.8'	579.1'
10:10 AM -	5#	135#	.75	217.1'	581.4'
10:20 AM -	5#	135#	.75	217.1'	581.4'
10:30 AM -	5#	135#	.75	217.1'	581.4'
10:40 AM -	<5#	135#	.75	217.1'	581.4'
10:50 AM -	<5#	140#	.50	217.1'	581.4'
11:00 AM -	<5#	140#	.50	217.1'	581.4'
11:15 AM -	<5#	140#	.50+	217.1'	581.4'
11:30 AM -	5#	140#	.50+	217.1'	581.4'

Shut pump off and started recovery test of well

WEST TEXAS WATER WELL SERVICE

October 10, 1994

11:30 AM -	5#
11:31 AM -	5#
11:32 AM -	5#+
11:33 AM -	5#+
11:34 AM -	5#+
11:35 AM -	6#
11:40 AM -	6#+
11:45 AM -	7.5#
11:50 AM -	8#
11:55 AM -	10#
12:00 PM -	10#
12:10 PM -	12#
12:20 PM -	14#
12:30 PM -	17#
12:45 PM -	20#
1:00 PM -	23#
1:30 PM -	29#
2:30 PM -	38#
3:30 PM -	46#
10-11-94	
6:30 AM -	90#
7:30 AM -	92#

October 12, 1994

Unit @ 2

8:30 AM -	Arrived on WQSP # 6, rig up pulling unit to pull test pump
9:00 AM - 11:00 AM -	Pulled test pump and moved to WQSP # 4
11:00 AM - 1:30 PM -	Rigged up and waited on cement
1:30 PM - 4:00 PM -	Bailed on well to develop and clean up any fines left by gravel pack TD 800'

WQSP #6
GEOPHYSICAL LOGS

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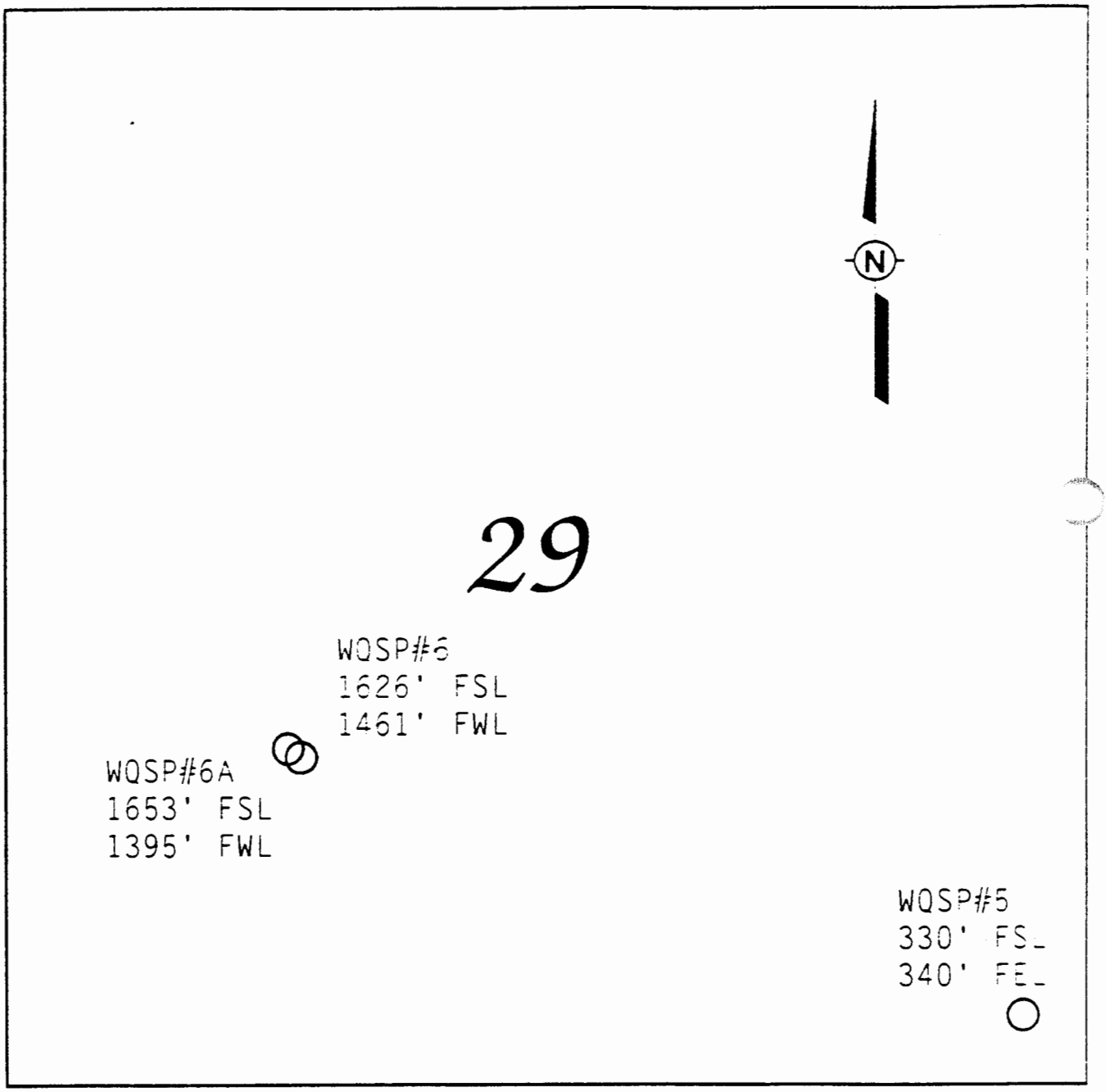
Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

WQSP#6a

Section 29, T22S, R31E



Location of WQSP #6a

WQSP #6a
Condensed Well Summary

Location:	Section 29, T22S, R31E 1653 ft from the south line 1395 ft from the west line	
Elevation: (Top of Casing)	3364.7 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 28, to November 1, 1994 225 ft below land surface 160 ft to 220 ft every 20 ft

WQSP #6a
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-35	
Dewey Lake Redbeds (partial)	35-220	160-220

WQSP #6a
CUTTINGS DESCRIPTION
(see WQSP 6)

WQSP #6a
DEWEY LAKE FORMATION
CORE DESCRIPTION

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/31 10:00		160.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation
		162.0					
		164.0					
		166.0					
		168.0					
		170.0					
		172.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94
DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/31	1	172.0 174.0 176.0 178.0 180.0 182.0 184.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation

WIPP CORE-LOG INVENTORY

INTERA FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		184.0					
	1	186.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation 2.5' of core loss
		188.0					
10/31 11:00		190.0					
10/31 12:35		192.0				191.0 - 192.6 ft: crumbly, highly fractured red-brown siltstone with reduction spots (gray-green) and some gray-green clay lenses.	
	2	194.0				192.6 - 205.6 ft: see next page.	
		196.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94
DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		196.0				192.6 - 205.6 ft: Competent dark red-brown siltstone with coarsely crystalline anhydrite occurring in 1-2 mm horizontal bands along bedding planes. Numerous reduction spots (1-2 mm, up to 0.5 cm) in varying frequency, isolated and in bands. Thin (1-2 mm) randomly oriented gypsum-healed fractures. Siltstone is coarser grained and appears more porous along bedding planes. Clayey, rubbly intervals occur from 203.2-203.4 ft and 205-205.6 ft.	Dewey Lake Formation
		198.0					
		200.0					
		202.0					
		204.0					
		206.0				205.6 - 220.0 ft: see next page.	
		208.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94
DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

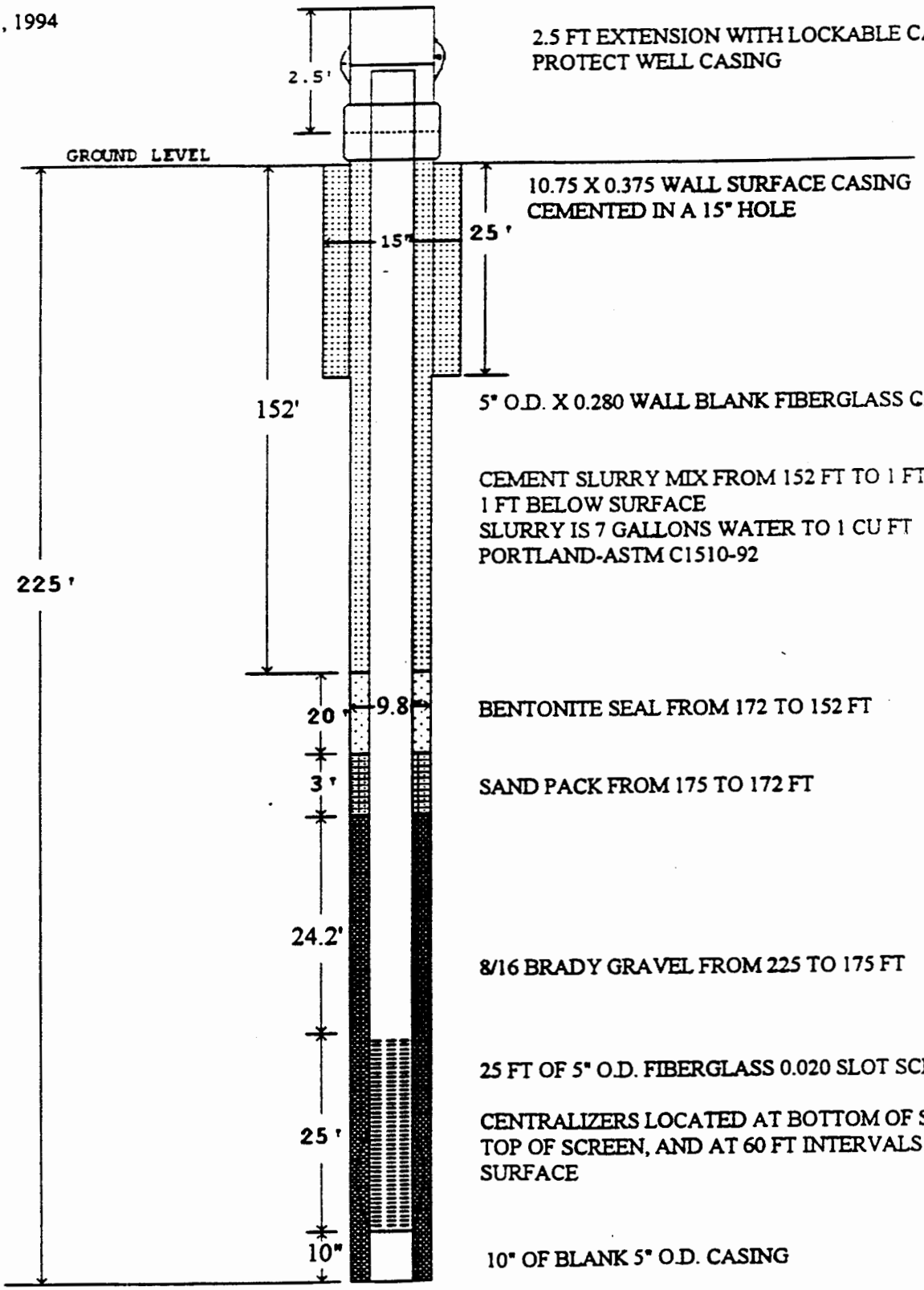
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/31	2	208.0 210.0 212.0 214.0 216.0 218.0 220.0				205.6 - 220.0 ft: competent light red-brown siltstone with very prominent, frequent, selenite bands, veins, and stringers. Prominent gray-green reduction bands and lenses. Unit has thin, wavy bedding.	Dewey Lake Formation

WQSP #6a
HOLE HISTORY

WIPP Project
WQSP #6a
Eddy County, New Mexico

October 28-31, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



WEST TEXAS WATER WELL SERVICE

October 28, 1994

WQSP # 6A

6:00 AM	6:40 AM	Carlsbad to WQSP # 3
6:40 AM	6:50 AM	Check fluid levels
6:50 AM	8:00 AM	Rig down on WQSP # 3
8:00 AM	9:30 AM	Work on rig
9:30 AM	10:10 AM	Rig up on WQSP # 6A
10:10 AM	11:30 AM	Drill 9 7/8" hole from 25' - 130'
11:30 AM	12:00 PM	Shut down and secure rig for weekend
12:00 AM	2:30 PM	WQSP # 6A to Odessa

October 31, 1994

WQSP # 6A

5:40 AM	7:35 AM	Odessa to WQSP # 6A
7:35 AM	7:50 AM	Check fluid levels
7:50 AM	8:00 AM	Trip pipe in hole
8:00 AM	8:15 AM	Wait on Mary and Ray
8:15 AM	8:40 AM	Drill 9 7/8" hole from 130' - 160'
8:40 AM	9:00 AM	Trip pipe out of hole & prepare to core
9:00 AM	10:15 AM	Rig up core barrel, trip in hole w/core assembly
10:15 AM	11:10 AM	Core from 160' - 191'
11:10 AM	11:50 AM	Pull core
11:50 AM	12:05 PM	Pick up 2nd inner barrel
12:05 PM	12:35 PM	Trip in hole with core barrel assembly
12:35 PM	1:20 PM	Coring from 191' - 220'
1:20 PM	2:00 PM	Trip out of hole and break down core barrel
2:00 PM	2:30 PM	Pump out core
2:30 PM	3:35 PM	Break down core barrel assembly and load on trailer
3:35 PM	3:55 PM	Service rig and shut down for the day
3:55 PM	4:00 PM	WQSP # 6A to Carlsbad

WEST TEXAS WATER WELL SERVICE

November 1, 1994

WQSP # 6A

5:50 AM - 6:30 AM - Carlsbad to WQSP # 6A
6:30 AM - 7:00 AM - Work on rig
7:00 AM - 8:20 AM - Wait on logging unit
8:20 AM - 9:55 AM - Run camera
9:55 AM - 10:55 AM - Run geophysical logs
10:55 AM - 12:10 PM - Trip pipe back in the hole & ream 8 1/2" to 9 7/8" hole from 160' - 225'
12:10 PM - 12:40 PM - Trip out of the hole to run casing
12:40 PM - 1:05 PM - Run trimmie line
1:05 PM - 2:00 PM - Run casing (10" x5" blank, 29.6' x5" fiberglass pipe with 25' .020 slot, 187' of 5" fiberglass blank)
2:00 PM - 2:40 PM - Start gravel packing from 225' - 175'
2:40 PM - 3:10 PM - Mix & pump bentonite seal 175' - 172'
3:10 PM - 4:00 PM - Cement through 2" trimmie line from 152' to surface
4:00 PM - 4:30 PM - Clean up grout machine, trimmie line, secure rig for the day
4:30 PM - 5:15 PM - WQSP # 6A to Carlsbad

November 2, 1994

WQSP # 6A

6:00 AM - 6:40 AM - Carlsbad to WQSP # 6A
6:40 AM - 11:15 Am - Rig down, pick up on location, secure load & depart for Odessa

Unit # 2

9:00 AM - 10:00 AM - Made 20 trips with bailer
10:00 AM - 10:45 AM - Run pump in well 6A to develop & test
10:45 AM - 11:15 AM - Rig up discharge and hook up to control box
11:15 AM - 12:00 PM - Wait on generator
12:10 PM - - Start pump to develop well-pumping 30 GPM
12:20 PM - - Pumping 30 GPM, clear no turbidity
12:35 PM - - Pumping 28 GPM, clear-shut off & surge 6 times
12:50 PM - - Started pumping 30 GPM, water clears up within 60 seconds
1:15 PM - - Pumping 28 GPM
1:25 PM - - Pumping 28 GPM
1:45 PM - - Pumping 28 GPM
2:15 PM - - Pumping 28 GPM

WQSP #6a
GEOPHYSICAL LOGS

Geophysical Log from DOE/WIPP 95-2154 has not been copied for inclusion in this report. This page is intentionally left blank.

Hole History Data for WQSP-6a (2 pages total).

FENIX & SCISSON, INC.

HOLE HISTORY DATA

02-19-80 Additional Work

DATE: 10-27-78

HOLE No.: WIPP Hydro #6A	W.O. No.:	I.D. No.:
USER: Sandia Lab	TYPE HOLE: Hydrologic	
LOCATION: New Mexico	COUNTY: Eddy	AREA: WIPP
SURFACE COORDINATES: **281.53' FNL, 272.77' FWL		GROUND ELEVATION: **
RIG ON LOCATION:	Started: 1-5-81	Recompleted: 1-23-81
CIRCULATING MEDIA: Air-water		
No. of COMPRESSORS & SIZE:		

BORE HOLE RECORD			CASING RECORD							
FROM	TO	SIZE	I. D.	WT./FT.	WALL	GRADE	CPL'G	FROM	TO	CU. FT. CMT.
* 0'	5'	Excav.		(5' x 5' cellar)				0'	5'	Dirt
* 5'	38'	18"	8.921"	36.00#		J-55	ST&C	2'	38'	72
38'	475'	7-7/8"	4.950"	15.50#		J-55	ST&C	0'	474.5'	155
475'	640'	4-3/4"	***							

TOTAL DEPTH: 640' MANDREL DEPTH PLUGS:

JUNK: None

LOGGING DATA: SURVEYS PAGE: CORING PAGE:

BOTTOM HOLE COORDINATES: 283.99' FNL, 273.22' FWL @ 527' REFERENCE: S-Sun #SUI.75-6123

NON-OPERATIONAL TIME		OPERATIONAL DELAY TIME		WORKING TIME	
Move Rig up & down	____ days	Equipment Repair	____ days	Drilling Time	____ day
Secured	____ days	Caving	____ days	Trip Time	____ day
Bail & Run Mandrel	____ days	Lost Circ.	____ days	Single Shot Survey Time	____ day
Logging	____ days	Fishing	____ days		____ day
Survey	____ days	W.O. Equipment	____ days	Total	____ day
Casing	____ days		____ days	Total Suspended Time	____ day
Cement	____ days		____ days	Secured	2.00 day
Coring	____ days		____ days	Repairs	0.15 day
	____ days		____ days	Working Time	0.81 day
TOTAL	____ days	TOTAL	____ days	TOTAL ELAPSED TIME	2.96 day

REMARKS: * Site prep items.

*** Packer and 2-3/8" tubing to 529.6', not cemented.

** Brass monument location: 285.10' FNL, 270.55' FWL, Sec. 18, T22S, R31E.

Elevation 3347.26'.

Horizontal deviation at 527' (deeper than driller's depth) was 2.50', S 10° 24' W, Sperry-Sun job #SUI.75-6123.

WDS:sjw

Rig No.	Name	Type	
3	Pennsylvania Drilling Co.		2.96 days
			____ days
			____ days
			____ days
			____ days
			____ days

WIPP HYDRO #6A
ADDITIONAL WORK

1-5-81	Ran USGS fluid probe and found fluid level at 289.75'.
1-20-81	Moved in Pennsylvania Drilling Company's rig #3 and rigged up. Ran 4-3/4" bit in the hole to 581' and unloaded hole with air. Reamed tight hole from 481' to 519' using mist drilling. Worked days only.
1-21-81	Repaired rig and reamed hole from 519' to 525'. Drilled 4-3/4" hole from 525' to 600'.
1-22-81	Drilled 4-3/4" hole from 600' to 640' and circulated hole clean. Ran Dresser Atlas caliper log.
1-23-81	Ran a Lynes inflatable bridge packer with a 1750# shear pin in the shut-in plug in the hole on 2-3/8" O.D., J-55, EUE tubing. Set top of the 4-1/4" O.D. x 66" packer element at 529.60'. Pulled tension on the tubing and hung in the tubing hanger slips. Moved out rig.

Appendix J

Material Safety Data Sheets for Materials used at Mudpit SWMUs

MSDSs and product information for bentonite-based muds, mud gels, and EZ MUD (13 pages total)

MSDSs and product information for surfactant additives, foaming agents, and defoamer (14 pages total)

MSDS for chemical wash CW-7 (5 pages total)

MSDS for cement (4 pages total)

MSDSs for the additives flocele and drispac (8 pages total)

MSDSs and product information for bentonite-based muds, mud gels, and EZ MUD (13 pages total)

WYOMING BENTONITE

INTERNATIONAL DRILLING FLUIDS, INC.
2707 North Loop West, Suite 550, Houston, Texas 77008
Emergency Telephone Number (713) 880-3883

MATERIAL SAFETY DATA SHEET

SECTION I PRODUCT IDENTIFICATION

Chemical Name: Bentonite, "Colloidal Clay"

Chemical Family: Hydrous Aluminum Silicates

Formula: $Al_2O_3 \cdot 4SiO_2 \cdot H_2O. (Ca_m Na_n)_x O$

Trade Name: Wyoming Bentonite

Application: Viscosifier and filtration reduces

Packaging: 100 lb sacks

SECTION II PHYSICAL DATA

Boiling Point: N/A

Specific Gravity: 2.5 gm/cm^3

Bulk Density: 54 lb/ft.^{3}

Solubility in Water: 3%

Vapor Pressure (mmHg): N/A

Vapor Density (air=1): N/A

Percent Volatiles by Weight: 10%

Evaporation Rate: N/A

Appearance and Odor: Pale grey to buff color, odorless

SECTION III HAZARDOUS INGREDIENTS

Hazardous Component	%	TLV
Silica	less than 1.5	27 mppcf
Total Mass	100	15 mg/M^3
Respirable Mass	—	5 mg/M^3

SECTION IV REACTIVITY DATA

Stability: Stable

Conditions to Avoid: None

Polymerization: Will not occur

Conditions to Avoid: None

Chemical Reactivity: None

Hazardous Decomposition Products: None

SECTION V FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method): Does not support combustion

Flammable Limits: None

LEL: N/A

UEL: N/A

Extinguishing Media: Carbon Dioxide, dry or chemical foam.

