

Administrative Record

FORT WINGATE DEPOT ACTIVITY, GALLUP, NEW MEXICO

**Document No. 80-2**

*Army Pollution Abatement Program Study,  
Hazardous Waste Management Consultation,  
Fort Wingate Depot Activity,  
Gallup, New Mexico*

*(Re: Ground-Water Monitoring Requirements  
at the TNT Wastewater Leaching Beds)*

U.S. Army Environmental Hygiene Agency

May 1981



---

INQUIRIES REGARDING THIS DOCUMENT AND/OR THE ADMINISTRATIVE RECORD FOR  
FORT WINGATE DEPOT ACTIVITY SHOULD BE MADE TO:  
COMMANDER, TOOELE ARMY DEPOT, TOOELE, UTAH 84074



**A  
E  
H  
A**

**UNITED STATES ARMY  
ENVIRONMENTAL HYGIENE  
AGENCY**

**ABERDEEN PROVING GROUND, MD 21518**

ARMY POLLUTION ABATEMENT PROGRAM STUDY  
HAZARDOUS WASTE MANAGEMENT CONSULTATION  
FORT WINGATE DEPOT ACTIVITY  
GALLUP, NEW MEXICO  
14-15 MAY 1981  
(USAHA CONTROL NO. 81-26-8263-81)

*92301, 92302, 92303, 92304, 92305, 92306, 92307, 92308, 92309, 92310, 92311, 92312, 92313, 92314, 92315, 92316, 92317, 92318, 92319, 92320, 92321, 92322, 92323, 92324, 92325, 92326, 92327, 92328, 92329, 92330, 92331, 92332, 92333, 92334, 92335, 92336, 92337, 92338, 92339, 92340, 92341, 92342, 92343, 92344, 92345, 92346, 92347, 92348, 92349, 92350, 92351, 92352, 92353, 92354, 92355, 92356, 92357, 92358, 92359, 92360, 92361, 92362, 92363, 92364, 92365, 92366, 92367, 92368, 92369, 92370, 92371, 92372, 92373, 92374, 92375, 92376, 92377, 92378, 92379, 92380, 92381, 92382, 92383, 92384, 92385, 92386, 92387, 92388, 92389, 92390, 92391, 92392, 92393, 92394, 92395, 92396, 92397, 92398, 92399, 92400*

*HC  
BY*



DEPARTMENT OF THE ARMY  
 U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
 ABERDEEN PROVING GROUND, MARYLAND 21010

Mr. Fox/TM/AUTOVCH  
 584-2024

REPLY TO  
 ATTENTION OF  
 HSE-ES-G/WP

21 AUG 1981

SUBJECT: Army Pollution Abatement Program Study, Hazardous Waste Management Consultation, Fort Wingate Depot Activity, Gallup, NM, 14-15 May 1981 (USAHA Control No. 81-26-8263-81)

Commander  
 DARCOMI & SA  
 ATTN: DRCIS-RI-IC  
 Rock Island, IL 61299

1. This study was conducted to develop data necessary for obtaining waivers for the ground-water monitoring requirements at the Ft Wingate Depot Activity TNT wastewater leaching beds. Subsurface characteristics, water balance, and nearby water supplies were considered during the study in terms of potential migration of hazardous waste from the facility to the uppermost aquifer.
2. The facility has a low potential for hazardous waste migration to the uppermost aquifer due to site and facility characteristics. Existing data, as presented in this report, appear to be adequate to support the waiver. Although it is not required until Part B submission, it is recommended that a request for a waiver of ground-water monitoring requirements be submitted by the installation to the US Environmental Protection Agency, Region VI, using this report to provide the technical support for the waiver request.

FOR THE COMMANDER:

1 Incl  
 as (10 cy)

*for Stephen L. Kistner*  
 CURTIS A. BOND  
 Acting Director, Environmental Quality

CF:  
 HQDA (DASG-PSP)  
 Cdr, HSC (HSPA-P)  
 DIVENGR, USAEDSP (SPDEQ-TM)  
 Cdr, DESCOM (DRSOS-EF)  
 Cdr, FMDA (SDSTE-FMS) (2 cy)  
 Cdr, TEAD (SDSTE-ASP-E) (2 cy)  
 DIVENGR, USAEDH (HNDEN-A)  
 DIVENGR, Sacramento (SPKED-M)  
 Cdr, DARCOM (DRCSE)  
 Cdr, MEDDAC, HMMTC

(PRINTED ADDRESS ONLY)