Special Fire Fighting Procedures: Will become slippery when wet. Wear self-contained breathing apparatus when fighting fires.

WYOMING BENTONITE

SECTION VI HEALTH HAZARD DATA

Threshold Limit Value: 5 mg/m^3 respirable dust

Effects of Overexposure:

Eyes: Redness, irritation, or abrasion may result from direct exposure.

Skin: No adverse effects are anticipated.

Inhalation: Respiratory tract irritation will result from exposure to concentrations greater than TLV, which may lead to severe lung damage.

Ingestion: Although considered non-toxic, excessive ingestion may cause cramping and constipation.

Emergency and First Aid Procedures:

Eyes: Do not touch eyes - flush immediately with warm water holding lids open to ensure complete removal. Seek medical attention if irritation persists.

Skin: Wash off with soap and water.

Inhalation: Remove immediately to fresh air. If irritation occurs or large concentrations inhaled, consult a physician.

Ingestion: Drink 2 glasses of water, each containing ½ teaspoon of salt. Consult a physician for persistant symptoms.

SECTION VII SPECIAL PRECAUTIONS

Precautionary Labeling: None

Handling and Storage: Do not handle with aqueous solutions or other aqueous adsorbent material. Material should not be opened and handled in unventilated areas.

SECTION VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: NIOSH/MSHA approved respirator, when concentration exceeds TLV. Particle dust mask required all other times.

Protective Gloves: Cotton gloves recommended **Eye Protection:** Dust goggles

Ventilation: Local exhaust required

Other: None

SECTION IX SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid adding water, the product will become slippery when moistened.

Waste Disposal Method: Place in approved sanitary landfill according to Federal, State, and local regulations.

SECTION X TRANSPORATION INFORMATION

DOT Classification: Not hazardous **Hazard Class:** Non-hazardous

DOT Proper Shipping Name: Not restricted

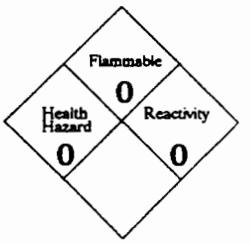
Required Labels: None

Other:

The information and recommendations are based upon data collected by International Drilling Fluids that are believed to be correct. However, no warranty, expressed or implied, is made with respect to the

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD IDENTIFICATION SYSTEM

Trade Name(s): EXTRA HIGH YIELD BENTONITE

Generic Name(s): Wyoming (Western) Bentonite (CAS No. 1302-78-9)

Chemical Name(s): Sodium Montmorillonite (CAS No. 1318-93-0)

Manufacturer: WYO-BEN, INC.
Address: P.O. Box 1979
Billings, Montana 59103

Telephone Numbers:
Information: (406) 652-6351
EMERGENCY: (406) 652-6351

Ingredient	CAS No.	%	Hazard
Crystalline Silica (SiO_2)	7631-86-9		Low concentrations of crystalline silica (SiO_2) in the form of quartz, crystobalite, and tridymite may be present in airborne bentonite dust. The concentration level of total free silica in airborne bentonite dust is variable depending upon origin of bentonite ore, fineness of product, moisture content of product, local humidity and wind conditions, etc. (See Section VI)

Boiling Point (°F): NA	Specific Gravity (H_2O=1): 2.45-2.55
Vapor Pressure (mm. Hg): NA	Melting Point: Approx. 1450°C
Vapor Density (Air = 1): NA	Evaporation Rate (Butyl Acetate = 1): NA
Solubility in Water: Insoluble, forms colloidal suspension.	pH: 8-10 (5% aqueous suspension)
Density (at 20° C): 55 lbs/cu.ft. as product.	

Appearance and Odor: Bluegray to green as moist solid, light tan to gray as dry powder. No odor.

Flash Point: NA	Flammable Limits: LEL: NA UEL: NA

Special Fire Fighting Procedures: NA

Unusual Fire and Explosion Hazards: None. Product will not support combustion.

Extinguishing Media: None for product. Any media can be used for the packaging.

Stability: Stable

Hazardous Polymerization: None

Incompatibility: None

Hazardous Decomposition Products: None

NA = Not Applicable ND = Not Determined

Date Prepared: March 9, 1990

Routes of Exposure and Effects:

Skin: Possible drying resulting in dermatitis.

Eyes: Mechanical irritant.

Inhalation: Acute (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough.

Chronic (long term) exposure to free silica containing airborne bentonite dust where levels are higher than TLV's may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion are symptomatic.

Ingestion: No adverse effects.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	ACGIH TLV
Bentonite as nuisance dust		
Total dust	$15 mg/m^3$	ND
Respirable dust	$5 mg/m^3$	ND
Crystalline Quartz (respirable)	$0.1 mg/m^3$	$0.1 mg/m^3$

Where crystobalite or tridymite are present use 1/2 of the PEL or TLV value for crystalline quartz.

Carcinogenicity: Bentonite is not listed by NTP, IARC or OSHA. IARC, 1987, concludes that there is limited evidence suggesting the carcinogenicity in humans of inhaled crystalline silica (IARC Class 2A).

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Skin: Wash with soap and water until clean.

Eyes: Flush with water until irritation ceases.

Inhalation: Move to area free from dust. If symptoms of irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

Steps to be Taken if Material is Released or Spilled: Avoid breathing dust; wear respirator approved for silica bearing dust. Vacuum up to avoid generating airborne dust. Avoid using water. Product slippery when wetted.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Use NIOSH/MSHA respirators approved for silica bearing dust when free silica containing airborne bentonite dust levels exceed PEL/TLV's. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.

Ventilation Requirements: Mechanical, general room ventilation. Use local ventilation to maintain PEL's/TLV's.

Respirator: Use respirators approved by NIOSH/MSHA for silica bearing dust.

Eye Protection: Generally not necessary. Personal preference.

Gloves: Generally not necessary. Personal preference.

Other Protective Clothing or Equipment: None

Avoid prolonged inhalation of airborne dust.

Shipping Name: Common Ground Clay (NOIBN)	Hazard Class: Not Hazardous

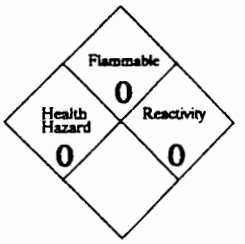
Hazardous Substance: None

Cautionary Labeling: None required

All information presented herein is believed to be accurate, however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD IDENTIFICATION SYSTEM

Trade Name(s): HYDROGEL®

Generic Name(s): Wyoming (Western) Bentonite (CAS No. 1302-78-9)

Chemical Name(s): Sodium Montmorillonite (CAS No. 1318-93-0)

Manufacturer: WYO-BEN, INC. Address: P.O. Box 1979 Billings, Montana 59103	Telephone Numbers: Information: (406) 652-6351 EMERGENCY: (406) 652-6351

Ingredient	CAS No.	%	Hazard
Crystalline Silica (SiO_2)	7631-86-9		Low concentrations of crystalline silica (SiO_2) in the form of quartz, crystobalite, and tridymite may be present in airborne bentonite dust. The concentration level of total free silica in airborne bentonite dust is variable depending upon origin of bentonite ore, fineness of product, moisture content of product, local humidity and wind conditions, etc. (See Section VI)

Boiling Point (°F): NA	Specific Gravity (H_2O=1): 2.45-2.55
Vapor Pressure (mm. Hg): NA	Melting Point: Approx. 1450°C
Vapor Density (Air = 1): NA	Evaporation Rate (Butyl Acetate = 1): NA
Solubility in Water: Insoluble, forms colloidal suspension.	pH: 8-10 (5% aqueous suspension)
Density (at 20° C): 55 lbs./cu.ft. as product.	

Appearance and Odor: Bluegray to green as moist solid, light tan to gray as dry powder. No odor.

Flash Point: NA	Flammable Limits: LEL: NA UEL: NA

Special Fire Fighting Procedures: NA

Unusual Fire and Explosion Hazards: None. Product will not support combustion.

Extinguishing Media: None for product. Any media can be used for the packaging.

Stability: Stable

Hazardous Polymerization: None

Incompatibility: None

Hazardous Decomposition Products: None

NA = Not Applicable ND = Not Determined

Date Prepared: March 9, 1990

Routes of Exposure and Effects:

Skin: Possible drying resulting in dermatitis.

Eyes: Mechanical irritant.

Inhalation: Acute (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough.

Chronic (long term) exposure to free silica containing airborne bentonite dust where levels are higher than TLV's may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion are symptomatic.

Ingestion: No adverse effects.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	ACGIH TLV
Bentonite as nuisance dust		
Total dust	15mg/m^3	ND
Respirable dust	5mg/m^3	ND
Crystalline Quartz (respirable)	0.1mg/m^3	0.1mg/m^3

Where crystobalite or tridymite are present use 1/2 of the PEL or TLV value for crystalline quartz.

Carcinogenicity: Bentonite is not listed by NTP, IARC or OSHA. IARC, 1987, concludes that there is limited evidence suggesting the carcinogenicity in humans of inhaled crystalline silica (IARC Class 2A).

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Skin: Wash with soap and water until clean.

Eyes: Flush with water until irritation ceases.

Inhalation: Move to area free from dust. If symptoms of irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

Steps to be Taken if Material is Released or Spilled: Avoid breathing dust; wear respirator approved for silica bearing dust. Vacuum up to avoid generating airborne dust. Avoid using water. Product slippery when wetted.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Use NIOSH/MSHA respirators approved for silica bearing dust when free silica containing airborne bentonite dust levels exceed PEL/TLV's. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.

Ventilation Requirements: Mechanical, general room ventilation. Use local ventilation to maintain PEL's/TLV's.

Respirator: Use respirators approved by NIOSH/MSHA for silica bearing dust.

Eye Protection: Generally not necessary. Personal preference.

Gloves: Generally not necessary. Personal preference.

Other Protective Clothing or Equipment: None

Avoid prolonged inhalation of airborne dust.

Shipping Name: Common Ground Clay (NOIBN)	Hazard Class: Not Hazardous

Hazardous Substance: None

Cautionary Labeling: None required

All information presented herein is believed to be accurate, however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

QUIK-GEL®
Viscosifier

QUIK-GEL® viscosifier is a finely ground, premium-grade western sodium bentonite, specially processed to promote ease of mixing and superior mud-making qualities in fresh water.

Recommended Uses

In Fresh Water or in Freshwater-based Drilling Fluids

Increasing hole-cleaning capabilities.

Forming on permeable sections of the well bore a thin filter cake that can be removed easily by backflushing.

Promoting hole stability in poorly consolidated and caving formations.

Reducing water seepage in permeable formations.

Avoiding or overcoming loss of circulation.

In Fresh Water

Making an economical, single-sack, low-solids drilling fluid.

Making gel-foam for air drilling.

Major Advantages

Effectiveness. QUIK-GEL® viscosifier makes more than twice as much mud of the same viscosity as an equal weight of API-standard bentonite.

Fast yield. QUIK-GEL viscosifier reaches high viscosity quickly.

Easy mixing. QUIK-GEL viscosifier saves time and effort in making mud.

Convenience. The 50-pound (22.7 kg) bag is easy to handle.

Environmental acceptability. QUIK-GEL viscosifier is not toxic and does not ferment.

Recommended Treatment

See table below.

Approximate Amounts of QUIK-GEL® Viscosifier Added to Fresh Water or to Freshwater Drilling Fluids

	lb/100 gal	lb/bbl	kg/m³
	Added to Fresh Water		
Under normal drilling conditions.	15-25	6-11	15-30
In gravel or other poorly consolidated formations.	25-40	12-18	35-50
To stop loss of circulation.	35-45	15-20	40-55
	Added to Freshwater Mud		
To improve performance: for better hole cleaning, thinner filter cake, and increased hole stability.	5-10	2-5	6-14

Method of addition: Preferably, mix by adding slowly through a jet mixer or high-speed stirrer. If such mixing equipment is not available, sift QUIK-GEL viscosifier slowly into the liquid close to the pump suction while circulating.

Packaging

QUIK-GEL® viscosifier is packaged in multiwall, water-resistant paper bags containing 50 pounds (22.7 kg).

Availability

QUIK-GEL® viscosifier may be purchased through any NL Baroid Service Center or from the Houston plant.

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DMD 34
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This product is environmentally safe. (See back of page).

NL Baroid, P.O. Box 1675, Houston, Texas 77251

NL Baroid
Drilling Fluids Products

EZ-MUD®

For Low Solids Drilling Fluids

EZ-MUD® is a white liquid, anionic polymer emulsion which is readily soluble in fresh or brackish water. EZ-MUD may be used to prepare a solids-free drilling fluid with exceptional hole stabilizing properties, or to improve the properties of low-solids QUIK-GEL® fluids and air/foam injection fluids. EZ-MUD drilling fluids are applicable to all types of drilling operations, including:

Water Wells
Diamond Coring
Minerals Exploration
Seismograph Shot Holes
Blast Holes
Monitor/Observation Holes
Soils and Foundation Investigations
Disposal/Injection Wells

Recommended Uses

EZ-MUD® can be used in plain water, in QUIK-GEL®/bentonite muds and in air/foam injection to:

Stabilize water-sensitive formations that swell, cave or disintegrate in ordinary drilling fluids.

Prevent mud rings, bit balling and booting-off in clay formations.

Reduce drill pipe torque and pumping pressure.

Eliminate rod chatter in diamond core drilling.

Improve properties of drilling fluids.

Major Advantages

Easy to mix. EZ-MUD® yields rapidly and completely with minimum shear.

Settles cuttings rapidly in pits. Prevents recirculation of drilled cuttings.

Lubricity. Reduces drillpipe torque and circulating pressure.

Clay-shale stability. Prevents swelling and disintegration of formation and gouge zone clays and shales.

Compatible with bentonite. Improves properties of QUIK-GEL®/bentonite mud.

Viscosifier. Rapid and efficient thickener to improve hole cleaning, control rod chatter in diamond core drilling, and stability in fractured sections of hole.

Non-toxic. Proven suitable for use in drilling potable water wells.

Non-fermenting. Not susceptible to loss of properties due to microorganic degradation. Biocides not required.

Filtration control. Effectively lowers water loss in QUIK-GEL®/bentonite and other drilling mud systems.

Cost effective. Small amounts produce desired results. Liquid form insures complete utilization of all EZ-MUD added.

Stable. EZ-MUD does not deteriorate in storage and is not subject to shear break-down characteristic of other polymers.

KCl salt addition. 3% by weight KCl can be added to enhance shale stabilization.

Non-damaging to producing formations. EZ-MUD is water-soluble.

Breaks down to water viscosity with sodium hypochlorite (Clorox®) treatment during well sterilization.

®EZ-MUD and QUIK-GEL are registered trademarks of NL Industries, Inc.

DMD-50
Printed in U.S.A.

NL BAROID, P.O. Box 1675, Houston, Texas 77251

Recommended Treatment

	Quarts Per 100 gal	Pints Per bbl	Liters Per m^3
Added to Fresh Water			
To formulate a solids-free drilling fluid			
• to stabilize water sensitive formations	1	1	2.5
• to stop rod vibration, reduce torque and pressure, increase hole stability	1.5	1.25	3.75
Added to QUIK-GEL®/Bentonite Drilling Mud			
To improve properties & performance:			
• better hole cleaning, thinner filter cake, increased hole stability	0.5	0.5	1.25
Added to Injection Liquid in Air/Foam Drilling			
To improve foam performance and hole conditions	0.5-1	0.5-1	1.25-2.5
Added to 3% KCl Drilling Fluids			
To improve performance and quality	2	1.75	5

Method of Addition

For best results:

- Mix through jet or mechanical hopper, no faster than 2 minutes per gallon.
- Mix with fresh water. Pretreat calcium with soda ash. Adjust to pH of 7.0 to 10.0.
- EZ-MUD® can be broken down with clorox (sodium hypochlorite). Use 0.5 gallons (not to exceed 0.7 gallons) Clorox per 100 gallons of EZ-MUD drilling fluid.

Environmental Information

EZ-MUD® is safe to use in any drilling operation, including potable water well, when added in recommended concentrations.

EZ-MUD has been found non-toxic when fed to animals in laboratory tests. No mortality was observed when fed to rats at levels of more than five thousand milligrams/kilogram of body weight.

EZ-MUD, in water solution, is odorless, colorless and tasteless. EZ-MUD does not ferment to produce objectionable odors, flavors or other undesirable results.

Physical Characteristics

Form: Opaque white to gray suspension, minimal synerisis.

Density: 8.8 lb/gal.

Packaging

EZ-MUD® is packaged in a five-gallon (U.S.) (18.9-liter) closed-top, high impact plastic container with a screw-on cap and carrying handle. EZ-MUD is also packaged in cardboard cartons containing four (4) one-gallon (3.8-liter) plastic jugs.

Availability

EZ-MUD® may be purchased through any NL Baroid Service Center, or from QUIK-GEL® Retailers.

Baroid
Environmental, Safety and Transportation Data Sheet

EZ MUD

I PRODUCT IDENTIFICATION

SUPPLIER BAROID DRILLING FLUIDS, INC.	TELEPHONE NO. 713/987-5900
ADDRESS P.O. BOX 1675 HOUSTON, TEXAS 77251	
TRADE NAME EZ MUD®	
GENERIC DESCRIPTION POLYACRYLAMIDE/POLYACRYLATE	

II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	%	HAZARD DATA
ISOPARAFFINIC PETROLEUM HYDROCARBON 64742-47-8	20-40	500 PPM OSHA

III PHYSICAL DATA

BOILING POINT (°F) 200	MELTING POINT NA	FREEZING POINT ND
SPECIFIC GRAVITY (H_2O = 1) 1.07	VAPOR PRESSURE (mm Hg) ND	
VAPOR DENSITY (AIR = 1) ND	SOLUBILITY IN H_2O, % BY WT. 70	
% VOLATILES BY VOL. 65	EVAPORATION RATE (BUTYL ACETATE = 1) SLOW	
APPEARANCE AND ODOR CREAM COLORED LIQUID, SLIGHT HYDROCARBON ODOR	Density @ 20° C: 8.6 LBS/GAL	
pH 8.4		

N/A = Not Applicable N/D = Not Determined

EZ MUD®

1 HEALTH HAZARD

1 FLAMMABILITY

0 REACTIVITY

Ratings based on NIOSH "Identification System for Occupationally Hazardous Materials" (1974)

All information, recommendations and suggestions herein concerning our product are based upon tests and data believed to be reliable, however, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by Baroid Corporation as to the effects of such use, the results to be obtained, or the safety and toxicity of the product nor does Baroid Corporation assume any liability arising out of use by others, of the product referred to herein. Nor is the information herein to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

BEST Sheet

IV FIRE AND EXPLOSION DATA

FLASH POINT: 200°F (SFCC)

EXTINGUISHING MEDIA: DRY-CHEMICAL, FOAM, CO_2

V HEALTH HAZARD INFORMATION

CARCINOGENICITY — NOT ON NTP, IARC OR OSHA LISTS

ACUTE ORAL LD_{50}	ACUTE DERMAL LD_{50}	AQUATIC TOXICITY (LC_{50})
5,000 mg/kg	ND	1000 mg/l

ROUTES OF EXPOSURE AND EFFECTS

EYE: MAY CAUSE IRRITATION. MAY CAUSE SLIGHT TEMPORARY CORNEAL INJURY.

SKIN: PROLONGED OR REPEATED CONTACT MAY CAUSE IRRITATION OR EVEN A BURN. MAY RARELY CAUSE ALLERGIC SKIN RESPONSE.

INGESTION: INGESTION OF LARGE AMOUNTS MAY CAUSE INJURY.

INHALATION: ASPIRATION OF MIST MAY CAUSE LUNG DAMAGE. INHALATION OF VAPORS IS NOT LIKELY TO CAUSE INJURY.

EMERGENCY AND FIRST AID PROCEDURES

EYES: FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. CALL A PHYSICIAN.

SKIN: WASH WITH SOAP AND WATER AFTER USE. LAUNDER CLOTHING BEFORE REUSE.

INGESTION: DO NOT INDUCE VOMITING. GIVE WATER. CALL A PHYSICIAN.

INHALATION: REMOVE TO FRESH AIR IF AFFECTED. CONSULT A PHYSICIAN.

BEST Sheet

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

NONE

INCOMPATIBILITY

ALKALINE, OXIDIZING MATERIALS

HAZARDOUS DECOMPOSITION PRODUCTS

INCOMPLETE THERMAL DECOMPOSITION MAY PRODUCE AMMONIA AND OXIDES OF NITROGEN.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

NONE

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

CONTAIN SPILL WITH ABSORBENT MATERIAL. PLACE IN CONTAINER FOR DISPOSAL. FINAL CLEAN-UP WITH DETERGENT AND WATER UNTIL SLIPPERY CONDITION IS ELIMINATED.

NEUTRALIZING CHEMICALS

NONE ARE REQUIRED

WASTE DISPOSAL METHOD

DISPOSE OF WASTE IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS.
THE INCLUSION OF EZ MUD IN A DRILLING MUD WILL NOT CAUSE THE DRILLING MUD TO BE CLASSIFIED AS A HAZARDOUS WASTE.

VIII INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS

GOOD GENERAL VENTILATION SHOULD BE SUFFICIENT

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY

NONE REQUIRED UNDER NORMAL CONDITIONS

EYE

GOGGLES.

GLOVES

RUBBER

OTHER CLOTHING AND EQUIPMENT

NONE

BEST Sheet

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

DO NOT TAKE INTERNALLY.
AVOID SKIN AND EYE CONTACT.
IF SPILLED MAY CAUSE SLIPPERY FLOOR CONDITIONS.

OTHER HANDLING AND STORAGE REQUIREMENTS

KEEP CONTAINERS CLOSED WHEN NOT IN USE

DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME: NONE

HAZARD CLASS: NOT HAZARDOUS

HAZARDOUS SUBSTANCE: NONE

LABELS: NONE

PREPARED BY **Baroid**
ENVIRONMENTAL SERVICES

DATE
9/22/87

MSDSs and product information for surfactant additives, foaming agents, and defoamer (14 pages total)

Occupational Safety and Health Administration

MATERIAL SAFETY DATA SHEET

DATE: September, 1984

SECTION I

Supplier's Name: The Western Company of North America	EMERGENCY TELEPHONE NO.: (817) 731-5100
ADDRESS (Number, Street, City, State, and ZIP Code): P. O. Box 186, Ft. Worth, TX 76101	
CHEMICAL NAME AND SYNONYMS: Proprietary blend	TRADE NAME AND SYNONYMS: De-emulsifier, Nine-40
CHEMICAL FAMILY: Surfactant	FORMULA: W.I.N. 100472

SECTION IA HAZARDOUS MATERIAL CLASSIFICATION

D.O.T. PROPER SHIPPING NAME	Flammable Liquid, n.o.s.
NAME OF HAZARDOUS COMPONENT	Methanol
HAZARD CLASS	Flammable Liquid
IDENTIFICATION NUMBER	UN1993
D.O.T. LABEL(S) REQUIRED	Flammable Liquid
PRECAUTIONARY LABEL	Attached

SECTION II - HAZARDOUS INGREDIENTS	%	TLV (Units)
Xylene	2	100pp
Methanol		200pp
Isopropanol		400pp
Heavy Aromatic Naphtha		100pp

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	162	SPECIFIC GRAVITY (H_2O=1)	0.881
VAPOR PRESSURE (mm Hg.)	200	PERCENT, VOLATILE BY VOLUME (%)	62
VAPOR DENSITY (AIR=1) @ 100°F	>5	EVAPORATION RATE (n-Butyl Acetate=1)	2.03
SOLUBILITY IN WATER	Dispersible		

APPEARANCE AND ODOR: light yellow liquid, hydrocarbon odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): 52°F Seta CC-ASTM	FLAMMABLE LIMITS	LEL: 9.8	UEL: 36.0

EXTINGUISHING MEDIA
Dry chemical, foam, water spray or water fog

SPECIAL FIRE FIGHTING PROCEDURES
Use water spray to cool fire exposed surfaces and to protect personnel.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Respiratory protection required for fire-fighting personnel.

(Continued on reverse side)

TRADE NAME: W.I.N. 100472, De-emulsifier, Nine-40

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Isopropanol, Methanol, Xylene, heavy aromatic naphtha (400, 200, 100, 100 ppm)

EFFECTS OF OVEREXPOSURE
Acute: Liquid is irritating to skin and eyes

Chronic: Prolonged or repeated skin contact may cause dermatitis

EMERGENCY AND FIRST AID PROCEDURES
Remove to fresh air. If not breathing, apply artificial respiration and call a physician. Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. If skin contact occurs, wash with soap and water.

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		None
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS
burning will emit smoke, fumes, CO and CO_2

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Keep public away. Eliminate source of ignition. Shut off source, if possible to do so safely. Prevent liquid from entering sewers, watercourses, or low areas. Advise authorities if material has entered a watercourse, or sewer or has contaminated soil or vegetation.

WASTE DISPOSAL METHOD
Contain spilled liquid with sand or earth. Recover by pumping or with suitable absorbent. Consult an expert on disposal of recovered material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Use NIOSH/MSHA approved respiratory protection such as air-supplied mask if used in confined spaces or other poorly ventilated areas.

VENTILATION		
	LOCAL EXHAUST Provide 300 fpm hood or face velocity for confined spaces.	SPECIAL Explosion-proof ventilation equipment.
	MECHANICAL (General) To provide ventilation equal to outdoors.	OTHER Not Applicable

PROTECTIVE GLOVES	EYE PROTECTION
Chemical resistant gloves	Chemical splash goggles

OTHER PROTECTIVE EQUIPMENT
Usually not needed.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Keep container closed when not in use. Containers used for this material may be hazardous when emptied. Observe all hazard precautions outlined in this sheet. Emptied containers retain product residues (vapor, liquid, etc.).

OTHER PRECAUTIONS
Keep away from heat, sparks and open flames.

Form OSHA-20

MATERIAL SAFETY DATA SHEET

DATE:

SECTION I

Supplier's Name The Western Company of North America	EMERGENCY TELEPHONE NO. (817) 731-5100
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 186, Ft. Worth, TX 76101	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS I-22
CHEMICAL FAMILY Surfactant Blend	FORMULA Proprietary W.I.N.499655

SECTION X - LABEL COPY

FOR INDUSTRIAL USE ONLY

FIRST AID:
FOR EYES: In case of contact, flush copiously with water immediately for 15 to 20 minutes. Get medical treatment.
FOR SKIN: In case of contact, wash with soap and water. Remove contaminated clothing and wash skin with soap and water. Launder clothing before re-use.
FOR INGESTION: If swallowed, drink water to dilute. Induce vomiting. Get emergency medical treatment for ingestion of methanol.
FOR INHALATION: If breathed in, remove from exposure. Control delirium, avoid respiratory depression.
HANDLING: Employees must wear

ATTENTION! After this container has been emptied, it may contain flammable and toxic liquid or vapor; observe all warnings and precautions listed for this product. Donot cut, puncture or weld on or near this container. Refer to MSDS and SPM-04-04 for other safety requirements.

MATERIAL SAFETY DATA SHEET

DATE: August 17, 1990

SECTION I

Supplier's Name: The Western Company of North America	EMERGENCY TELEPHONE NO.: (817) 731-5100
ADDRESS (Number, Street, City, State, and ZIP Code): P. O. Box 186, Ft. Worth, TX 76101	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS: T-22
CHEMICAL FAMILY: Surfactant Blend	FORMULA: Proprietary W.I.N. 499655

SECTION IA HAZARDOUS MATERIAL CLASSIFICATION

D.O.T. PROPER SHIPPING NAME	Flammable liquid (n.o.s.) (RQ /)
NAME OF HAZARDOUS COMPONENT	Methanol
HAZARD CLASS	Flammable liquid
IDENTIFICATION NUMBER	UN 1993
D.O.T. LABEL(S) REQUIRED	Flammable
PRECAUTIONARY LABEL	Flammable

SECTION II - HAZARDOUS INGREDIENTS

	%	TLV (Units)
Methanol (67561)	15-25	200
Heavy Aromatic Naptha (64742945)	3-[illegible]	100

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	ND	SPECIFIC GRAVITY (H_2O=1)	0.94
VAPOR PRESSURE (mm Hg.)	ND	PERCENT, VOLATILE BY VOLUME (%)	25
VAPOR DENSITY (AIR=1)	ND	EVAPORATION RATE (_____=1)	ND
SOLUBILITY IN WATER	Dispersible		
APPEARANCE AND ODOR	Dark liquid with methanol/alkyl amine odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): 62°F (PMCC)	FLAMMABLE LIMITS	Lel: [illegible]	Uel: [illegible]

EXTINGUISHING MEDIA
Foam, dry chemical, CO_2, water spray.

SPECIAL FIRE FIGHTING PROCEDURES
Water spray may be used to cool fire exposed metal containers to prevent re-ignition from hot surfaces. Do not breathe smoke or hot fumes.

UNUSUAL FIRE AND EXPLOSION HAZARDS
None known

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET

NFPA FIRE HAZARD IDENTIFICATION SYSTEM

Trade Name(s): AIR FOAM®

Generic Name(s): Detergent

Chemical Name(s): Ammonium salt of ethoxylated alcohol sulfate

Manufacturer: WYO-BEN, INC. Address: P.O. Box 1979 Billings, Montana 59103	Telephone Numbers: Information: (406) 652-6351 EMERGENCY: (406) 652-6351

Ingredient	CAS No.	%	Hazard
Isopropyl Alcohol (IPA)	67-63-0	25 ± 2	Concentrated vapors may be flammable in enclosed areas (See Section IV) and may be irritating or nauseous (See Section VI).

Boiling Point (°F): ND	Specific Gravity (H_2O=1): 0.98
Vapor Pressure (mm. Hg): ND	Melting Point: ND
Vapor Density (Air = 1): ND	Evaporation Rate (Butyl Acetate = 1): ND
Solubility in Water: Completely soluble	pH: 8.5
Density (at 20° C): 8.1 lb./gal.	

Appearance and Odor: Light yellow brown liquid with alcohol odor.

Flash Point: 75°F (closed cup)	Flammable Limits: LEL: ND UEL: ND

Special Fire Fighting Procedures: Wear protective clothing. Emergency personnel should be equipped with NIOSH approved SCBA with full face piece. Cool exposed container with water.

Unusual Fire and Explosion Hazards: Heating may cause pressure buildup and possible rupture of the container.

Extinguishing Media: Water fog, dry chemical, foam or carbon dioxide.

Stability: Stable at normal temperatures. Avoid high temperatures.

Hazardous Polymerization: Will not occur.

Incompatibility: None currently known.

Hazardous Decomposition Products: Thermal decomposition may produce sulfur dioxide and hydrogen sulfide.

NA = Not Applicable ND = Not Determined

Date Prepared: March 15, 1990

Routes of Exposure and Effects:

Eyes: Vapors may be irritating; contact by liquid may be moderately to severely irritating.
Skin: Prolonged or repeated skin contact may remove skin oils leading to mild dermatitis.
Inhalation: May cause headache, nausea and other symptoms of exposure to isopropyl alcohol.
Ingestion: May cause irritation to the mouth and gastrointestinal tract including nausea, vomiting, cramps and diarrhea.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	OSHA STEL (15min. TWA)
Isopropyl Alcohol	980mg/m^3	1225mg/m^3

Carcinogenicity:
Not listed by NTP, IARC or OSHA.

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Eyes: Immediately flush with clear water for 15 minutes. Obtain medical attention.
Skin: Wash thoroughly with soap and water.
Inhalation: Remove to fresh air, give oxygen if necessary.
Ingestion: Induce vomiting until vomit is clear, obtain medical attention.

Steps to be Taken if Material is Released or Spilled: Eliminate all sources of ignition. Wear suitable protective clothing. Prevent additional discharge. Contain area of spill and recover by pumping or with suitable absorbent. If not significantly contaminated, product may be used as originally intended.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Do not get in eyes, on skin, on clothing or ingest. Wash skin & clothing thoroughly after contact with liquid.

Ventilation Requirements: Mechanical, general room ventilation to prevent buildup of fumes.

Respirator: Normally not required. SCBA recommended when vapors present in high concentrations.

Eye Protection: Monogoggles suggested.

Gloves: Chemical resistant.

Other Protective Clothing or Equipment: Synthetic chemical resistant apron, eye wash station.

Use normal industrial hygiene practices appropriate for any nonhazardous liquid chemical. As with most detergents, this product may be toxic to aquatic life due to interference with oxygen uptake mechanisms and, as a result, should not be allowed to enter streams or lakes.

Shipping Name: Combustible Liquid (NOS)	Hazard Class: Combustible Liquid (DOT 173.115)

Hazardous Substance: Alcohol

Cautionary Labeling: Combustible Liquid

All information presented herein is believed to be accurate, however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET

NFPA FIRE HAZARD IDENTIFICATION SYSTEM

Trade Name(s): WYO-FOAMER®

Generic Name(s): Detergent

Chemical Name(s): Ammonium salt of ethoxylated alcohol sulfate

Manufacturer: WYO-BEN, INC.
Address: P.O. Box 1979
Billings, Montana 59103

Telephone Numbers:
Information: (406) 652-6351
EMERGENCY: (406) 652-6351

Ingredient	CAS No.	%	Hazard
Isopropyl Alcohol (IPA)	67-63-0	20 ± 2	Concentrated vapors may be flammable in enclosed areas (See Section IV) and may be irritating or nauseous (See Section VI).

Boiling Point (°F): ND

Specific Gravity (H_2O=1): 1.00

Vapor Pressure (mm. Hg): ND

Melting Point: ND

Vapor Density (Air = 1): ND

Evaporation Rate (Butyl Acetate = 1): ND

Solubility in Water: Completely soluble

pH: 8.5

Density (at 20° C): 8.3 lb./gal.

Appearance and Odor: Light yellow brown liquid with alcohol odor.

Flash Point: 82°F (closed cup)

Flammable Limits: LEL: ND UEL: ND

Special Fire Fighting Procedures: Wear protective clothing. Emergency personnel should be equipped with NIOSH approved SCBA with full face piece. Cool exposed container with water

Unusual Fire and Explosion Hazards: Heating may cause pressure buildup and possible rupture of the container.

Extinguishing Media: Water fog, dry chemical, foam or carbon dioxide.

Stability: Stable at normal temperatures. Avoid high temperatures.

Hazardous Polymerization: Will not occur.

Incompatibility: None currently known.

Hazardous Decomposition Products: Thermal decompostion may produce sulfur dioxide and hydrogen sulfide.

NA = Not Applicable ND = Not Determined

Date Prepared: March 15, 1990

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Ingestion: May cause irritation to the mouth and gastrointestinal tract including nausea, vomiting, cramps and diarrhea.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	OSHA STEL (15min. TWA)
Isopropyl Alcohol	980mg/m^3	1225mg/m^3

Carcinogenicity:
Not listed by NTP, IARC or OSHA.

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Eyes: Immediately flush with clear water for 15 minutes. Obtain medical attention.
Skin: Wash thoroughly with soap and water.
Inhalation: Remove to fresh air, give oxygen if necessary.
Ingestion: Induce vomiting until vomit is clear, obtain medical attention.

Steps to be Taken if Material is Released or Spilled: Eliminate all sources of ignition. Wear suitable protective clothing. Prevent additional discharge. Contain area of spill and recover by pumping or with suitable absorbent. If not significantly contaminated, product may be used as originally intended.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Do not get in eyes, on skin, on clothing or ingest. Wash skin & clothing thoroughly after contact with liquid.

Ventilation Requirements: Mechanical, general room ventilation to prevent buildup of fumes.

Respirator: Normally not required. SCBA recommended when vapors present in high concentrations.

Eye Protection: Monogoggles suggested.

Gloves: Chemical resistant.

Other Protective Clothing or Equipment: Synthetic chemical resistant apron, eye wash station.

Use normal industrial hygiene practices appropriate for any nonhazardous liquid chemical. As with most detergents, this product may be toxic to aquatic life due to interference with oxygen uptake mechanisms and, as a result, should not be allowed to enter streams or lakes.

Shipping Name: Combustible Liquid (NOS)	Hazard Class: Combustible Liquid (DOT 173.115)

Hazardous Substance: Alcohol

Cautionary Labeling: Combustible Liquid

All information presented herein is believed to be accurate, however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

QUIK-FOAM®

Foaming Agent

QUIK-FOAM® foaming agent is a biodegradable liquid mixture of anionic surfactants which can be added to fresh, hard, or salty water for air drilling.

Recommended Uses

Increasing the hole-cleaning capability of the air stream.

Providing a technique for drilling in zones of extreme loss of circulation.

Lowering the compressor capacity requirements for a given depth or rate of water influx.

Counteracting the sticking tendencies of wet clays, thereby eliminating mud rings, wall packing, and the like.

Permitting the recovery of larger, harder cuttings.

Suppressing dust while dry-air drilling.

Major Advantages

Effectiveness. QUIK-FOAM® foaming agent provides high foam-quality in low concentration.

Versatility. QUIK-FOAM is effective in fresh, hard, or salty waters.

Economy. QUIK-FOAM reduces water consumption and compressor capacity requirements.

Environmental Acceptability. QUIK-FOAM foaming agent is biodegradable. It does not irritate if it contacts the skin. QUIK-FOAM has a slight ammonia order when opened.

Recommended Treatment

For air/foam drilling, mix QUIK-FOAM foaming agent and fresh water in the amounts shown in table below.

For Gel-foam/air drilling, mix QUIK-GEL® gellant (12-15 lb/100 gal water), QUIK-TROL® organic polymer (1/2-1 lb/100 gal water) or EZ-MUD® polymer (1/2-1 quart/100 gal water), then add QUIK-FOAM foaming agent in the amounts shown in the table below.

Mixtures of QUIK-FOAM foaming agent and water are injected into the air stream at rates of 10 to 20 gallons (38 to 46 L) per hour. Gel-foam mixtures are injected at rates of 7 to 10 gallons per cubic foot (.79 to 1.14 L/m^3) of hole drilled.

See table for amounts.

Packaging

QUIK-FOAM™ foaming agent is packaged in plastic pails containing five gallons (19 L) or in metal drums containing 55 gallons (208 L).

Availability

QUIK-FOAM® foaming agent may be purchased through any NL Baroid Service Center or from Quik-Gel Retailers.

Approximate Amounts of QUIK-FOAM™ Foaming Agent Added to Injection Water

	per 100 gal	pints per bbl	L per m^3
Dry-air drilling, as a dust suppressant.	0.5-1 pint	0.2-0.5	0.5-1.5
Mist drilling in sticky clays.	1-2 quarts	1-2	2.5-5
Foam drilling, for all purposes.	0.5-2 gallons	1.5-7	5-20
Gel-foam drilling.	0.5-2 gallons	1.5-7	5-20
As a slug to clean the annulus.	1 pint*		0.5†

*in drill pipe, followed by 3 to 5 gallons of water.

†followed by 20 liters of water.

Warning: Close container tightly after use to avoid gellation of QUIK-FOAM.

®QUIK-FOAM, QUIK-GEL, and QUIK-TROL are registered trademarks of NL Industries, Inc.
™EZ-MUD is a trademark of NL Industries, Inc.
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DMD 33
Printed in U.S.A.

NL Baroid, P.O. Box 1675, Houston, Texas 77251

MATERIAL SAFETY DATA SHEET

DeFoamer Silicon

3	HMIS HEALTH
3	HMIS FLAMMABILITY
0	HMIS REACTIVITY
C	HMIS PERSONAL PROTECTION

SECTION I - IDENTIFICATION

COMPANY NAME..... B.B. CHEMICALS, INC.
16107 W. UNIVERSITY
ODESSA, TX 79769
PHONE NUMBER..... 915/381-2595
EMERGENCY PHONE NUMBER... 800/732-9876
EFFECTIVE DATE..... August, 1993
TRADE NAME..... DeFoamer Silicon
CHEMICAL FAMILY..... DeFoamer
CAS NUMBER..... Blend
CHEMICAL FORMULA..... Confidential

SECTION II - HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENTS	%	TLV (Units)	PROD. CAS #

NOT HAZARDOUS AS DEFINED
IN 29 CFR 1910.1200

SECTION III - PHYSICAL DATA

BOILING Point(F)..... ND
FREEZING POINT (F)..... ND
VAPOR PRESSURE (mm Hg)... ND
VAPOR DENSITY (Air=1).... ND
VOLATILITY/VOL(%)..... ND
SOLUBILITY IN H20..... Insoluble
APPEARANCE/ODOR..... Clear solution, Solvent odor
SPECIFIC GRAVITY (H20=1). ND
PH..... NA

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT..... Below 100 Degrees F.
LOWER FLAME LIMIT..... ND
HIGHER FLAME LIMIT..... ND
EXTINGUISH MEDIA..... Dry Powder, Carbon Dioxide (CO2), "Alcohol Foam"
UNUSUAL FIRE HAZARD..... Containers may explode from internal pressure if confined to fire. Cool with water. Keep unnecessary people away.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE.... 5 ppm based on 2-Ethylhexanol

ROUTES OF ENTRY	INHALATION?	SKIN?	INGESTION?
	Irritant	Irritant	Irritant

HEALTH HAZARDS ..... Chronic, Kidney and liver damage possible. Glycol ethers have been linked with birth defects and mutagenic claims. Acute, Inhalation of vapors may be narcotic and can be fatal. Ingestion of liquid will cause gastrointestinal distress, irritation, possibly nausea, and can be fatal. Liquid or vapors may be irritating to skin and eyes.