CONTENTS

Paragraph	Page
1. AUTHORITY .....	1
2. REFERENCES .....	1
3. PURPOSE .....	1
4. GENERAL .....	1
a. Personnel Contacted .....	1
b. Location and Mission .....	1
c. Regulatory Considerations .....	1
5. FINDINGS AND DISCUSSION .....	2
a. Hazardous Waste Surface Impoundments .....	2
b. Subsurface Characteristics .....	2
c. Climate and Water Balance .....	5
d. Location of Water Sources Near the Leaching Beds .....	5
6. CONCLUSION .....	6
7. RECOMMENDATIONS .....	6
8. TECHNICAL ASSISTANCE .....	6
APPENDICES	
A - References .....	A-1
B - Sample Description Log of Well 69 .....	B-1
C - Lithologic Logs for Monitoring Wells Around the Leaching Beds .....	C-1



DEPARTMENT OF THE ARMY  
U S ARMY ENVIRONMENTAL HYGIENE AGENCY  
ABERDEEN PROVING GROUND, MARYLAND 2070

REPLY TO  
ATTENTION OF

HSE-ES-G/WP

ARMY POLLUTION ABATEMENT PROGRAM STUDY  
HAZARDOUS WASTE MANAGEMENT CONSULTATION  
FORT WINGATE DEPOT ACTIVITY  
GALLUP, NEW MEXICO  
14-15 MAY 1981  
(USAEHA CONTROL NO. 81-26-8263-81)

1. **AUTHORITY.** Letter, DRCIS-A, HQ, DARCOM, 2 February 1981, subject: Request for Assistance, RCRA, and indorsements thereto.

2. **REFERENCES.** See Appendix A for a listing of references.

3. **PURPOSE.** To develop data necessary for preparation of a waiver for ground-water monitoring requirements at a hazardous waste site to be in compliance with the Resource Conservation and Recovery Act (RCRA) (reference 1, Appendix A) and in accordance with 40 CFR 265, Subpart F (reference 2, Appendix A).

4. **GENERAL.**

a. Personnel Contacted.

- (1) MAJ Tetreault, Commander, Fort Wingate Depot Activity
- (2) Mr. Adrian Bond, Environmental Coordinator, Fort Wingate Depot Activity
- (3) Mr. L. Vargas, Fire Chief, Fort Wingate Depot Activity
- (4) Mr. David Gishewski, Enforcement Official, US Environmental Protection Agency (EPA) Region VI
- (5) Mr. Ray Krehoff, Engineer, New Mexico Environmental Improvement Board

b. Location and Mission. The Ft Wingate Depot Activity is located 11 miles east of Gallup, New Mexico. The installation operates as a storage facility for the care, preservation, and maintenance of assigned commodities.

c. Regulatory Considerations. Administration of the hazardous waste management program in the State of New Mexico is presently being accomplished by the EPA, Region VI, located in Dallas, Texas. Requirements for data to be submitted in support of a ground-water monitoring waiver are listed in 40 CFR 265, Subpart F. Waivers may be developed and retained by the owner/operator of a hazardous waste facility from 19 November 1981 until EPA requests submission of the Part B, RCRA permit and the waiver (reference 7, Appendix A). However, it is recommended that coordination with EPA and the State be initiated at this time. The State of New Mexico does not have interim

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
NM, 14-15 May 81

primacy at the present time, but receives courtesy copies of any permits or waivers from EPA. Although New Mexico may be granted interim primacy in the future, it is anticipated (reference 8, Appendix A) that the ground-water monitoring requirements will be the same as those in 40 CFR 265, Subpart F. If New Mexico is granted interim authority for hazardous waste facilities, the waiver would be sent to the appropriate State office.

## B. FINDINGS AND DISCUSSION.

a. Hazardous Waste Surface Impoundments. TNT wastewater leaching beds are located approximately 400 feet south of the Fort Wingate Depot Activity Administration Area as shown on Figure 1. The twin leaching beds cover an area of 90,000 square feet and are 5 feet deep. The leaching beds contain no water or wastewater at the present time and have been inactive since 1967 (reference 6, Appendix A). There are no plans to reactivate this waste facility in the near future.

### b. Subsurface Characteristics.

(1) Soils. Soils in the area of the leaching beds have developed on alluvium of the South Fork of the Puerco River. Fine grained sand is the predominant material with large percentages of silt and clay present.