CARCINOGENICITY	NTP?	IARC MONOGRAPHS?	OSHA REGULATED
No	No	No	OSHA Table Z1

OVER EXPOSURE EFFECTS.... Skin irritation develops slowly after contact. Eye irritation develops immediately upon contact. Signs of Inhalation Overexposure: Irritation of Respiratory Tract, Nervous System Depression, Headaches, Dizziness, Staggering Gait, Confusion, Unconsciousness, Coma.

FIRST AID PROCEDURES..... IN CASE OF EYE CONTACT, FLUSH IMMEDIATELY WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES AND GET MEDICAL ATTENTION; FOR SKIN, WASH THOROUGHLY WITH SOAP AND WATER. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET MEDICAL ATTENTION. IF SWALLOWED, DO NOT INDUCE VOMITING, GET IMMEDIATE MEDICAL ATTENTION.

SECTION VI - REACTIVITY DATA

CHEMICAL STABILITY..... Stable
CONDITIONS TO AVOID..... None
INCOMPATIBLE MATERIALS... Oxidizers or Oxidizing Materials
DECOMPOSITION PRODUCTS... FROM FIRE: SMOKE, CARBON DIOXIDE AND CARBON MONOXIDE
HAZARDOUS POLYMERIZATION. Will not occur
POLYMERIZATION AVOID..... None

SECTION VII - SPILL OR LEAK PROCEDURE

FOR SPILL ..... In case of spillage, absorb with inert material and dispose of in accordance with applicable regulations.

WASTE DISPOSAL METHOD.... Hazardous Waste. Follow Federal and State Regulations

SECTION VIII - SPECIAL PROTECTION

RESPIRATORY PROTECTION... Not Normally needed.
VENTILATION..... Desired in closed places
MECHANICAL EXHAUST..... Desired
LOCAL EXHAUST..... Desired in closed places
PROTECTIVE GLOVES..... Chemical Type suitable for hydrocarbon solvents.

EYE PROTECTION..... Chemical Goggles or Full Face Shield recommended
OTHER PROTECTIVE
EQUIPMENT..... HMIS Personal Protection: B: Safety glasses and Gloves.

==========

SECTION IX - SPECIAL HANDLING AND DOT

==========

HANDLING AND STORAGE..... Store away from oxidizers or materials bearing a yellow "DOT" label. Store in a cool place away from ignition sources. Store away from oxidizers or materials bearing a yellow "DOT" label.
PRECAUTIONARY MEASURES... Keep away from heat, sparks and flame. Use with adequate ventilation. Do not breathe vapors Avoid prolonged or repeated contact with skin.
HAZARD CLASS..... NON HAZARDOUS
DOT SHIPPING NAME..... Drums: Chemicals N.O.S.
Bulk: Chemicals N.O.S.
REPORTABLE QUANTITY (RQ). None
UN NUMBER..... None
NA #..... None
PACKAGING SIZE..... Bulk and Drums

==========

FOOT NOTES N/A=NOT APPLICABLE - N/D=NO DATA AVAILABLE
<=LESS THAN - >=GREATER THAN

PREPARED BY..... Glen White,
Scientific Information Services (817) 560-4631
REVISED DATE..... New

THIS PRODUCT'S HEALTH AND SAFETY INFORMATION IS PROVIDED TO ASSIST OUR CUSTOMERS IN ASSESSING COMPLIANCE WITH HEALTH, SAFETY AND ENVIRONMENTAL REGULATIONS. THE INFORMATION CONTAINED HEREIN IS BASED ON DATA AVAILABLE TO US, AND IS BELIEVED TO BE ACCURATE, ALTHOUGH NO GUARANTEE OR WARRANTY IS PROVIDED OR IMPLIED BY THE COMPANY IN THIS RESPECT. SINCE THE USE OF THIS PRODUCT IS WITHIN THE EXCLUSIVE CONTROL OF THE USER, IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE CONDITIONS OF SAFE USE. SUCH CONDITIONS MUST COMPLY WITH ALL GOVERNMENTAL REGULATIONS.

ALL MATERIALS IN THIS PRODUCT ARE PRODUCED IN COMPLIANCE WITH PUBLIC LAW 94-469. (ALSO KNOWN AS THE "TOXIC SUBSTANCES CONTROL ACT" OF 1976.)

DeFoamer Silicon

TRADE NAME..... DeFoamer Silicon

SIGNAL WORD..... WARNING!

STATEMENT OF HAZARD.....

DOT LABEL REQUIRED..... None

ENVIRONMENTAL DATA SHEET

SECTION I - IDENTIFICATION

COMPANY NAME..... B.B. CHEMICALS, INC.
16107 W. UNIVERSITY
ODESSA, TX 79769
PHONE NUMBER..... 915/381-2595
EMERGENCY PHONE NUMBER... 800/732-9876
EFFECTIVE DATE..... August, 1993
TRADE NAME..... DeFoamer Silicon
CHEMICAL FAMILY..... DeFoamer

SPECIAL NOTICE: In accordance with 40 CFR 372.45, this product contains the following materials which have been classified as TOXIC under SARA Title III, Section 313. This page is a part of the Material Safety Data Sheet describing the above named product and shall not be detached. Any reproduction or distribution of this Material Safety Data Sheet after January 1, 1989 must include this page.

SECTION XI - SARA TITLE III, SECTION 313

TOXIC CHEMICALS	%	PROD. CAS #
None		

SECTION X - ENVIRONMENTAL DATA

EPA HAZARD..... ACUTE
CHRONIC

CERCLA RQ VALUE..... NONE

SARA TPQ..... NONE
SARA RQ..... NONE

RCRA HAZARDOUS WASTE..... NONE
CLEAN AIR..... CAA SECTION 111
CLEAN WATER..... NONE

MSDS for chemical wash CW-7 (5 pages total)

Schlumberger

Dowell

MATERIAL SAFETY DATA SHEET

(Complies with USA OSHA 29 CFR 1910.1200 and ANSI Z 400.1)

DOWELL PRODUCT CODE: **D122A** Effective Date: 04-March-1997

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Identification of the substance or preparation:

CHEMICAL WASH CONCENTRATE D122A

Company/undertaking identification:	Dowell Safety/Environment - Worldwide 300 Schlumberger Drive Sugar Land, Texas 77478, USA
Corporate Emergency Phone:	USA 1-281-595-3518
Corporate Non-Emergency Phone:	USA 1-281-285-8081

2. COMPOSITION/INFORMATION ON INGREDIENTS

PROPRIETARY MIXTURE CONTAINING:

AROMATIC ALCOHOL GLYCOL ETHER; 10-30%

DODECYLBENZENE SULFONIC ACID; CAS 27176-87-0; 10-30%

PROPAN-2-OL; CAS 67-63-0; 5-10%

DIMETHYL SILOXANES AND SILICONES; CAS 63148-62-9; 10-30%

WATER; CAS 7732-18-5; 10-30%

3. HAZARDS IDENTIFICATION

Emergency Overview

Form:	Liquid
Color:	Brown
Odor:	Acrid

Main environmental hazards:

Toxic to aquatic organisms.

Main Physical Hazards

Special Precautions:	None.
Physical Hazard:	None.

Main Health Hazards:

HMIS RATING: Health 2 Flammability 1 Reactivity 0

Causes severe eye burns. Harmful if swallowed. May cause respiratory tract irritation. Causes skin irritation.

See Section 11 for a complete discussion of health hazards.

4. FIRST AID MEASURES

Eye contact:	Immediately flush eyes with water for 30 minutes while holding eyelids open. Seek medical attention at once.
Skin contact:	Immediately remove contaminated clothes and shoes. Wash with soap and water for 15 minutes. Seek medical attention.
Inhalation:	Remove to fresh air. Seek medical attention if

	irritation persists or you feel unwell.
Swallowing:	DO NOT induce vomiting. Give activated charcoal in water, or give 2 glasses milk or water. Seek medical attention at once.
Notes:	None.

5. FIRE FIGHTING MEASURES

Extinguishing media:	Water Fog, Alcohol Foam, CO2, Dry Chemical
Further Information:	Wear protective fire fighting clothing and avoid breathing vapors. Use self-contained breathing apparatus in closed areas.
Flash point:	> 212°F
Method:	Setaflash CC

Flammability (explosion limits in air):

Lower:	Not determined	Upper:	Not determined

Autoflammability (auto-ignition temperature):	Not determined
Explosive properties (thermal decomposition temperature):	Not determined

NFPA Rating: Health 2 Flammability 1 Reactivity 0 Other: None

Combustion products: see Section 10.

6. ACCIDENTAL RELEASE MEASURES

After spillage/leakage:	Contain with dikes. Put in plastic drum. Flush residual with plenty of water.

See Section 8 for protective equipment information.

See Section 13 for disposal information.

7. HANDLING AND STORAGE

Special Precautions:	No special precautions required.
Packaging requirements:	High density polyethylene (HDPE) drum (DOT 34) or can.
Ventilation:	Provide ventilation to keep airborne concentrations below exposure limits.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory protection:	Use NIOSH approved respirator with organic vapor/acid gas protection (color coded yellow). Use SCBA (self contained breathing apparatus) in confined areas and for emergencies.
Eye protection:	Chemical splash goggles. For spills and emergencies, also wear face shield.
Hand protection:	Impervious gloves made of: Rubber
Skin protection:	Chemical resistant suit. Chemical resistant boots.

Exposure Limit Guidelines (mg/m3)

Components having no established limits are not listed.

(NE: Not established, ND: Not determined)

These numbers may be referred to as OEL, MAC, MAK, MEL, OES, REL, PEL, or TLV.

TWA is the 8 hour time weighted average. STEL is the short term exposure limit.

"C" indicates the value is a maximum concentration (ceiling).

	PROPAN-2-OL	
	TWA	STEL ANM
CANADA	NE	NE
USA: ACGIH	985	1230
USA: OSHA	980	1225

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Brown
Odor:	Acrid
pH value:	4.5-7.5 (68°F)
Boiling point:	192°F
Pour point:	Not determined
Vapor pressure:	Not determined
Relative density (specific gravity):	1.030 (68°F)
Bulk Density (solids):	Not applicable
Solubility in water:	Dispersable
Viscosity:	Not determined
Relative Vapor Density (air=1):	>1
% Volatile:	50
Nature	Surfactant

10. STABILITY AND REACTIVITY

Stability:	Stable.
Conditions to avoid:	Not determined
Materials to avoid:	Metals Oxidizers
Hazardous Polymerization:	Will not occur.
Dust explosion hazard (solids):	Not applicable.
Special hazards:	None.
Hazardous decomposition products:	When heated strongly or burned, oxides of carbon, sulfur oxides, nitrogen oxides, ammonia and harmful organic fumes are released.

11. TOXICOLOGICAL INFORMATION

Eye contact:	Corrosive. Rapidly causes pain, burns, corneal injury. May cause permanent damage and blindness.
Skin contact:	Severe irritant; causes pain, redness, dermatitis or mild burn.
Inhalation:	Irritant; may cause pain and coughing.
Ingestion:	Harmful if swallowed; large amounts may cause illness. Irritant; may cause pain or discomfort to mouth, throat and stomach.
Carcinogenicity:	Not listed by IARC, USA NTP, or USA OSHA.
Mutagenicity:	Not known to cause heritable genetic damage.
Teratogenicity:	Not known to cause birth defects.
Target organs which may be affected:	None known.

Sensitization:	Not known to cause allergic reaction.
Other:	Can cause headache, narcosis. May cause nausea.

12. ECOLOGICAL INFORMATION

Information on product as a whole:

Main environmental hazards:	Toxic to aquatic organisms.
Degradability:	Not determined
Fish Toxicity:	Not determined
Acute invertebrates toxicity:	Chaetogammarus marinus LC50 (96h) = 9.7 mg/l
Growth Inhibition (algae):	Skeletonema costatum EC50 (72h) = 3.5 mg/l
Other:	None known.

Information on components:

CHEMICAL NAME: PROPAN-2-OL
Invertebrate Tox: LC50=(96hr) 1150 mg/l
LC50=(48hr) 1400 mg/l Species: Brown shrimp (Crangon crangon)
Fish Tox - Fresh Water: LC50=(7d) 7060 mg/l Species: Poecilia reticulata

CHEMICAL NAME: DIMETHYL SILOXANES AND SILICONES
Growth Inhibition Algae: EC50=42 ppm Species: Skeletonema costatum

13. DISPOSAL CONSIDERATIONS

Product:	Ship via permitted waste hauler to permitted hazardous waste disposal facility for incineration.
Container:	Sell to approved drum reconditioner or render container unuseable by puncturing or crushing. Send to sanitary landfill unless prohibited by local regulations.
USA EPA RCRA:	D002

14. TRANSPORT INFORMATION

ICC Tariff Classification	Compound, Gas or Oil Well Drilling					
ICC Item Number:	138640	ICC Class:	50	LTL	35	TL
CERCLA RQ:	830 gallons (dodecylbenzenesulfonic acid).					

Department of Transportation (DOT)

Package Size:	0 - 829 gals
Designation:	Hazardous Material
Hazard Class:	8
Shipping Name:	Corrosive liquid, acidic, organic, n.o.s. (contains dodecylbenzene sulfonic acid), 8, UN 3265, PG III
DOT Label:	Corrosive 8

Package Size:	> 830 gals
Designation:	Hazardous Material and Hazardous Substance
Hazard Class:	8

Shipping Name: Corrosive liquid, acidic, organic, n.o.s. (contains dodecylbenzene sulfonic acid), 8, UN 3265, PG III, RQ

DOT Label: Corrosive 8

Canadian Shipments

Shipping Name: Corrosive liquid, n.o.s. (contains dodecylbenzene sulfonic acid)

Label: Corrosive 8

Classification: 8, 9.2 Package Group: III PIN: UN 1760

15. REGULATORY INFORMATION

Notification/restrictions status:

USA:

All components of this material are on the USA TSCA inventory, or the components are exempt from inventory reporting.

CANADA:

All components of this material are on the Canada DSL, or the components are exempt from inventory reporting.

This product contains no chemicals subject to the USEPA reporting requirements of SARA 313.

The USEPA CERCLA Reportable Quantity (RQ) for this product as a whole is: 830 gallons (dodecylbenzenesulfonic acid).

Canadian WHMIS classification: E ,D2B

16. OTHER INFORMATION

Sections affected by last revision:

REGULATORY INFORMATION

*Mark of Schlumberger. The information herein is believed to be accurate and is presented in good faith; however, no warranties or representations are made by Dowell regarding the accuracy or completeness of the information.

MSDS for cement (4 pages total)

MATERIAL SAFETY DATA SHEET DATE: 07-18-94
HALLIBURTON SERVICES REVISED DATE 10-17-90
DUNCAN, OKLAHOMA 73536

EMERGENCY TELEPHONE: 405/251-4687 OR 405/251-3569
AFTER HOURS: 405/251-3760

* * * * * * * * * SECTION I - PRODUCT DESCRIPTION * * * * * * * * * * * * * *

TICAL CODE: CEMENT, PREMIUM, BULK PART NUMBER: 516002700
QTY: BULK APPLICATION: CEMENTING
VICE USED: CEMENT

* * * * * * * * * SECTION II - COMPONENT INFORMATION * * * * * * * * * * *

COMPONENT+ * * * * * * * * *	PERCENT	TLV	PEL
TLAND CEMENT	> 60 %	10 MG/M3	10 MG/M3
(CA, CRYSTALLINE--QUARTZ	<3 %	0.1 MG/M3	0.1 MG/M3

* * * * * * * * * * SECTION III - PHYSICAL DATA * * * * * * * * * * * * * * *

PROPERTY	MEASUREMENT
ARANCE	GRAY SOLID, POWDER
	ODORLESS
IFIC GRAVITY (H2O=1)	3.150
DENSITY	94.00 LB/CU.FT.
	12.4
BILITY IN WATER AT 20 C, GMS/100ML H2O	.1-1.0
EGRADABILITY	N/A
ENT VOLATILES	0
IRATION RATE(BUTYL ACETATE=1)	N/A
DENSITY	N/A
PRESSURE (MMHG)	N/A
ING POINT(760 MMHG)	N/A
POINT	N/A
E POINT	N/A
BILITY IN SEAWATER	NOT EVALUATED
TION COEF (OCTANOL IN WATER)	NOT EVALUATED

* * * * * * * * SECTION IV - FIRE AND EXPLOSION DATA * * * * * * * * * * *

704) RATING:
EALTH 1 FLAMMABILITY 0 REACTIVITY 0 SPECIAL NONE
H POINT N/A
GNITION TEMPERATURE NO NO
MABLE LIMITS (OZ. PER CU. FT.) LOWER N/O UPPER N/O

EXTINGUISHING MEDIA:
NONCOMBUSTIBLE
AL FIRE FIGHTING PROCEDURES:
T APPLICABLE.
AL FIRE AND EXPLOSION HAZARDS:
FIRE HAZARD.
T APPLICABLE.

* * * * * * * * * SECTION V - HEALTH HAZARD DATA * * * * * * * * * * * *

CALIFORNIA PROPOSITION 65:
PRODUCT OR PRODUCT COMPONENTS ARE REGULATED UNDER CALIF. PROPOSITION 65.

CARCINOGENIC DETERMINATION:
PRODUCT OR COMPONENTS ARE LISTED AS A POTENTIAL CARCINOGEN
ACCORDING TO : IARC

PRODUCT TOXICITY DATA: NOT DETERMINED

PRODUCT TLV: 10 MG/M3

---------- EFFECTS OF EXPOSURE ----------

ROUTES OF EXPOSURE:
EYE OR SKIN CONTACT, INHALATION.
EYE:
MAY CAUSE SEVERE IRRITATION WHICH MAY BE PERSISTENT.
SKIN:
CEMENT DUST CAN BE IRRITATING TO SKIN. WET CEMENT CAN DRY THE SKIN AND CAUSE ALKALI BURNS. SENSITIVE INDIVIDUALS MAY DEVELOP ALLERGIC DERMATITIS.
INHALATION:
MAY BE IRRITATING.
TREAT AS NUISANCE DUST.
INGESTION:
THIS MATERIAL IS OF VERY LOW ACUTE TOXICITY. THERE IS NO EVIDENCE OF ADVERSE EFFECTS FROM AVAILABLE INFORMATION.
CHRONIC EFFECTS:
CRYSTALLINE SILICA IS NOT ON THE OSHA CARCINOGEN LIST. NTP AND IARC HAVE DETERMINED THERE IS SUFFICIENT EVIDENCE FOR CARCINOGENICITY OF CRYSTALLINE SILICA TO EXPERIMENTAL ANIMALS AND LIMITED EVIDENCE TO HUMANS. "LIMITED EVIDENCE" MEANS POSSIBLE RELATIONSHIP, BUT OTHER FACTORS CANNOT BE EXCLUDED. CONTAINS TRACE AMOUNTS OF ARSENIC, A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER. EXPOSURE TO ARSENIC SHOULD NOT EXCEED THE FEDERAL OSHA PEL UNLESS USED IN A MANNER THAT PRODUCES EXTREMELY HEAVY AIR-BORNE CONCENTRATIONS OF PRODUCT AT LEVELS WELL ABOVE THE ALLOWABLE LIMITS.
THER SYMPTOMS AFFECTED:
A REVIEW OF AVAILABLE DATA DOES NOT IDENTIFY ANY CONDITIONS WORSENED BY EXPOSURE TO THIS PRODUCT.

---------- EMERGENCY AND FIRST AID PROCEDURES ----------

E:
IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, SEEK PROMPT MEDICAL ATTENTION.
IN:
PROMPTLY WASH SKIN WITH SOAP AND WATER.
HALATION:
REMOVE TO FRESH AIR. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION.
GESTION:
DO NOT INDUCE VOMITING! IN GENERAL, NO TREATMENT IS NECESSARY UNLESS LARGE QUANTITIES ARE INGESTED. HOWEVER, MEDICAL ADVICE SHOULD BE OBTAINED.

* * * * * * * * * * SECTION VI - REACTIVITY DATA * * * * * * * * * * * * *

BILITY: STABLE
DITIONS TO AVOID:
STORE IN A DRY LOCATION.
MPATIBILITY (MATERIALS TO AVOID):
ONE KNOWN.
ZARDOUS DECOMPOSITION PRODUCTS:
ONE KNOWN.
ZARD POLYMERIZATION: WON'T OCCUR
DITIONS TO AVOID:
OT APPLICABLE.

* * * * * * * * SECTION VII - SPILL OR LEAK PROCEDURES * * * * * * * * * *

EPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
USE PROTECTIVE EQUIPMENT. SWEEP UP AND REMOVE. AVOID CREATING OR INHALING DUST.
TE DISPOSAL METHOD:
IF NOT CONTAMINATED, REUSE PRODUCT.
SET APPROVAL FROM LANDFILL OPERATOR AND TRANSPORT TO SANITARY LANDFILL.

* * * * * * * SECTION VIII - SPECIAL PROTECTION INFORMATION * * * * * * *

PIRATORY PROTECTION (USE NIOSH/MSHA APPROVED EQUIPMENT):
TOXIC DUST/MIST RESPIRATOR.
TILATION:
USE ONLY WITH ADEQUATE VENTILATION.
TECTIVE GLOVES:
NORMAL WORK GLOVES.
PROTECTION:
DUST PROOF GOGGLES.
ER PROTECTIVE EQUIPMENT:
NORMAL WORK COVERALLS.

* * * * * * * * * * SECTION IX - SPECIAL PRECAUTIONS * * * * * * * * * * *

CAUTIONARY LABELING CEMENT, PREMIUM, BULK 516.002700

WARNING!
CONTAINS A SMALL AMOUNT OF CRYSTALLINE SILICA, REPEATED OR PROLONGED INHALATION OF DUST MAY CAUSE A DELAYED RESPIRATORY ILLNESS (SILICOSIS). THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) AND NTP HAVE DETERMINED THERE IS LIMITED EVIDENCE OF THE CARCINOGENICITY OF CRYSTALLINE SILICA.
MAY CAUSE EYE AND SKIN IRRITATION.
MAY CAUSE SKIN BURNS IF CEMENT IS WET OR WITH CONFINED INTIMATE CONTACT.
FOR PRECAUTIONARY STATEMENTS, REFER TO SECTIONS IV-VIII.
ER HANDLING AND STORAGE CONDITIONS:
STORE IN DRY LOCATION TO PROTECT PRODUCT QUALITY. REQUIRES COVERED STORAGE.
AVOID CREATING OR INHALING DUST.
AVOID CONTACT WITH SKIN, EYES AND CLOTHING.
TAINER DISPOSITION:
CONTAINER SHOULD BE TRANSPORTED WITH ALL CLOSURES IN PLACE AND RETURNED FOR REUSE.

* * * * * * * * SECTION X - TRANSPORTATION INFORMATION * * * * * * * * * *

SHIPPING DESCRIPTION:
RESTRICTED

* * * * * * * * SECTION XI - ENVIRONMENTAL EVALUATION * * * * * * * * * *

SUPERFUND(SARA) TITLE III - HAZARD CLASSIFICATION & ASSOCIATED INFORMATION
FIRE: N PRESSURE: N REACTIVE: N ACUTE (IMMEDIATE): Y
CHRONIC (DELAYED): N MIXTURE OR PURE MATERIAL: MIX

RA - CERCLA/SUPERFUND, 40 CFR 302 (REPORTABLE SPILL QUANTITY)
N/A

RA - SARA TITLE III, CFR 355 (EXTREMELY HAZARDOUS SUBSTANCES)
RODUCT CONTAINS NO EXTREMELY HAZARDOUS COMPONENTS

RA - SARA TITLE III, 40 CFR 372 (LIST OF TOXIC CHEMICALS)
HEMICAL CONTAINS NO TOXIC INGREDIENTS

OMPONENTS LISTED ON FOLLOWING CHEMICAL INVENTORIES
CPA YES CERA NE SEC YES ROCIN YES NPR NE ORSM NE

. EPA - RCRA (HAZARDOUS WASTE), 40 CFR 261

IF PRODUCT BECOMES A WASTE, IT DOES NOT MEET THE CRITERIA OF A HAZARDOUS WASTE

* *

HE INFORMATION WHICH IS CONTAINED IN THIS DOCUMENT IS BASED UPON AVAILABLE ATA AND BELIEVED TO BE CORRECT. HOWEVER, AS SUCH AS IT HAS BEEN OBTAINED FROM ARIOUS SOURCES, INCLUDING THE MANUFACTURER AND INDEPENDENT LABORATORIES, IT IS IVEN WITHOUT WARRANTY OR REPRESENTATION THAT IT IS COMPLETE, ACCURATE AND CAN E RELIED UPON. HALLIBURTON HAS NOT ATTEMPTED TO CONCEAL IN ANY WAY THE ELETERIOUS ASPECTS OF THE PRODUCT LISTED HEREIN, BUT MAKES NO WARRANTY AS TO ACH. FURTHER, AS HALLIBURTON CANNOT ANTICIPATE NOR CONTROL THE MANY ITUATIONS IN WHICH THE LISTED PRODUCT OR THIS INFORMATION MAY BE USED BY OUR USTOMER, THERE IS NO GUARANTEE THAT THE HEALTH AND SAFETY PRECAUTIONS UGGESTED WILL BE PROPER UNDER ALL CONDITIONS. IT IS THE SOLE RESPONSIBILITY F EACH USER OF THE LISTED PRODUCT TO DETERMINE AND COMPLY WITH THE EQUIREMENTS OF ALL APPLICABLE LAWS AND REGULATIONS REGARDING ITS USE OR ISPOSAL. THIS INFORMATION IS GIVEN SOLELY FOR THE PURPOSES OF HEALTH AND AFETY TO PERSONS AND PROPERTY. ANY OTHER USE OF THIS INFORMATION IS EXPRESSLY XHIBITED. HEALTH, SAFETY AND ENVIRONMENT DEPARTMENT, HALLIBURTON ENERGY ERVICES.

MSDSs for the additives flocele and drispac (8 pages total)

MATERIAL SAFETY DATA SHEET DATE: 07-18-94
HALLIBURTON SERVICES REVISED DATE 09-09-91
DUNCAN, OKLAHOMA 73536

EMERGENCY TELEPHONE: 405/251-4689 OR 405/251-3569
AFTER HOURS: 405/251-3760

* * * * * * * * * * SECTION I - PRODUCT DESCRIPTION * * * * * * * * * * * *

HEMICAL CODE: FLOCELE 3/8" PART NUMBER: 890500710
XG QTY: 25 LBS APPLICATION: LOSS CIRCULATION ADDITIVE
ERVICE USED: CEMENTING

* * * * * * * * * * SECTION II - COMPONENT INFORMATION * * * * * * * * * * *

COMPONENT+ * * * * * * * * * *	PERCENT	TLV	PEL
ELLOPHANE	> 60 %	10 MG/M3	15 MG/M3

* * * * * * * * * * SECTION III - PHYSICAL DATA * * * * * * * * * * * * * *

PROPERTY	MEASUREMENT
PEARANCE	COLORLESS SOLID, FLAKES
OR	ODORLESS
ECIFIC GRAVITY (H2O=1)	1.440
LK DENSITY	15.00 LB/CU.FT.
	5.5
OLUBILITY IN WATER AT DEG C. GMS/100ML H2O	INSOLUBLE
BIODEGRADABILITY	SLOWLY
PCENT VOLATILES	N/A
APORATION RATE(BUTYL ACETATE=1)	N/A
POR DENSITY	N/A
POR PRESSURE (MMHG)	N/D
OILING POINT(760 MMHG)	N/A
ASH POINT	N/A
REEZE POINT	N/A
OLUBILITY IN SEAWATER	NOT EVALUATED
RTITION COEF (OCTANOL IN WATER)	NOT EVALUATED

* * * * * * * * * * SECTION IV - FIRE AND EXPLOSION DATA * * * * * * * * * * *

PA(704) RATING:
HEALTH 1 FLAMMABILITY 0 REACTIVITY 0 SPECIAL NONE
ASH POINT N/A
IGNITION TEMPERATURE NB NB
LAMABLE LIMITS (OZ. PER CU. FT.) LOWER N/D UPPER N/D
++
TINGUISHING MEDIA:
USE WATER SPRAY, FOAM, DRY CHEMICAL, OR CARBON DIOXIDE.
CIAL FIRE FIGHTING PROCEDURES:
AVOID CREATING DUST CLOUDS WITH EXTINGUISHERS.
FULL PROTECTIVE CLOTHING AND NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING
APPARATUS REQUIRED FOR FIRE FIGHTING PERSONNEL.
SUAL FIRE AND EXPLOSION HAZARDS:
INCOMPLETE THERMAL DECOMPOSITION MAY PRODUCE CARBON DIOXIDE AND CARBON
MONOXIDE.

* * * * * * * * * * SECTION V - HEALTH HAZARD DATA * * * * * * * * * * * *

ALIFORNIA PROPOSITION 65:
RODUCT OR PRODUCT COMPONENTS ARE NOT REGULATED UNDER CALIF. PROPOSITION 65.

ARCINOGENIC DETERMINATION:
RODUCT OR COMPONENTS ARE NOT LISTED AS A POTENTIAL CARCINOGEN
CCORDING TO : "NTP, IARC, OSHA, OR, ACIGH".

RODUCT TOXICITY DATA: NOT DETERMINED

RODUCT TLV: 10 MG/M3 (T); 5 MG/M3 (R)

---------- EFFECTS OF EXPOSURE ----------

RIMARY ROUTES OF EXPOSURE:
INHALATION.
YE:
ESSENTIALLY NON-IRRITATING.
KIN:
ESSENTIALLY NON-IRRITATING.
NHALATION:
TREAT AS NUISANCE DUST.
NGESTION:
THIS MATERIAL IS OF VERY LOW ACUTE TOXICITY. THERE IS NO EVIDENCE OF ADVERSE EFFECTS FROM AVAILABLE INFORMATION.
HRONIC EFFECTS:
NO CHRONIC EFFECTS EXPECTED.
THER SYMPTOMS AFFECTED:
A REVIEW OF AVAILABLE DATA DOES NOT IDENTIFY ANY CONDITIONS WORSENED BY EXPOSURE TO THIS PRODUCT.

---------- EMERGENCY AND FIRST AID PROCEDURES ----------

UNDER NORMAL CIRCUMSTANCES, NO FIRST AID PROCEDURES WOULD BE REQUIRED.

* * * * * * * * * * * SECTION VI - REACTIVITY DATA * * * * * * * * * * * * * *

ABILITY: STABLE
NDITIONS TO AVOID:
NOT APPLICABLE.
OMPATIBILITY (MATERIALS TO AVOID):
STRONG OXIDIZERS.
ZARDOUS DECOMPOSITION PRODUCTS:
CARBON MONOXIDE AND/OR CARBON DIOXIDE.
ZARD POLYMERIZATION: WON'T OCCUR
NDITIONS TO AVOID:
NOT APPLICABLE.

* * * * * * * * * SECTION VII - SPILL OR LEAK PROCEDURES * * * * * * * * * *

EPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
USE PROTECTIVE EQUIPMENT. SWEEP UP AND REMOVE. AVOID CREATING OR INHALING DUST.
STE DISPOSAL METHOD:
IF NOT CONTAMINATED, REUSE PRODUCT.
SET APPROVAL FROM LANDFILL OPERATOR AND TRANSPORT TO SANITARY LANDFILL.

* * * * * * * * SECTION VIII - SPECIAL PROTECTION INFORMATION * * * * * * * *

SPIRATORY PROTECTION (USE NIOSH/MSHA APPROVED EQUIPMENT):
NOT NORMALLY NECESSARY.
NTILATION:
USE ONLY WITH ADEQUATE VENTILATION. LOCAL EXHAUST VENTILATION IS NOT NORMALLY NEEDED.
OTECTIVE GLOVES:
NORMAL WORK GLOVES.

EYE PROTECTION:
GOGGLES AND/OR FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT:
NORMAL WORK COVERALLS.

* * * * * * * * * * * SECTION IX - SPECIAL PRECAUTIONS * * * * * * * * * * *

PRECAUTIONARY LABELING FLOCELE 3/8" 890.500710

CAUTION!
TREAT AS NUISANCE DUST.
FOR PRECAUTIONARY STATEMENTS, REFER TO SECTIONS IV-VIII.
OTHER HANDLING AND STORAGE CONDITIONS:
STORE IN DRY LOCATION TO PROTECT PRODUCT QUALITY. REQUIRES COVERED STORAGE.
AVOID CREATING OR INHALING DUST.
CONTAINER DISPOSITION:
EMPTY CONTAINER COMPLETELY. DISPOSE OF EMPTY CONTAINER IN SANITARY LANDFILL
BY FIRST OBTAINING LANDFILL OPERATOR'S AUTHORIZATION.

* * * * * * * * * SECTION X - TRANSPORTATION INFORMATION * * * * * * * * * *

DOT SHIPPING DESCRIPTION:
DOT RESTRICTED

* * * * * * * * * SECTION XI - ENVIRONMENTAL EVALUATION * * * * * * * * *

EPA SUPERFUND(SARA) TITLE III - HAZARD CLASSIFICATION & ASSOCIATED INFORMATION
FIRE: N PRESSURE: N REACTIVE: N ACUTE (IMMEDIATE): Y
CHRONIC (DELAYED): N MIXTURE OR PURE MATERIAL: MIX

EPA - CERCLA/SUPERFUND, 40 CFR 302 (REPORTABLE SPILL QUANTITY)
N/A

EPA - SARA TITLE III, CFR 355 (EXTREMELY HAZARDOUS SUBSTANCES)
PRODUCT CONTAINS NO EXTREMELY HAZARDOUS COMPONENTS

EPA - SARA TITLE III, 40 CFR 372 (LIST OF TOXIC CHEMICALS)
CHEMICAL CONTAINS NO TOXIC INGREDIENTS

COMPONENTS LISTED ON FOLLOWING CHEMICAL INVENTORIES
TSCA YES CEPA NE EEC YES ACGIH YES NPR NE OHSA NE

EPA - RCRA (HAZARDOUS WASTE), 40 CFR 261

IF PRODUCT BECOMES A WASTE, IT DOES NOT MEET THE CRITERIA OF A
HAZARDOUS WASTE

* *

INFORMATION WHICH IS CONTAINED IN THIS DOCUMENT IS BASED UPON AVAILABLE
AND BELIEVED TO BE CORRECT. HOWEVER, AS SUCH AS IT HAS BEEN OBTAINED FROM
OUS SOURCES, INCLUDING THE MANUFACTURER AND INDEPENDENT LABORATORIES, IT IS
WITHOUT WARRANTY OR REPRESENTATION THAT IT IS COMPLETE, ACCURATE AND CAN
ELIED UPON. HALLIBURTON HAS NOT ATTEMPTED TO CONCEAL IN ANY WAY THE
ERIOUS ASPECTS OF THE PRODUCT LISTED HEREIN, BUT MAKES NO WARRANTY AS TO
FURTHER, AS HALLIBURTON CANNOT ANTICIPATE NOR CONTROL THE MANY
TIONS IN WHICH THE LISTED PRODUCT OR THIS INFORMATION MAY BE USED BY OUR
MER, THERE IS NO GUARANTEE THAT THE HEALTH AND SAFETY PRECAUTIONS
STED WILL BE PROPER UNDER ALL CONDITIONS. IT IS THE SOLE RESPONSIBILITY
CH USER OF THE LISTED PRODUCT TO DETERMINE AND COMPLY WITH THE
REMENTS OF ALL APPLICABLE LAWS AND REGULATIONS REGARDING ITS USE OR
SAL. THIS INFORMATION IS GIVEN SOLELY FOR THE PURPOSES OF HEALTH AND

AFETY TO PERSONS AND PROPERTY. ANY OTHER USE OF THIS INFORMATION IS EXPRESSLY
ROHIBITED. HEALTH, SAFETY AND ENVIRONMENT DEPARTMENT, HALLIBURTON ENERGY
ERVICES.

NL Baroid

Environmental, Safety and Transportation Data Sheet

DRISPAC

I PRODUCT IDENTIFICATION

SUPPLIER NL BAROID	TELEPHONE NO. 713/987-5900
ADDRESS P.O. BOX 1675 HOUSTON, TEXAS 77251	
TRADE NAME DRISPAC®	
GENERIC DESCRIPTION POLYANIONIC CELLULOSIC POLYMER	

II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	%	HAZARD DATA
NONE		

III PHYSICAL DATA

BOILING POINT (°F) NA	MELTING POINT ND	FREEZING POINT NA
SPECIFIC GRAVITY (H_2O = 1) 1.6 g/ml (film)	VAPOR PRESSURE (mm Hg) NA	
VAPOR DENSITY (AIR = 1) NA	SOLUBILITY IN H_2O, % BY WT. 100% AT 25°C	
% VOLATILES BY VOL. MOISTURE 8% MAXIMUM	EVAPORATION RATE (BUTYL ACETATE = 1) NA	
APPEARANCE AND ODOR WHITE POWDER, ODORLESS	Density @ 20° C: ND	
pH ND		

N/A = Not Applicable N/D = Not Determined

DRISPAC®

HEALTH HAZARD: 0

FLAMMABILITY: 0

REACTIVITY: 0

Ratings based on NIOSH "Identification System for Occupationally Hazardous Materials" (1974)

All information recommendations and suggestions herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by NL Petroleum Services, Inc. as to the effects of such use, the results to be obtained, or the safety and toxicity of the product, nor does NL Petroleum Services, Inc. assume any liability arising out of use, by others, of the product referred to herein. Nor is the information herein to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

BEST Sheet

IV FIRE AND EXPLOSION DATA

NO FIRE OR EXPLOSION HAZARD.

TREAT AS FLAMMABLE DUST IN THE FINELY DIVIDED AND SUSPENDED STATE

EXTINGUISHING MEDIA: WATER, CO_2, FOAM OR DRY CHEMICAL

V HEALTH HAZARD INFORMATION

CARCINOGENICITY — NOT ON NTP, IARC OR OSHA LISTS

ACUTE ORAL LD_{50}	16,000 mg/kg	ACUTE DERMAL LD_{50}	ND	AQUATIC TOXICITY (LC_{50})	2700 ppm

ROUTES OF EXPOSURE AND EFFECTS

NONTOXIC

NUISANCE DUST TLV = 10 mg/m^3

EMERGENCY AND FIRST AID PROCEDURES

TREAT AS INERT OR NUISANCE PARTICLE.

TREAT DUST PARTICLES IN THE EYES BY RINSING WITH RUNNING WATER. NO EMERGENCY PROCEDURES ARE NECESSARY IN OTHER FORMS OF CONTACT.

BEST Sheet

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

NONE

INCOMPATIBILITY

NONE

HAZARDOUS DECOMPOSITION PRODUCTS

NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

WILL NOT OCCUR

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

SWEEP UP SPILLED MATERIAL AND DISPOSE BY DUMPING, INCINERATION. IN SOLUTION FLUSH WITH WATER TO SEWER OR WASTE TREATMENT FACILITY.

NEUTRALIZING CHEMICALS

NA

WASTE DISPOSAL METHOD

A NONBIODEGRADABLE MATERIAL.
DISPOSE OF IN DESIGNATED LAND FILL.

VIII INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS

GENERAL

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY

NIOSH APPROVED RESPIRATOR FOR NONTOXIC DUST

EYE

GOGGLES, FACESHIELD

GLOVES

GENERAL PURPOSE WORK GLOVES

OTHER CLOTHING AND EQUIPMENT

EYEWASH

BEST Sheet

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

NO PRECAUTIONARY LABELING.

OTHER HANDLING AND STORAGE REQUIREMENTS

TO PROTECT PRODUCT QUALITY STORE IN SEALED CONTAINERS IN A DRY, COOL PLACE, AWAY FROM SUNLIGHT.

DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME: NOT REGULATED

HAZARD CLASS: NOT HAZARDOUS

HAZARDOUS SUBSTANCE: NONE

LABEL: NONE REQUIRED

PREPARED BY **NL Baroid**
ENVIRONMENTAL SERVICES

DATE
JULY, 1987

Appendix K

NMED/WIPP Soil Sampling and Analysis Plan and Analytical Results for SWMU 007b (Evaporation Pond)

NMED/WIPP Nonradiological Soil Sampling and Analysis Plan, complete document (7 pages total).

DOE Analytical Data for Facility West (SWMU 007b) and Dune Blow Out (Background) Samples (10 pages total).

NMED Analytical Data for Facility West (SWMU 007b) Sample (8 pages total).

NMED/WIPP Nonradiological Soil Sampling and Analysis Plan, complete document (7 pages total).

Nonradiological Soil Sampling
and Analysis Plan
Revised September 29, 1992

NMED/WIPP Environmental Oversight

As an exercise under the agreement in Principle (AIP) between the New Mexico Environment Department (NMED) and Department of Energy (DOE), NMED/WIPP staff will be initiating a limited sampling investigation to close identified data gaps in the environmental baseline at WIPP. An NMED/WIPP assessment of the 1985-1991 DOE/WIPP OEMP program revealed that no significant measurement of organic chemicals and heavy metals in soils around the WIPP site have been documented. In addition, several mudpits were used to store drilling fluids within the land withdrawal area and have not been characterized in detail in terms of locations or composition.

Sampling Event Dates: 10/5/92 - 10/6/92
Number of Sample Locations: 6 Locations
Sampling Method: Grab/Composite
Types of Analyses:
- ***Aromatic and Halogenated Purgeables (VOC Screen EPA 8010/8020)***
- ***Aliphatic Hydrocarbons (Semi-VOC Screen EPA 8015)***
- ***Base/Neutral Extractables (Semi-VOC EPA 625)***
- ***Heavy Metals (ICAP Scan)***

Field Team Leader: Paul Sanchez
Site Safety Officer: Pat McCasland

Objectives

To quantify artificial levels, if any, of organics, hydrocarbons and heavy metal constituents in minor drainages, areas of sediment accumulation, and/or areas of artificial fill near Zone 1 of the WIPP facility. Grading and construction activities and runoff, drilling fluids, stormwater outfall, and gray water are sources of artificial levels of constituents around the perimeter of the facility.