#### (2) Geology.

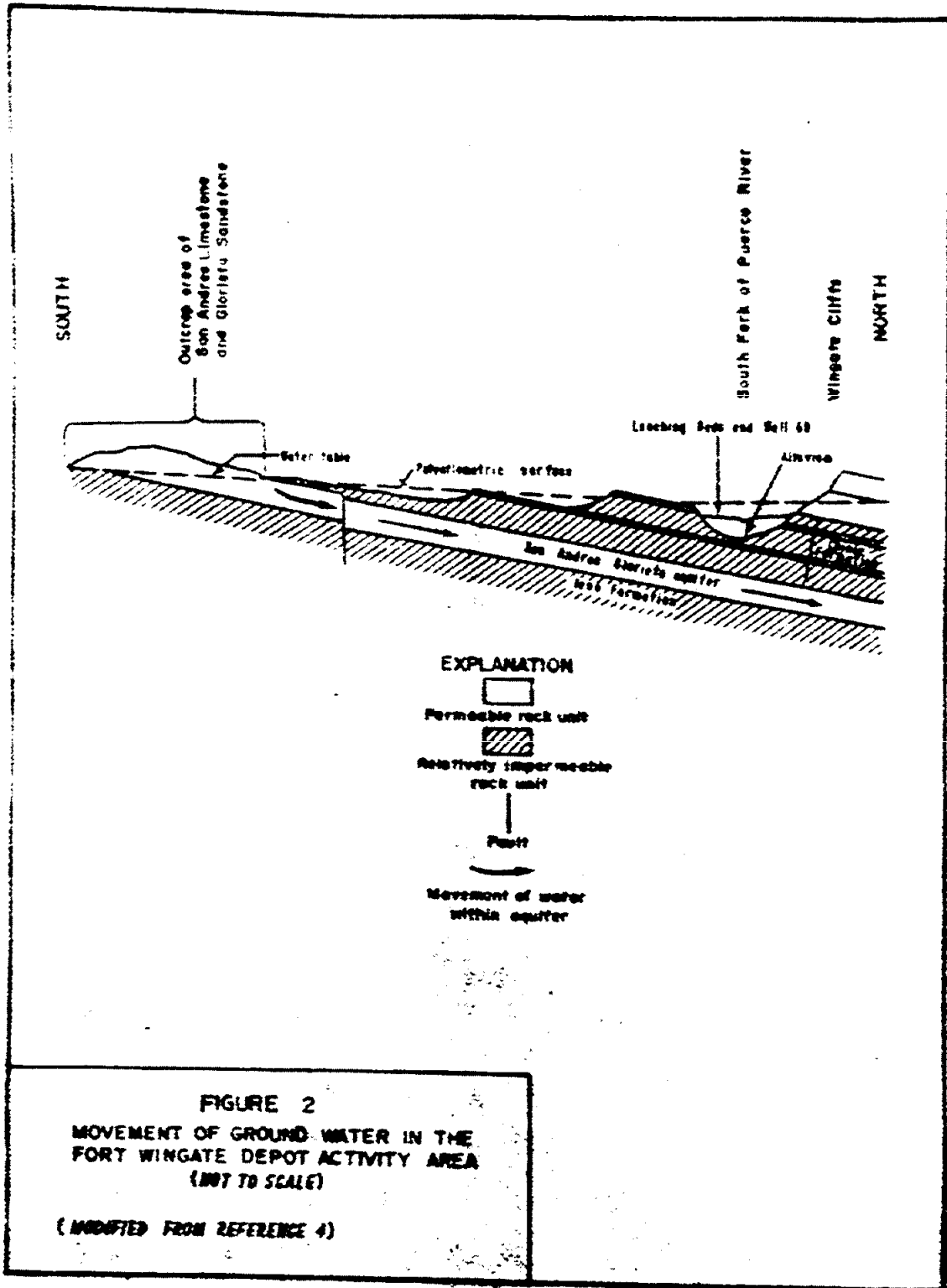
(a) Three geologic units are of primary concern in the area of the leaching beds, as shown on Figure 2. The oldest (Permian age) of these units is the Glorieta sandstone which is the major aquifer for Fort Wingate Depot Activity. The Glorieta sandstone is a fine grained to very fine grained quartz sandstone, cemented with calcium carbonate or silica. Well 69 is 2200 feet north of the leaching beds and is used to characterize the geology of the site. The lithologic log for Well 69 (Appendix B) shows the top of the Glorieta sandstone at 1170 feet below the surface with a thickness of 180 feet.

(b) Overlying the Glorieta sandstone is the Chinle formation which is 1100 feet thick at Well 69 beginning at 70 feet below ground surface. The Chinle consists primarily of claystone with some thin sandstone units and a few thin siltstone units.