To quantify artificial levels of organics, hydrocarbons, and heavy metal constituents within mudpits associated with WIPP exploratory wells, or oil and potash test holes within the 16 section land withdrawal area. As described in DOE/WIPP 91-005 (Rev 1), materials in the mudpits may consist of brine, starch, bentonite gel, and diesel fuel; drill cuttings, trace amounts of hydraulic fluid grease, and motor oil.

To map the location of identified mudpits and characterize the three-dimensional extent of a select few; and

To describe stratigraphic sections of selected mudpits, including any general physical or compositional changes with depth.

Sampling Strategy

The selection of the sampling sites is judgmental, and is based on a review of available documentation, air photos and field reconnaissance. The emphasis will be on making a preliminary characterization which may guide future sampling efforts. Additional sampling may be required if the investigation reveals anomalous levels of constituents. Figure 1 shows the proposed sampling locations.

Grab samples will be collected by judgement at shallow and deep locations within the soil profile. Samples will not be mixed to generate a composite, as mixing may cause aeration of volatiles and dilution of other potential contaminants.

301404.06 A4

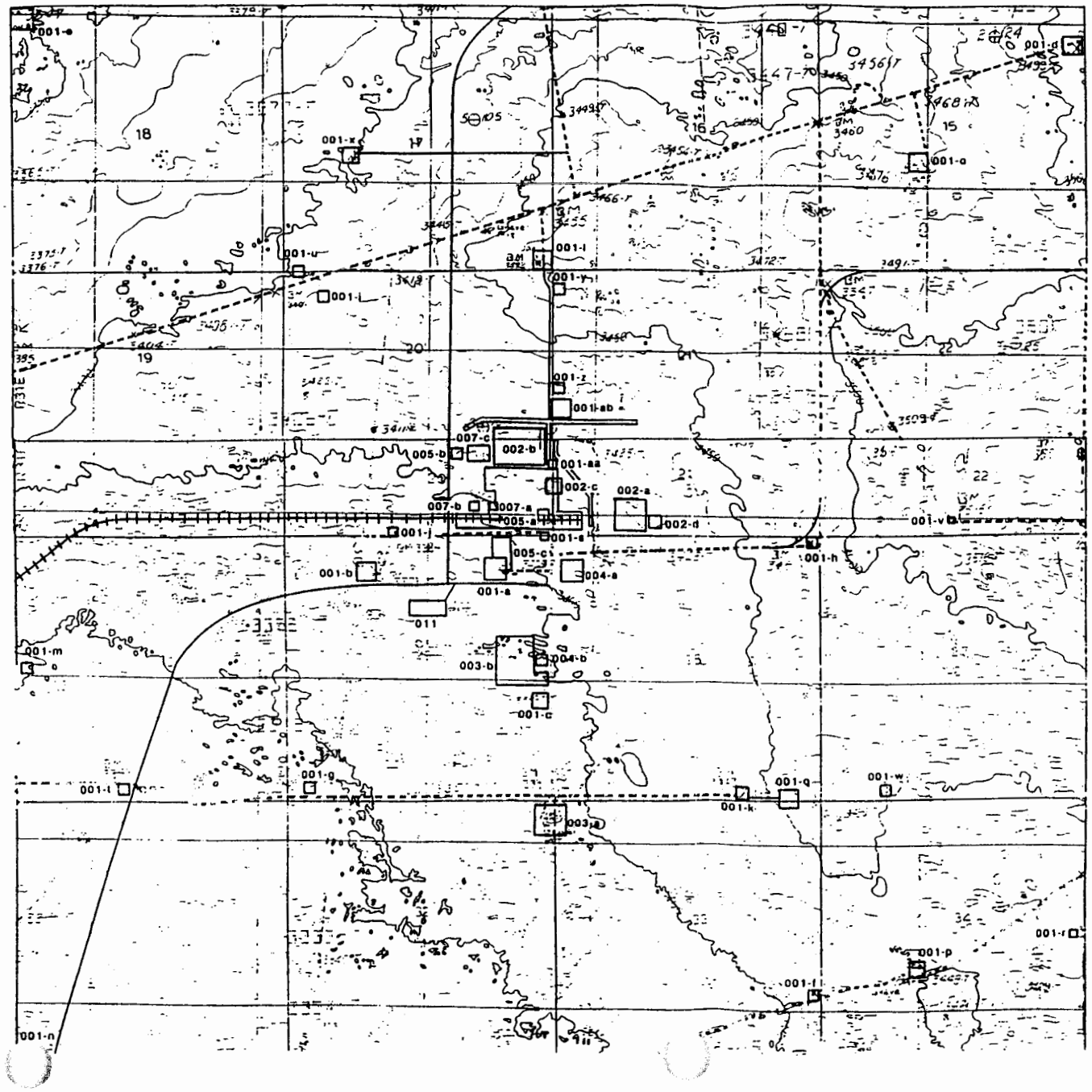


Figure 1

NMED/WIPP Soil Sampling and Analysis Plan

Sampling Location

Cotton Baby - 001-P
Badger Unit - 001-e
DOE-1 - 001-h

2000 0 2000 FEET
SCALE

FIGURE J-1

LOCATION OF SWMUs
IN THE 16 - SQUARE - MILE AREA
AROUND THE WIPP SITE

Zone 1/WIPP Facility West and South. The WIPP facility stormwater outfall on the western boundary and southern boundary of Zone 1 has been the site of construction and facility run-off and sediment accumulation since the early 1980's. Sampling will occur up to 3-4 feet in the soil profile to document artificial concentrations of constituents as effected by facility activities. Background soil samples will be taken for comparison. Table 1 shows the proposed sampling intervals in the shallow (0-2') and lower soil profile (2-4') and the analytical tests proposed for each horizon.

Mudpits. Out of approximately 46 mudpits located on 28 drill pads within the land withdrawal area, several contain little or no detailed documentation on their closure. The Cotton Baby and Badger Unit mudpits are prominant features and display soil discoloration and lack of vegetative growth. Most potash test hole mudpits appear completely reclaimed and show no adverse features. WIPP exploratory well sites also appear largely innocuous, as indicated by an NMED/WIPP field survey and review of available Sandia borehole data reports. DOE-1 is being investigated to document the actual composition of a typical DOE/Sandia hydrological observation borehole mudpit. Table 2 shows the analytical tests proposed at 0-5 and 5-10 feet within the selected mudpits. As the contents of the mudpits are not known for certain, field levels of organic gases and vapors will be measured during sample acquisition.

Sampling Method. A hand auger will be used to obtain samples. Two 5 foot extensions will be used on the hand auger at the mudpit sites to core through the lower boundary of the unit. Ten to twenty grams of soil will be collected by syringe directly from the auger bit from the interior of the auger core. This procedure is acceptable under EPA soil sampling guidelines *(RCRA Sampling Procedures Handbook, EPA CN68-W9-0007)*. NMED/WIPP ***Augered Boring Data Sheets*** will be used to document soil descriptions and the locations of samples collected within the soil profile.

Tables 1 and 2 show the number of samples required at each horizon for BNE (base/neutral extractables), AHP (aromatic and halogenated purgeables), AH (aliphatic hydrocarbons), and HM (heavy metals). Heavy metals will be collected in standard 8 ounce ziplock bags. AHP VOC's and AH total petroleum hydrocarbon soil samples will be placed in 40 ml septum vials with Teflon lids. Methyl alcohol is added to the AHP VOC containers prior to sampling as an extracting agent. Sample containers used for aliphatic hydrocarbon analysis are prepared with carbon disulfide as an extracting agent. Base/neutral extractables and heavy metals will not be field extracted or chemically preserved.

Quality Assurance/Quality Control

NMED/WIPP ***Environmental Sample Collection Forms*** will be used to document sample collection and to ensure chain of custody for the transfer of split samples. New Mexico Scientific Laboratory Division (SLD) quality assurance (QA) requirements dictate the collection of duplicate field samples for aliphatic hydrocarbons and aromatic and halogenated purgeables to verify reproducibility of the data. SLD has additional laboratory QA requirements that are run during the sample analyses. One rinsate blank will be collected as a check on decontamination effectiveness. Two extraction agent 40 ml vials (CS_2 and MeOH) will be used as field lab/travel blanks.

Decontamination

Sampling equipment will be cleaned prior to sampling and will be decontaminated after each sampling event between individual sampling locations. In a departure from HRMB standard operating procedure, decontamination will be achieved solely by washing equipment with nonphosphatic detergent and rinsing with deionized/distilled water.

Table 1 Schedule for Sampling Near WIPP Facility

Sample Location	*Depth Interval (ft)*	*Analytical Tests*[1]	*Samples Sets Per Interval*[2] *BNE*	*AHP*	*AH*	*HM*	*Comments*
Facility West Shallow	0-2	BNE, AH, HM	1	1	1		AH only if stained soil
Facility West Deep	2-4	BNE, AH, HM	1	1	1		" "
Facility South Shallow	0-2	BNE, AH, HM	1	1	1		AH only if stained soil
Facility South Deep	2-4	BNE, AH, HM	1	1	1		" "
Background Shallow	0-2	BNE, AH, HM	1	1	1		" "
Background Deep	2-4	BNE, AH, HM	1	1	1		" "
Total Samples			6	6	6		

1) ***AHP*** *- Aromatic and Halogenated Purgeables (VOC)*
AH *- Aliphatic Hydrocarbons (Semi-VOC)*
BNE *- Base Neutral Extractables (Semi-VOC)*
HM *- Heavy Metals*

2) *Each sample set consists of the following containers: 1-8oz glass jar (BNE); 3-40 ml vials (AHP); 3-40 ml vials (AH); 2-8oz ziplock bags*

Table 2 Schedule for Sampling at Mudpits

Sample Location	*Depth Interval (ft)*	*Analytical Tests*[1]	*Samples per Interval*[2] *BNE AHP AH HM*	*Comments*
Cotton Baby	0-5	AHP, AH, HM	1, 1, 1	
	5-10	AHP, AH, HM	1, 1, 1	
Badger Unit	0-5	AHP, AH, HM	1, 1, 1	
	5-10	AHP, AH, HM	1, 1, 1	
DOE-1	0-5	AHP, AH, HM	1, 1, 1	
	5-10	AHP, AH, HM	1, 1, 1	
Total Samples			6, 6, 6	

1) ***AHP*** *- Aromatic and Halogenated Purgeables (VOC)*
AH *- Aliphatic Hydrocarbons (Semi-VOC)*
BNE *- Base Neutral Extractables (Semi-VOC)*
HM *- Heavy Metals*

2) *Each sample set consists of the following containers: 1-8oz glass jar (BNE); 3-40 ml vials (AHP); 3-40 ml vials (AH); 2-8oz ziplock bags*

SOIL SAMPLE COLLECTION FOR TOTAL PETROLEUM HYDROCARBONS IN GASOLINE THROUGH OIL CONTAMINATED SOILS SLD METHOD 751 (ALIPHATIC HYDROCARBONS)

This procedure is to be used when collecting soil samples to be analyzed f Total Petroleum Hydrocarbons (TPH) by Carbon disulfide extraction followed by analysis by GC-FID. This method is appropriate for gasoline, diesel fuel, fuel oils, oils, etc. If there is a question about a particular compound or fuel please consult the Organic Section of the Scientific Laboratory Division.

EQUIPMENT

CONTAINERS SUPPLIED BY SLD:

2 40 ml Septum Vials (weighed and containing 10 ml of carbon disulfide). The carbon disulfide has been carefully measured and will keep volatiles from being lost if the sample is tightly recapped.

1 40 Septum Vial (empty)

1 10 ml disposable plastic syringe with tip cut off to be used to get a plug of about 10 grams of soil (7-8 ml soil).

RECOMMENDED EQUIPMENT

Clean, dry, metal sampling device. This could be a spoon or stainless steel lab scoop (VWR Scientific No. 57952-162).

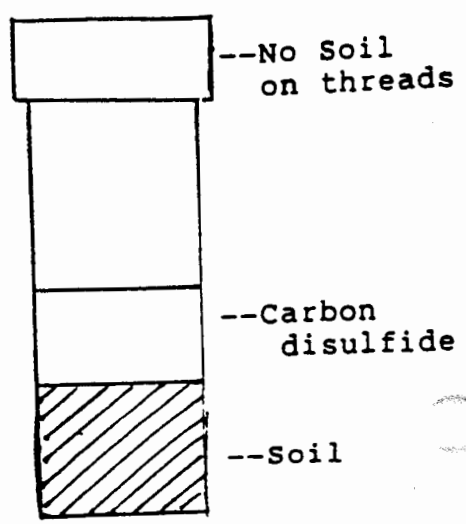
PROCEDURE

1. Write site information on bottle labels and forms. Evidentiary tape (i necessary) should be used on the outside of the plastic bag - not on the bottles.

2. Add about 10-20 grams of soil (a 7-8 ml plug) to each of the two bottles containing carbon disulfide. Be sure that threads and top of bottle are free of any soil, or the bottles will leak invalidating the analysis. There should be only enough soil to fill the bottle 1/4 full of soil. Cap bottles securely. If carbon disulfide leaks, or appears to have leaked from bottle, retake sample with another bottle. Soils should be collected as quickly as possible, from beneath the surface of the soil (not exposed to the air), and should be representative of the site.

3. Fill the third bottle (empty) completely full of soil (no air space). Again clean threads of bottle before capping.

4. Send to Lab as quickly as possible.



This method is consistent with the "Modified 8015" procedure. The result will give a TPH value as well as an indication of the type(s) of fuel(s) if the fuel has not been too badly degraded so that the GC "fingerprint" is no longer similar to the standard. In such cases TPH values will be given for the ranges of normal hydrocarbon ranges. C-17:Pristane and C-18:Phytane ratios will be reported when possible.

CAUTION CARBON DISULFIDE IS VERY FLAMMABLE. AVOID SKIN CONTACT AND INHALATION OF VAPORS.

SOIL SAMPLE COLLECTION FOR SOLVENT AND GASOLINE CONTAMINATED SOILS

This procedure is to be used when collecting soil samples to be analyzed for gasoline volatiles (benzene, toluene, ethylbenzene, and xylenes) and volatile solvents such as trichloroethene (TCE), tetrachloroethene (PCE), 1,1,i-trichloroethane, etc. This method is not appropriate for diesel fuel, fuel oils, oils, etc. If there is a question about a particular compound please consult the Organic Section of the Scientific Laboratory Division.

EQUIPMENT

CONTAINERS SUPPLIED BY SLD:

2 40 ml Septum Vials (weighed and containing 10 ml of methyl alcohol). The methyl alcohol has been carefully measured an will keep volatiles from being lost if the sample is tightly recapped.

1 40 Septum Vial (empty)

RECOMMENDED EQUIPMENT

Clean, dry, metal sampling device. This could be a spoon or stainless steel lab scoop (VWR Scientific No. 57952-162).

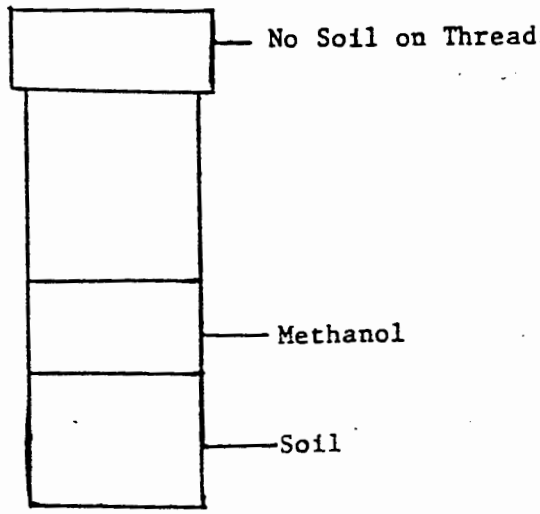
PROCEDURE

1. Write site information on bottle labels and forms.

2. Add about 10-20 grams of soil to the two bottles containing methyl alcohol. Be sure that threads and top of bottle are free of any soil, or the bottles will leak invalidating the analysis. There should be only enough soil to fill the bottle 1/4 full of soil. Cap bottles securely. If methyl alcohol leaks, or appears to have leaked from bottle, retake sample with another bottle. Soils should be collected as quickly as possible, from beneath the surface of the soil (not exposed to the air), and should be representative of the site.

3. Fill the third bottle (empty) completely full of soil (no air space). Again clean threads of bottle before capping.

4. Send to Lab as quickly as possible.



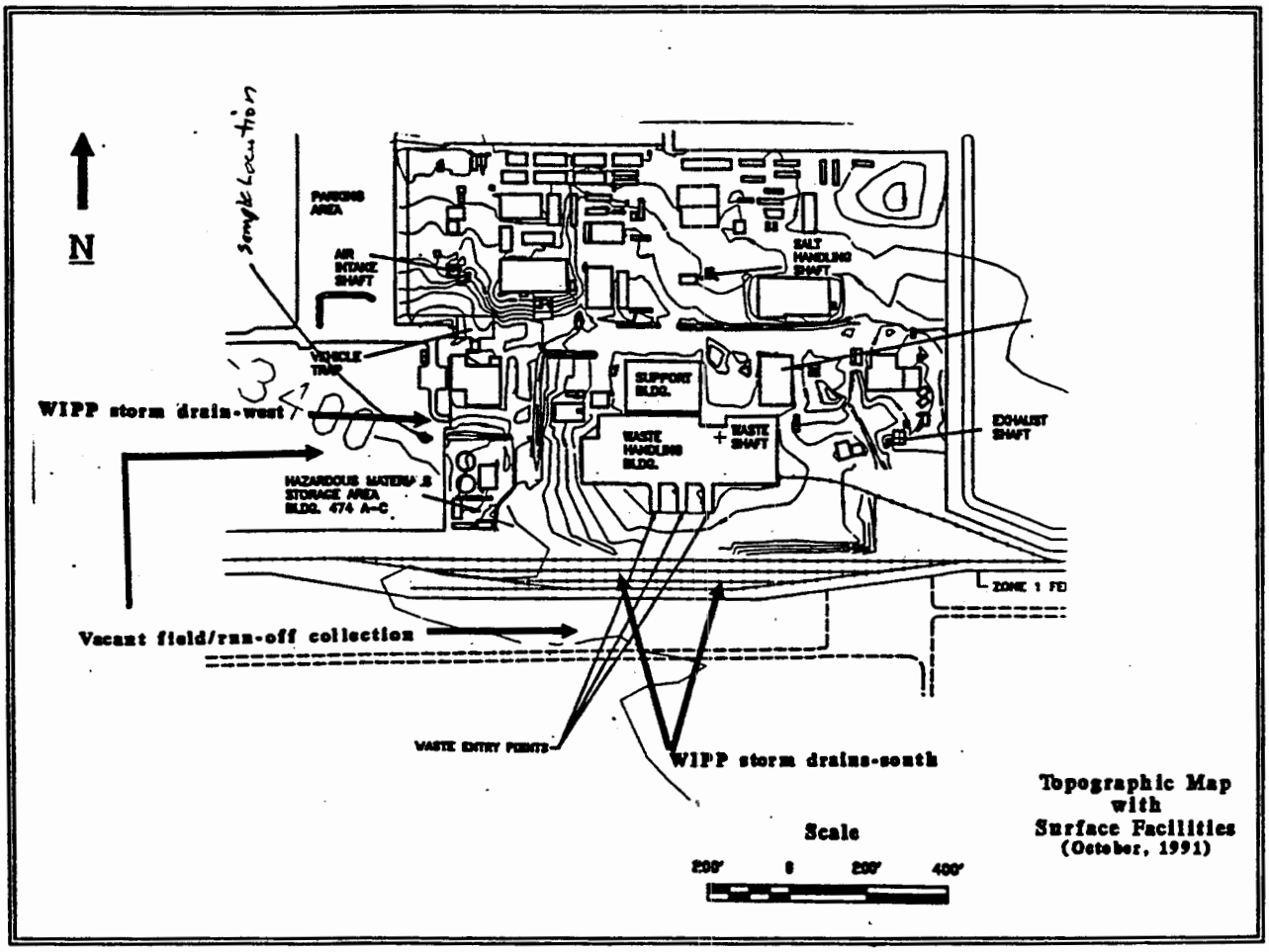
This method is consistent with the procedures required for EPA methods 8010, 8020, 8021, and 8240.

For Total Petroleum Hydrocarbons (TPH) analysis (EPA Method 8015) two bottles completely full of soil (NO methyl alcohol) are required.

DOE Analytical Data for Facility West (SWMU 007b) and Dune Blow Out (Background) Samples (10 pages total).

Sampling Location
Site Sketch
Scale: ~~1" = 40'~~

New Mexico Environment Department
Location: Facility West
Date: 10/7/92
Comments:



Topographic Map with Surface Facilities (October, 1991)

New Mexico Environment Department
DOE/WIPP Oversight
TEST PIT/AUGERED BORING LOG AND DATA SHEET

Project No. 550040	Location. Facility West	Boring No. 1	Sheet 1 of 1

Feature. Outfall/soil/sediment
Date (Time) Logged. 10/7/92
Area Designation.

Method. Hand Auger
Logged By. PES
Monitoring.

Depth and Soil Class	Graphic Log	Sample Taken	Description of Materials Visual Observations	OVA
0 SP-SM Poorly sorted silty sand			Sand: Red brown, silty fine to medium, medium dense, porous Artificial fill/disturbed dune sand (0-0.5ft)	
SC Clayey Sand		Semi-Volatile Base/Neutral Heavy Metal (ICAP/As)	Clayey Sand: Red brown, silty fine to medium (clay 5-10%), medium dense, moist, less porous Artificial fill/disturbed dune sand (0.5-1.0ft)	
1' SP-SM Poorly sorted silty sand			Sand: Red brown, silty fine to medium, medium dense, porous Artificial fill/disturbed dune sand (1.0-3.0ft)	
			Very moist to wet	
2'			1cm pockets of brown SP sand 2.6ft suggests disturbed sand/artificial fill.	
		Semi-Volatile Base/Neutral Heavy Metal (ICAP/As)		
3' SP/Caliche			Caliche: White, poorly sorted sand and silt with minor clay, moderate to strongly cemented ($CaCO_3$), medium dense to dense, moist, low porosity. Inplace "C" soil horizon underlying disturbed fill	
4'				

Remarks: Located within drainage area for storm water outfall west of WIPP facility.

HALLIBURTON NUS
Environmental Corporation
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
Report No.: 00011392
Section A Page 24

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

SAMPLE ID: WIPP-524 Facility West, 1.2'
NUS SAMPLE NO: P0214189
P.O. NO.: 37109

DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	AALS	Aluminum, Total (Al)	10000	mg/kg
2	ABAS	Barium, Total (Ba)	44	mg/kg
3	ABES	Beryllium, Total (Be)	< 0.5	mg/kg
4	ABS	Boron, Total (B)	< 5	mg/kg
5	ACDS	Cadmium, Total (Cd)	< 0.5	mg/kg
6	ACAS	Calcium, Total (Ca)	1200	mg/kg
7	ACRS	Chromium, Total (Cr)	8	mg/kg
8	ACOS	Cobalt, Total (Co)	3	mg/kg
9	ACUS	Copper, Total (Cu)	2	mg/kg
10	APBS	Lead, Total (Pb)	6	mg/kg
11	AFES	Iron, Total (Fe)	8000	mg/kg
12	AMGS	Magnesium, Total (Mg)	1400	mg/kg
13	AMNS	Manganese, Total (Mn)	70	mg/kg
14	AMOS	Molybdenum, Total (Mo)	< 5	mg/kg
15	ANIS	Nickel, Total (Ni)	5	mg/kg
16	ASIS	Silicon, Total (Si)	580	mg/kg
17	AAGS	Silver, Total (Ag)	< 1	mg/kg
18	ASRS	Strontium, Total (Sr)	14	mg/kg
19	ASNS	Tin, Total (Sn)	< 10	mg/kg
20	AVS	Vanadium, Total (V)	15	mg/kg
21	AZNS	Zinc, Total (Zn)	18	mg/kg
22	AASS	Arsenic, Total (As)	< 10	mg/kg

COMMENTS: The results are not corrected for percent moisture

HALLIBURTON NUS
Environmental Corporation
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
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LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

SAMPLE ID: WIPP-525
NUS SAMPLE NO: P0214190
P.O. NO.: 37109

Facility West 1.5'

DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	G173S	Petroleum Hydrocarbons (Diesel)		
		petroleum hydrocarbons (diesel)	1.9	mg/kg

COMMENTS: The results are not corrected for percent moisture.

HALLIBURTON NUS
Environmental Corporation
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
Report No.: 00011392
Section A Page 27

LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

Facility West, 3.6'

SAMPLE ID: WIPP-527
NUS SAMPLE NO: P0214475
P.O. NO.: 37109

DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	AALS	Aluminum, Total (Al)	7600	mg/kg
2	ABAS	Barium, Total (Ba)	32	mg/kg
3	ABES	Beryllium, Total (Be)	< 0.5	mg/kg
4	ABS	Boron, Total (B)	< 5	mg/kg
5	ACDS	Cadmium, Total (Cd)	< 0.5	mg/kg
6	ACAS	Calcium, Total (Ca)	1600	mg/kg
7	ACRS	Chromium, Total (Cr)	7	mg/kg
8	ACOS	Cobalt, Total (Co)	1	mg/kg
9	ACUS	Copper, Total (Cu)	2	mg/kg
10	APBS	Lead, Total (Pb)	6	mg/kg
11	AFES	Iron, Total (Fe)	6300	mg/kg
12	AMGS	Magnesium, Total (Mg)	1400	mg/kg
13	AMNS	Manganese, Total (Mn)	32	mg/kg
14	AMOS	Molybdenum, Total (Mo)	< 5	mg/kg
15	ANIS	Nickel, Total (Ni)	4	mg/kg
16	ASIS	Silicon, Total (Si)	350	mg/kg
17	AAGS	Silver, Total (Ag)	< 1	mg/kg
18	ASRS	Strontium, Total (Sr)	13	mg/kg
19	ASNS	Tin, Total (Sn)	< 10	mg/kg
20	AVS	Vanadium, Total (V)	10	mg/kg
21	AZNS	Zinc, Total (Zn)	14	mg/kg
22	AASS	Arsenic, Total (As)	< 10	mg/kg

COMMENTS: The results are not corrected for percent moisture

HALLIBURTON NUS
Environmental Corporation
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
Report No.: 00011392
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LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

SAMPLE ID: WIPP-526 Facility West 3.5'
NUS SAMPLE NO: P0214191
P.O. NO.: 37109

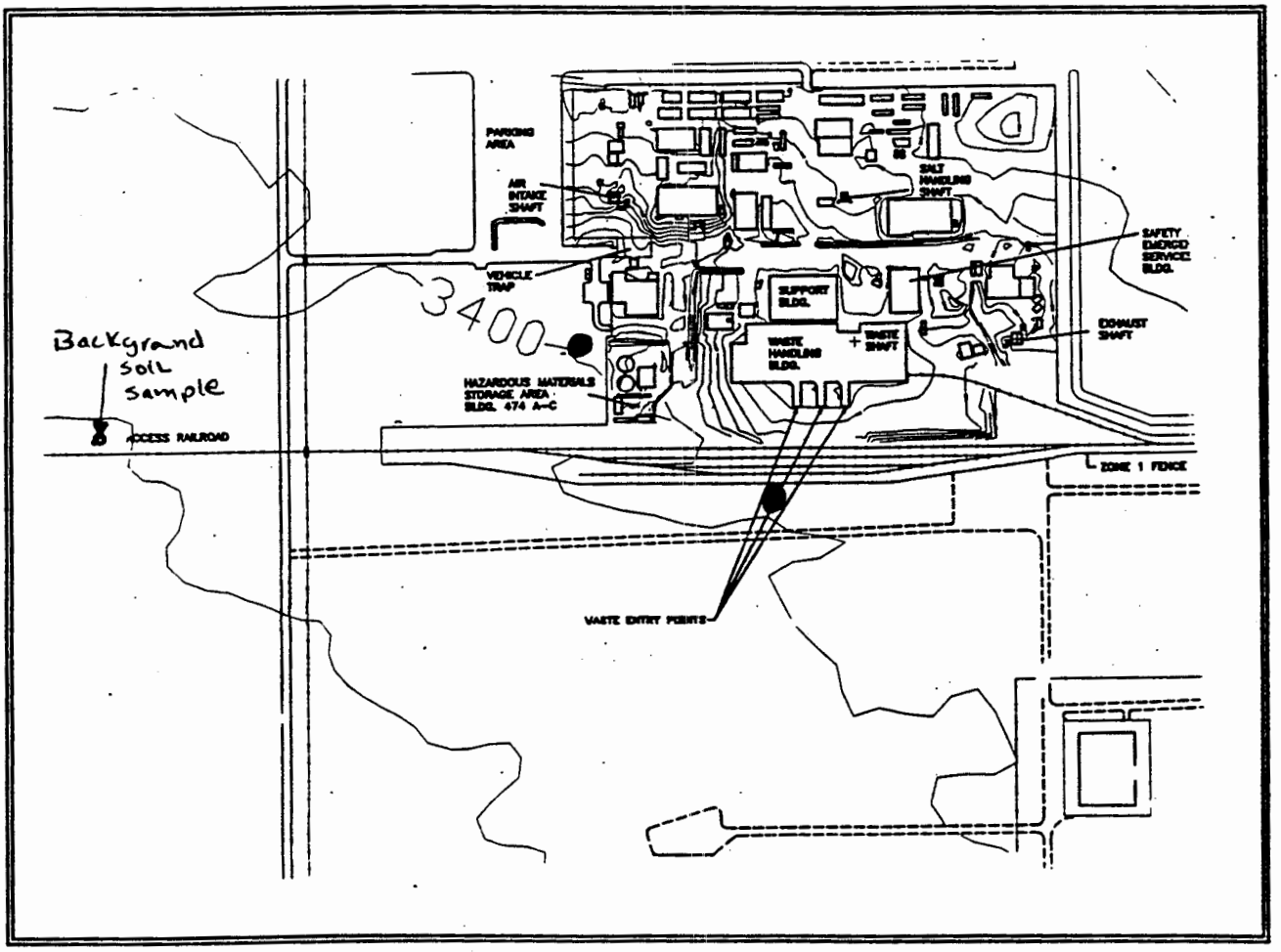
DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	G173S	Petroleum Hydrocarbons (Diesel)		
		petroleum hydrocarbons (diesel)	5.7	mg/kg

COMMENTS: Result is not corrected for percent moisture

Sampling Location
Site Sketch
Scale: 1" = 40'

New Mexico Environment Department
Location: west of WIPP facility - Background soil sample
Date: 10/7/92
Comments:
● - other near facility sampling sites sampled on 10/7/92



New Mexico Environment Department
DOE/WIPP Oversight
TEST PIT/AUGERED BORING LOG AND DATA SHEET

Project No. 550040	Location. Background Soil WIPP Area	Boring No. 1	Sheet 1 of 1

Feature. Sand Dune Blowout
Date (Time) Logged. 10/7/92
Area Designation.

Method. Hand Auger
Logged By. PES
Monitoring.

Depth and Soil Class	Graphic Log	Sample Taken	Description of Materials Visual Observations	OVA
0 SP-SM Poorly sorted silty sand			Sand: Red brown, silty fine to medium, loose, dry, porous, homogeneous Internally-drained dune sand medium dense, some organics (roots/leaves)	
1'				
2'		Semi-Volatile Base/Neutral Heavy Metal (ICAP/As)		
3'	BOH			
4'				

Remarks: Internally-drained sand dune blow out west of access road and north of railroad line.

HALLIBURTON NUS
Environmental Corporation
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5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
Report No.: 00011392
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LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

SAMPLE ID: WIPP-532 Background, 2.5-3'
NUS SAMPLE NO: P0214480
P.O. NO.: 37109

DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	G173S	Petroleum Hydrocarbons (Diesel)		
		petroleum hydrocarbons (diesel)	4.0	mg/kg

COMMENTS: Result is not corrected for percent moisture

HALLIBURTON NUS
Environmental Corporation
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205

900 Gemini Avenue
Houston, TX 77058

October 28, 1992
Report No.: 00011392
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LABORATORY ANALYSIS REPORT

CLIENT NAME: WESTINGHOUSE ELECTRIC CORPORATION
ADDRESS: WASTE ISO. PILOT PL/P.O.BOX 2078
CARLSBAD, NM 88221-2078
ATTENTION: F. LOPEZ

NUS CLIENT NO: 0527 0021
WORK ORDER NO: 55830
VENDOR NO: 01830782

Carbon Copy:

Background, 2-2.5'

SAMPLE ID: WIPP-533
NUS SAMPLE NO: P0214481
P.O. NO.: 37109

DATE SAMPLED: 07-OCT-92
DATE RECEIVED: 12-OCT-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	AALS	Aluminum, Total (Al)	1700	mg/kg
2	ABAS	Barium, Total (Ba)	11	mg/kg
3	ABES	Beryllium, Total (Be)	< 0.5	mg/kg
4	ABS	Boron, Total (B)	< 5	mg/kg
5	ACDS	Cadmium, Total (Cd)	< 0.5	mg/kg
6	ACAS	Calcium, Total (Ca)	220	mg/kg
7	ACRS	Chromium, Total (Cr)	3	mg/kg
8	ACOS	Cobalt, Total (Co)	< 1	mg/kg
9	ACUS	Copper, Total (Cu)	1	mg/kg
10	APBS	Lead, Total (Pb)	< 5	mg/kg
11	AFES	Iron, Total (Fe)	2000	mg/kg
12	AMGS	Magnesium, Total (Mg)	260	mg/kg
13	AMNS	Manganese, Total (Mn)	19	mg/kg
14	AMOS	Molybdenum, Total (Mo)	< 5	mg/kg
15	ANIS	Nickel, Total (Ni)	< 2	mg/kg
16	ASIS	Silicon, Total (Si)	290	mg/kg
17	AAGS	Silver, Total (Ag)	< 1	mg/kg
18	ASRS	Strontium, Total (Sr)	2	mg/kg
19	ASNS	Tin, Total (Sn)	< 10	mg/kg
20	AVS	Vanadium, Total (V)	4	mg/kg
21	AZNS	Zinc, Total (Zn)	6	mg/kg
22	AASS	Arsenic, Total (As)	< 10	mg/kg

COMMENTS: The results are not corrected for percent moisture.

NMED Analytical Data for Facility West (SWMU 007b) Sample (8 pages total).

STATE OF NEW MEXICO
ENVIRONMENT DEPARTMENT
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU
MIXED WASTE SECTION / WIPP GROUP
P.O. Box 3090, MS - M/R, Jal hiway, Carlsbad, NM 88220
Telephone - {505} 887-8947

DATE: April 27, 1993

Dr. James A. Mewhinney
DOE Point of Contact
P. O. Box 3090
W.I.P.P. Site / Jal hiway
Carlsbad, New Mexico 88221

Dear Dr. Mewhinney,

As per your request and with verbal approval from our manager, enclosed herewith are the analytical results of the NMED soil sampling event that took place during October of 1992 and two figures depicting the sample locations. Thank you for transmitting the split sampling data generated by WID/WIPP. I might point out that the NMED/WIPP investigators did not request a full suite of analyses be performed or all samples analyzed, but only those that were strategically appropriate. Below is as comparison of samples taken and analyses requested by NMED:

Cotton Baby Shallow and Deep - Aliphatic Hydrocarbons, VOC, Semi-VOC, Heavy Metals - ICAP and Arsenic.
Badger Unit 0-5 ft. Shallow - Aliphatic Hydrocarbons, VOC, Heavy Metals - ICAP Scan and Arsenic.
Badger Unit Deep - Samples taken but no analyses requested.
Background Soil - not analyzed.
DOE-1 mudpit Shallow - Aliphatic Hydrocarbons, VOC, Heavy Metals - ICAP scan and Arsenic.
DOE-1 mudpit Deep - Aliphatic Hydrocarbons and VOC.
Facility West Shallow - Semi-VOC and Heavy metals - ICAP scan and Arsenic.
Facility West Deep - not analyzed.
Facility South Shallow - Semi-VOC and Heavy metals - ICAP scan and Arsenic.
Facility South Deep - not analyzed.

The NMED data will be used to support conclusions made by the EPA as to any further corrective action that DOE/WIPP may be subject to relative to the Hazardous and Solid Waste Act Amendments (HSWA) culminating in the issuance of the HSWA permit by the EPA. Thank you again for the cooperation and if further information is needed please feel free to drop by our site office or call either Paul or myself.

Sincerely,

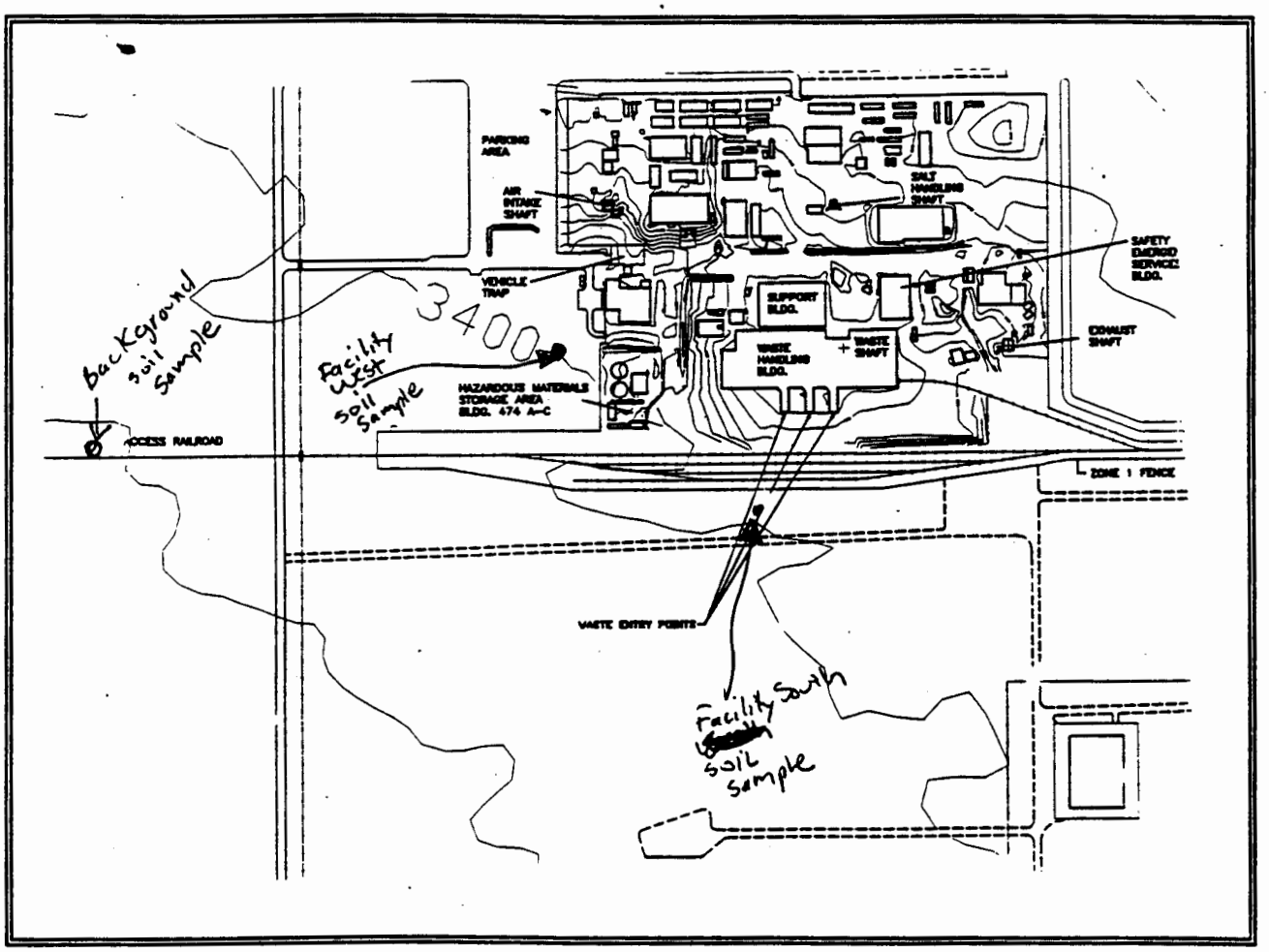
Patrick W. McCasland
NMED/WIPP Point of Contact

cc w/o enclosure:

NMED John Parker

Sampling Location
Site Sketch
Scale: 1" = 40'

New Mexico Environment Department
Location:
Date:
Comments:



ORGANIC CHEMISTRY ANALYTICAL REQUEST FORM

SCIENTIFIC LABORATORY DIVISION
700 CAMINO DE SALUD N.E., ALBUQUERQUE, NM 87106
Organic Chemistry Section - Telephone: (505) 841-2570

SLD No. 1 OR92 2368 B

Date Received: 10-15-92

2 User Code #: 5 5 8 0 2

3 Request ID No.: Request ID No. 039100-B

4 Priority Code #: 3 (1, 2 or 3 call ED-SLD Coordinator)

Facility Name: Waste Isolation Pilot Plant

6 County: Eddy

7 City: Carlsbad 26 miles East

8 State: NM

9 Sample Location: FACILITY WIEST WIPP Shallow

10 Collected By: Paul Biainchez (First / Last) On: 10/7/92 (Date: YY/MM/DD) At: 1050 (Time: 24 hr. clock 3:00 pm = 1500 hrs.) hrs.