(c) The surficial unit is the alluvium of the South Fork Puerco River, which is 70 feet thick at Well 69. This material is described in detail in the lithologic logs for monitoring Wells FW 10, 11, 12, and 13 (Appendix C). The alluvium at the leaching beds is silty sand, silt, and clay. The deepest well, FW 10, encountered a 16.5-foot clay unit from 35 feet to 51.5 feet in depth. This clay may be weathered claystone of the Chinle formation.



Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
 NM, 14-15 May 81



**FIGURE 2**  
**MOVEMENT OF GROUND WATER IN THE**  
**FORT WINGATE DEPOT ACTIVITY AREA**  
**(NOT TO SCALE)**

**(MODIFIED FROM REFERENCE 4)**



(3) Ground Water. Ground water has not been encountered in the monitoring wells FW 10, 11, 12, 13 with Well FW 10 being the deepest at 51.5 feet (Appendix C). The wells were dry during the environmental survey conducted in late 1980 and early 1981 by Environmental Science and Engineering, Inc. The Glorieta sandstone is the uppermost aquifer at a depth of 1170 feet below the surface at Well 69. The Chinle formation serves as a confining stratum over the Glorieta aquifer. The potentiometric surface of this aquifer is above the ground surface at the leaching beds and Well 69 (Figure 2). The claystone of the Chinle formation effectively stops the downward movement of any water in the alluvium.

c. Climate and Water Balance.

(1) Fort Wingate Depot Activity enjoys a semiarid climate with an annual average precipitation of 10.6 inches. Most of the precipitation comes in the form of thunderstorms, causing large amounts of runoff over a short time period. There are no perennial surface water streams on Fort Wingate Depot Activity.

(2) The dominant factors in a water balance are precipitation and evapotranspiration since surface water and ground-water resources are insignificant near the leaching beds. Annual water gains to Fort Wingate Depot Activity and the leaching beds are 10.6 inches of precipitation. Water losses correspond to the potential evapotranspiration rate which is approximately 52 inches per year (reference 5, Appendix A). The potential net annual water loss calculated from the precipitation and evapotranspiration rates is 41.4 inches at the leaching beds area. The effect of a large negative water balance is to severely limit the ground-water recharge to the regional aquifer. The amount of water reaching an aquifer equals the total infiltration minus the amount of water absorbed by the soil or subsurface material in the unsaturated zone. In semiarid regions, rainfall is rarely sufficient to exceed the storage capacity of the soil. Since the unsaturated zone in the semiarid Fort Wingate Depot Activity area contains very little water from natural sources, a large amount of water from an artificial source would be required before recharge to the ground-water system could occur.

d. Location of Water Sources Near the Leaching Beds. No perennial streams are near the leaching beds. The largest stream to the north of Fort Wingate Depot Activity is the South Fork of the Puerco River which is dry most of the year. The closest water supply well to the leaching beds is Well 69 which is 2200 feet to the north. However, this well taps the Glorieta aquifer, which is separated from the leaching beds by approximately 1000 feet of claystone from the Chinle formation. The claystone is impermeable and therefore acts as a large barrier between the leaching beds and the water supply aquifer.

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
NM, 14-15 May 81

6. CONCLUSION. The leaching beds at Fort Wingate Depot Activity are effectively isolated from any surface water and ground water by a high negative water balance and thick impermeable geologic units. Therefore, the potential for contaminant migration to the uppermost aquifer or any surface water is virtually nonexistent.

7. RECOMMENDATIONS.

a. Prepare a request for a waiver for ground-water monitoring at the TNT wastewater leaching beds using this report as the supporting document.

b. Coordinate the ground-water monitoring waiver with EPA and New Mexico State officials, as appropriate.

8. TECHNICAL ASSISTANCE. This Agency will furnish assistance in the implementation of recommendations contained herein, on a continuing basis, as required. Informal technical advice and/or consultation may be obtained telephonically from Chief, Waste Disposal Engineering Division, USAEHA (AUTOVON 584-2024).