11 Codes: Submitter / WSS # / Organization

12 Latitude (DDMMSS) / Longitude (DDDMMSS) / 2 Digit ID (if needed)

13 Report To: Name Paul Sanchez

14 Phone #: 887-8947

Address: PO Box 3090
WIPP Site

City, State Zip: Carlsbad, New Mexico 88220

15 Sampling Information:
Sample Purpose:
- [ ] Compliance
- [x] Check
- [ ] Monitoring
- [ ] Special

- [x] Grab
- [ ] Composite ____ (Composite Time Period)
  - [ ] Flow Proportioned
  - [ ] Equal Aliquot
- [ ] Sample Split w/Permittee
- [ ] Chain of Custody

16 Field Data: pH: ____, Conductivity: ____ umhos @ ____ °C, Temperature: ____ °C, Chlorine Residual: ____ mg/l, Flow: ____

17 Sample Source:
- [ ] Stream
- [ ] Lake
- [ ] Drain
- [ ] Pool
- [ ] WWTP
- [ ] Well; Depth: ____
- [ ] Spring
- [ ] Distribution
- [ ] Point-of-Entry
- [x] Other: Surface Terrain

18 Field Notes/ Sample #:

Sample Type: [ ] Water, [x] Soil, [ ] Food, [ ] Wastewater, [ ] Other ____

This form accompanies a single sample consisting of:
____ - septum vial(s) (volume = ____)
____ - glass jugs (volume = ____)
1 - Glass Jar (volume = 8 oz)

20 Preservation:
- [ ] NP — No Preservation; Sample stored at room temperature
- [x] P-Ice — Sample stored in an ice bath (Not Frozen)
- [ ] P-TS — Sample Preserved with Sodium Thiosulfate to remove chlorine residual
- [ ] P-HCl — Sample Preserved with Hydrochloric Acid (2 drops/40 ml)
- [ ] Other ____

21 Analyses Requested: Please check the appropriate box(es) below to indicate the type of analytical screen(s) required. Whenever possible, list specific compounds suspected or required.

Volatile Screens:
- [ ] (753) Aliphatic Headspace (1-5 Carbons)
- [ ] (754) Aromatic & Halogenated Purgeables (EPA 601 & 602)
- [ ] (765) Mass Spectrometer Purgeables (EPA 624)
- [ ] (766) SDWA Total Trihalomethanes (EPA 501.1)
- [ ] (774) SDWA VOC's I [8 Regulated +] (EPA 502.2)
- [ ] (775) SDWA VOC's II [EDB & DBCP] (EPA 504)

Other Specific Compounds or Classes:
- [ ] ( )
- [ ] ( )
- [ ] ( )

Semivolatile Screens:
- [ ] (763) Acid Extractables
- [ ] (751) Aliphatic Hydrocarbons
- [x] (755) Base/Neutral Extractables (EPA 625)
- [ ] (756) Base/Neutral/Acid Extractables (EPA 8270)
- [ ] (758) Herbicides, Chlorophenoxy Acid
- [ ] (759) Herbicides, Triazines
- [ ] (760) Organochlorine Pesticides
- [ ] (761) Organophosphate Pesticides
- [ ] (767) Polychlorinated Biphenyls (PCB's)
- [ ] (764) Polynuclear Aromatic Hydrocarbons
- [ ] (762) SDWA Pesticides & Herbicides

Remarks:

STATE OF NEW MEXICO DEPARTMENT OF HEALTH

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
ORGANIC CHEMISTRY SECTION [505]-841-2570

November 17, 1992

Request
ID No. 039100

ANALYTICAL REPORT
SLD Accession No. OR-92-2368

Distribution
(_) User 55802
(■) Submitter 536
(※) SLD Files

RECEIVE
DEC 01 19
NM ED WIPP

To: P. Sanchez
ED - DOE Project; Carlsbad
NM - Envir. Dept.; WIPP
P.O. Box 3090
Carlsbad, NM 88220

From: Organic Chemistry Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: A ~~water~~ soil, Extractab sample submitted to this laboratory on October 15, 1992

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*
On: 7-Oct-92	*By:* San . . .	Facility West WIPP Shallow
At: 10:30 hrs.	*In/Near:* Carlsbad	

ANALYTICAL RESULTS: Base/Neutral Extractable [EPA-625] Screen {755}

Parameter	Value	Note	MDL	Units
Bis(2-ethylhexyl)phthalate	81.40	T	500.00	ppb

See Laboratory Remarks for Additional Information

Notations & Comments:

MDL = Minimal Detectable Level.

A = Approximate Value; N = None Detected above Detection Limit; P = Compound Present, but not quantified;
T = Trace (<Detection Limit); U = Compound Identity Not Confirmed.

Evidentiary Seals: Not Sealed [X]; Intact: No [ ], Yes [ ] & Broken By: _____ Date: _____

Laboratory Remarks: Waste Isolation Pilot Plant

B/N EXTRACTABLE ANALYSIS DATA SHEET

Lab Name: NM SCIENTIFIC LABORATORY DIVISION Contract: N/A
Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: N/A
Matrix: (soil/water) Soil Lab Sample ID: OR-92-2368
Sample wt/vol: 19.91 (g/mL) g SLD Batch No: 308
Level: (low/med) Low Date Received: 10/15/92
% Moisture: not dec. 23.4 dec. ____ Date Extracted: 10/16/92
Extraction: (SepF/Cont/Sonc) Sonc Date Analyzed: 10/20/92
GPC Cleanup: (Y/N) No pH: ____ Dilution Factor: 1
CONCENTRATION UNITS:
(ug/L or ug/Kg): ug/Kg

This sample was analyzed for the following compounds
using EPA Method 8270 without acid extraction

CAS NO.	COMPOUND	CONC.	QUALIFIER

(Continued on page 2.)

83-32-9	Acenaphthene	500.0	U
208-96-8	Acenaphthylene	500.0	U
120-12-7	Anthracene	500.0	U
117-81-7	Benzo(a)anthracene	500.0	U
205-99-2	Benzo(b)fluoranthene	1000.0	U
207-08-9	Benzo(k)fluoranthene	1000.0	U
191-24-2	Benzo(g,h,i)perylene	1000.0	U
50-32-8	Benzo(a)pyrene	1000.0	U
100-51-6	Benzyl alcohol	500.0	U
111-91-1	Bis(2-chloroethoxy)methane	500.0	U
111-44-4	Bis(2-chloroethyl)ether	500.0	U
39638-32-9	Bis(2-chloroisopropyl)ether	500.0	U
117-81-7	Bis(2-ethylhexyl)phthalate	81.4	JB
101-55-3	4-Bromophenylphenyl ether	500.0	U
85-68-7	Butylbenzyl phthalate	500.0	U
106-47-8	4-Chloroaniline	1000.0	U
91-58-7	2-Chloronaphthalene	500.0	U
7005-72-3	4-Chlorophenylphenyl ether	500.0	U
218-01-9	Chrysene	500.0	U
53-70-3	Dibenz(a,h)anthracene	500.0	U
132-64-9	Dibenzofuran	500.0	U
84-74-2	Di-n-butyl phthalate	500.0	U
95-50-1	1,2-Dichlorobenzene	500.0	U
541-73-1	1,3-Dichlorobenzene	500.0	U
106-46-7	1,4-Dichlorobenzene	500.0	U
91-94-1	3,3'-Dichlorobenzidine	500.0	U
84-66-2	Diethyl phthalate	500.0	U
131-11-3	Dimethyl phthalate	500.0	U
121-14-2	2,4-Dinitrotoluene	500.0	U
606-20-2	2,6-Dinitrotoluene	500.0	U
117-84-0	Di-n-octyl phthalate	1000.0	U
206-44-0	Fluoranthene	500.0	U
86-73-7	Fluorene	500.0	U
118-74-1	Hexachlorobenzene	500.0	U
87-68-3	Hexachlorobutadiene	2500.0	U
77-47-4	Hexachlorocyclopentadiene	2500.0	U
67-72-1	Hexachloroethane	500.0	U
193-39-5	Indeno(1,2,3-cd)pyrene	500.0	U
78-59-1	Isophorone	500.0	U
91-57-6	2-Methylnaphthalene	500.0	U
91-20-3	Naphthalene	500.0	U
88-74-4	2-Nitroaniline	500.0	U

(Continued on page 3.)

99-09-2	3-Nitroaniline	5000.0	U
100-01-6	4-Nitroaniline	2500.0	U
98-95-3	Nitrobenzene	500.0	U
86-30-6	N-nitrosodiphenylamine	500.0	U
621-64-7	N-nitroso-di-n-propylamine	500.0	U
85-01-8	Phenanthrene	500.0	U
129-00-0	Pyrene	500.0	U
120-82-1	1,2,4-Trichlorobenzene	500.0	U

* Qualifier Definitions:
B - Indicates compound was detected in the Lab Blank as well as in the sample.
D - Indicates value taken from a secondary (diluted) sample analysis.
E - Indicates compound concentration exceeded the range of the standard curve.
J - Indicates an estimated value for tentatively identified conpounds, or for compounds detected and identified but present at a concentration less than the quantitation limit.
N - Indicates that more than one peak was used for quantitation.
U - Indicates compound was analyzed for, but not detected.

TENTATIVELY IDENTIFIED COMPOUNDS DATA SHEET

The following compounds were tentatively identified by Mass Spec:

CAS NO.	COMPOUND	RT	EST. CONC.	Q
42513-42-8	8-dodecenol	26.9	4458.0	J
111-02-4	2,6,10,15,19,23-hexamethyl-			
	2,6,10,14,18,22-tetra-			
	cosahexaene	36.9	672.1	J
52078-56-5	11-tricosene	27.0	446.0	J
15232-05-6	1-pentyl-cyclohexene	27.7	340.3	J
19812-64-7	1,14-tetradecanediol	28.8	239.0	J
16695-40-2	7-dodecenol	27.5	235.3	J
994-05-8	2-methoxy-2-methyl butane	5.1	223.8	J
109-87-5	dimethoxy methane	11.1	212.4	J

QUALITY CONTROL SUMMARY FOR SEMIVOLATILES SCREEN

(Continued on page 4.)

DATE EXTRACTED: 10/16/92

METHOD BLANK: A laboratory method blank was analyzed along with this sample to assure the absence of interfering contaminants from lab reagents, instruments, or the general laboratory environment. Unless listed below, no contaminants were detected in this blank above the reported detection limit.

COMPOUND DETECTED	CONCENTRATION (PPB)
bis(2-ethylhexyl)phthalate	51.0
7-pentyl-bicyclo 4.1.0 heptane	11916.0
3-chloro decane	1222.0
1-pentyl cyclohexene	690.0
11-dodecenol	667.0
7-dodecenol	494.0
1,E-13,Z-13-hexadecatriene	475.0
2-methyl anthracene	355.0
2-heptadecanol	225.0

SURROGATE RECOVERIES:

SURROGATE		CONCENTRATION		% RECOVERY
Nitrobenzene-d5	(B/N)	44	ppb	88.0
2-Fluorobiphenyl	(B/N)	58	ppb	116.0
Terphenyl-d14	(B/N)	47	ppb	94.0

SPIKE RECOVERY: The % recoveries for compounds in the batch spike were within EPA SW-846 criteria with the exception of the compounds listed below:

COMPOUND	CONCENTRATION	% RECOVERY
2,4-Dinitrotoluene	0.0 ppb	0.0

Analyst: Michael J. Owen
Analyst, Organic Chemistry

Reviewed By: Richard F. Meyerhein 11/17/92
Supervisor, Organic Chemistry Section

STATE OF NEW MEXICO DEPARTMENT OF HEALTH

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
AIR & HEAVY METALS SECTION [505]-841-2553

March 11, 1993

Request
ID No. 039102

ANALYTICAL REPORT
SLD Accession No. IC-92-0964

Distribution
( ) User 55802
(■) Submitter 536
(✱) SLD Files

To: Paul Sanchez
NMED - WIPP Oversight
P.O. Box 3090 MS # 180
WIPP Site, Jal Highway
Carlsbad, NM 87220

From: Air & Heavy Metals Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: **A soil sample submitted to this laboratory on October 15, 1992**

User:
ED Haz. & Rad. Materials Bur.
ED DOE Project, H&R Materials
P.O. Box 26110
Santa Fe, NM 87502

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*
On: 7-Oct-92	*By:* San . . .	Facility West WIPP Shallow
At: 10:45 hrs.	*In/Near:* Carlsbad	

ANALYTICAL RESULTS in uG/Gram

Analysis	Value	Analysis	Value	Analysis	Value
Aluminum	>9999.99	Copper	< 5.00	Silver	< 5.00
Barium	51.00	Iron	>9999.99	Strontium	17.00
Beryllium	< 5.00	~~Lead~~	~~< 5.00~~ JFA	Tin	< 5.00
Boron	< 5.00	Magnesium	1700.00	Vanadium	17.00
Cadmium	< 5.00	Manganese	61.00	Zinc	19.00
Calcium	1600.00	Molybdenum	< 5.00	Arsenic	1.6000
Chromium	10.00	Nickel	7.00		
Cobalt	< 5.00	Silicon	530.00		

Laboratory Remarks: Digested. 89.8% solids.
Aluminum by ICP = 14100.00 ug/g
Iron by ICP = 10100.00 ug/g

Pb is being analyzed by flame AA. A revised report will follow. JFA

Reviewed By: JFA
Jim F. Ashby 10/03/93
Supervisor, Air & Heavy Metals Section

Appendix L

WIPP Sample Results and Statistical Analysis For Samples Collected Outside the SWMU

WIPP Sample Results and Statistical Analysis for Samples Collected Outside the SWMU, Upgradient/Background Samples - 12 to 24 inches below ground surface (1 page total)

WIPP Sample Results and Statistical Analysis for Samples Collected Outside the SWMU, Upgradient/Background Samples - more than 24 inches below ground surface (1 page total)

WIPP SAMPLE RESULTS AND STATISTICAL ANALYSIS FOR SAMPLES COLLECTED OUTSIDE THE SWMU

Upgradient/background shallow samples - 12 to 24 inches below ground surface																
			Concentrations in ppmw (mg/kg)													
SWMU	Hole	Location	Total Arsenic (As)		Total Barium (Ba)		Total Cadmium (Cd)		Total Chromium (Cr)		Total Lead (Pb)		Total Mercury (Hg)		Total Thallium (Tl)	
001g	1	H-14	0.9	J	15		0.7	J	3		1.9	J	0.01	UJ	10	U
001g	1	Mudpit P-1	1	J	35		0.25	UJ	5		2.1	J	0.01	U	10	U
001g	2	Mudpit P-1	1.2	J	39		0.25	UJ	3		1.8	J	0.01	U	10	U
001l	1	Mudpit P-5	1.5	J	120		0.25	UJ	3		2.2	J	0.01	U	10	U
001m	1	Mudpit P-15	0.6		13		0.25	U	4		1.2		0.01	UJ	10	UJ
001t	1	IMC 374	0.5		10		0.25	U	4		1.5		0.01	UJ	10	UJ
001h	1	H-15	0.9		21		0.25	U	4		2.8	J	0.015	U	10	U
001h	1	Mudpit P-2	0.8		19		0.25	U	6		2.1		0.015	U	10	U
001x	1	WIPP-13	0.15	U	10		0.25	U	3		1.6		0.015	U	10	U
001j	3	Mudpit P-3	0.5		17		0.25	U	26		1.5		0.03		10	U
001k	2	Mudpit P-4	0.6	J	15	J	0.25	UJ	4	J	1.4		0.06		10	U
001m	1	Mudpit P-6	0.4	J	11	J	0.25	UJ	1	UJ	1.3		0.015	U	10	U
001s	1	ERDA-9	1.4	J	110	J	0.25	UJ	4	J	1.9		0.015	U	10	U
004a	5	Portacamp	0.7	J	14		0.25	U	2		1.4		0.015	U	30	
SUMMARY STATISTICS																
		Max	1.5	J	120		0.7	J	26		2.8	J	0.06		30	
		Min	0.15	U	10		0.25	U	1	UJ	1.2		0.01	U	10	U
		Mean	0.80		32		0.3		5		1.8		0.02		11	
		Geom. Mean	0.70								1.7					
		Std. Dev.	0.38		36		0.1		6		0.44		0.01		5	
		Number	14		14		14		14		14		14		14	
BACKGROUND STATISTICS																
		>50 % Non Detect?	No		No		Yes		No		No		Yes		Yes	
		"W" / Normal?	0.968	Y	0.621	N	NA		0.481	N	0.927	Y	NA		NA	
		"W" / Lognormal?	0.915	Y	0.823	N	NA		0.832	N	0.964	Y	NA		NA	
		Outliers?	No		NA		NA		NA		No		NA		NA	
		Rec. Bkg. Statistic	95%UTL(ln)		NPUTL		NPUTL		NPUTL		95%UTL(ln)		NPUTL		NPUTL	
		Rec. Bkg. Value	3.3		120		0.7		26		3.2		0.06		30	
Carlsbad Background Value			6.5		500		No Data		50		<10		0.051		No Data	
Western U.S. Bkg. Value			5.5		580		No Data		41		17		0.046		No Data	

FOOTNOTES:

Concentrations reported with U or UJ qualifiers represent one-half of the laboratory reporting limit; U = not detected; J = estimated value

Critical value for Shapiro-Wilk statistic "W", n=14, risk = 0.05 : 0.874;

Geom. Mean = geometric mean; ppmw = parts per million by weight; mg/kg = milligrams per kilogram; NA = not applicable; Y = yes; N = no;

Rec. Bkg. Statistic = Recommended background statistic; 95%UTL(ln) = inv. ln of 95 percent upper tolerance limits for natural logarithms

UTL = upper tolerance limit; NPUTL = nonparametric upper tolerance limit; LRL = laboratory reporting limit

Reference for Carlsbad and Western U.S. Background Values (USGS, 1984)

WIPP SAMPLE RESULTS AND STATISTICAL ANALYSIS FOR SAMPLES COLLECTED OUTSIDE THE SWMU

Upgradient/background deep samples - more than 24 inches below ground surface																
			Concentrations in ppmw (mg/kg)													
SWMU	Hole	Location	Total Arsenic (As)		Total Barium (Ba)		Total Cadmium (Cd)		Total Chromium (Cr)		Total Lead (Pb)		Total Mercury (Hg)		Total Thallium (Tl)	
001g	1	H-14	2	J	26		0.25	UJ	7		2.7	J	0.01	UJ	10	U
001g	1	Mudpit P-1	1.8	J	52		0.25	UJ	2		3.8	J	0.04		10	U
001g	2	Mudpit P-1	1.3	J	34		0.25	UJ	7		5.4	J	0.01	U	10	U
001l	1	Mudpit P-5	0.9	J	62		0.25	UJ	4		3.6	J	0.03		10	U
001m	1	Mudpit P-15	0.8		16		1.8		5		1.4		0.01	UJ	10	UJ
001t	1	IMC 374	0.6		15		0.25	U	5		1.6		0.01	UJ	10	UJ
001h	1	H-15	1.7		33		0.25	U	5		2.9	J	0.03		10	U
001h	1	Mudpit P-2	1.4		28		0.25	U	6		2.6		0.015	U	10	U
001x	1	WIPP-13	0.6		12		0.5		4		1.5		0.015	U	10	U
001j	3	Mudpit P-3	0.6		20		0.25	U	5		2		0.015	U	10	U
001k	2	Mudpit P-4	0.7	J	19	J	0.25	UJ	4	J	1.4		0.015	U	10	U
001m	1	Mudpit P-6	0.5	J	10	J	0.25	UJ	4	J	1.2		0.015	U	10	U
001s	1	ERDA-9	0.5	J	15		0.25	UJ	4		1.8		0.015	U	10	U
004a	5	Portacamp	0.7	J	14		0.25	U	4		1.5		0.015	U	10	U
SUMMARY STATISTICS																
		Max	2	J	62		1.8		7		5.4	J	0.04		10	U
		Min	0.5	J	10	J	0.25	U	2		1.2		0.01	U	10	U
		Mean	1.0		25		0.38		5		2.4		0.02		10	U
		Geom. Mean	0.90		22				5		2.2					
		Std. Dev.	0.5		15		0.41		1		1.2		0.01		0	
		Number	14		14		14		14		14		14		14	
BACKGROUND STATISTICS																
		>50 % Non Detect?	No		No		Yes		No		No		Yes		Yes	
		"W" / Normal?	0.841	N	0.84	N	NA		0.891	Y	0.851	N	NA		NA	
		"W" / Lognormal?	0.888	Y	0.951	Y	NA		0.848	N	0.926	Y	NA		NA	
		Outliers?	No		No		NA		No		No		NA		NA	
		Rec. Bkg. Statistic	95%UTL(ln)		95%UTL(ln)		NPUTL		95%UTL		95%UTL(ln)		NPUTL		LRL	
		Rec. Bkg. Value	3.3		91		1.8		8.2		7.1		0.04		20	
Carlsbad Background Value			6.5		500		No Data		50		<10		0.051		No Data	
Western U.S. Bkg. Value			5.5		580		No Data		41		17		0.046		No Data	

FOOTNOTES:

Concentrations reported with U or UJ qualifiers represent one-half of the laboratory reporting limit; U = not detected; J = estimated value

Critical value for Shapiro-Wilk statistic "W", n=14, risk = 0.05 : 0.874;

Geom. Mean = geometric mean; ppmw = parts per million by weight; mg/kg = milligrams per kilogram; NA = not applicable; Y = yes; N = no;

Rec. Bkg. Statistic = Recommended background statistic; 95%UTL(ln) = inv. ln of 95 percent upper tolerance limits for natural logarithms

UTL = upper tolerance limit; NPUTL = nonparametric upper tolerance limit; LRL = laboratory reporting limit

Reference for Carlsbad and Western U.S. Background Values (USGS, 1984)