*Wayne A. Fox*

WAYNE A. FOX  
Geologist  
Waste Disposal Engineering Division

APPROVED:

*David J. Warner*

DAVID J. WARNER, P.E.  
MAJ, MSC  
Chief, Waste Disposal Engineering Division

Hazardous Waste Mgt Consultation No. 01-26-8253-61, Ft Wingate Depot Activity,  
M. 14-15 May 81

#### APPENDIX A

#### REFERENCES

1. Public Law 94-580, Resource Conservation and Recovery Act of 1976 (RCRA),  
21 October 1976.
2. Title 40, Code of Federal Regulations (CFR), Part 265, 1980 rev., Interim  
Status Standards for Owners and Operators of Hazardous Waste Treatment,  
Storage, and Disposal Facilities.
3. Mercer, J. W. and E. G. Cappala, "Drilling and Testing of Well 69, Fort  
Wingate Army Depot, McKinley County, New Mexico," US Geological Survey Open  
File Report, November 1971.
4. Shomaker, John W., "Water Resources of Fort Wingate Army Depot and  
Adjacent Areas, McKinley County, New Mexico," US Geological Survey Open File  
Report, September 1971.
5. US Department of Commerce, Climatic Atlas of the United States, June  
1958.
6. Installation Assessment of Fort Wingate Army Depot Activity, Record  
Evaluation Report No. 136, January 1980, US Army Toxic and Hazardous  
Materials Agency, Aberdeen Proving Ground, Maryland.
7. FONECON, between Mr. David Olshewski, EPA Region VI, and Mr. Wayne Fox,  
this Agency, 3 April 1981, subject: Waivers for Monitoring Well Requirements  
at White Sands Missile Range and Ft Wingate Depot Activity, New Mexico.
8. FONECON, between Mr. Ray Krehoff, New Mexico State Environmental  
Improvement Board, and Mr. Wayne Fox, this Agency, 3 April 1981, subject:  
Monitoring well Waivers at New Mexico Installations.

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
MM, 14-15 May 81

APPENDIX B

SAMPLE-DESCRIPTION LOG OF WELL 69  
FORT WINGATE DEPOT ACTIVITY, MCKINLEY COUNTY, NEW MEXICO\*

Note: Drill cuttings samples were collected at 10-foot intervals.

In effort was made to adjust sample-description log to  
geophysical logs and to identify cavings and exclude them  
from the description.

Color symbols in parentheses following the color of the rock  
are from the "Rock-Color Chart", 1963, distributed by the  
Geological Society of America, New York, N. Y.

Sample description by J. W. Mercer

<u>Stratigraphic unit and material</u>	<u>Thickness (feet)</u>	<u>Depth (feet)</u>
<u>Quaternary System:</u>		
<u>Alluvium:</u>		
Sand, pale-red (5 R 5/2); fine to medium-grained; silty; composed of subangular to subrounded, stained, quartz; minor dark accessory min- erals, unconsolidated -----	30	50
Silt, pale-red (10 R 6/2); sandy; contains subrounded, stained, quartz grains; minor fragments of claystone and sandstone, unconsolidated -----	20	70

\* Extracted from reference 3, Appendix A.

<u>Stratigraphic unit and material</u>	<u>Thickness (feet)</u>	<u>Depth (feet)</u>
<b>Triassic System:</b>		
<b>Chinle Formation:</b>		
<b>Petrified Forest Member (upper part):</b>		
Claystone, pale-reddish-brown (10 R 5/4); silty; calcareous; dark-gray limestone fragments common; minor stained quartz grains	60	130
Claystone, grayish-red (5 R 4/2); silty; calcareous; contains light- gray spots; white crystalline calcite and dark gray limestone fragments common	30	160
Claystone, pale-red (5 R 6/2) to grayish-red (5 R 4/2); silty; slightly calcareous	10	170
Claystone, pale-red (5 R 6/2); silty; slightly calcareous; grayish-pink (5 R 8/2) to pale-red (5 R 6/2) fine-grained calcareous sandstone common to abundant	20	190

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
---------------------------------	---------------------	-----------------

Triassic System - Continued:

Chinle Formation - Continued:

Petrified Forest Member (upper part) -- Continued:

<p>Sandstone, pale-red (5 R 6/2); silty;            very fine- to fine-grained; poorly            sorted; composed of clear to gray,            angular quartz grains; moderately            cemented; slightly calcareous;            red claystone and gray limestone            fragments common -----</p>	20	210
<p>Siltstone, pale-red (5 R 6/2) to            grayish-red (5 R 4/2); very sandy;            slightly calcareous; contains            minor mica flakes; red sandstone and            claystone fragments common -----</p>	50	260
<p>Sandstone, pale-red (10 R 6/2) to            grayish-orange-pink (5 YR 7/2); silty;            very fine- to fine-grained; poorly            sorted; composed of clear to amber,            subangular, quartz grains; moderately            cemented; slightly calcareous; contains            minor mica and dark accessory minerals;            red siltstone and gray limestone frag-            ments common -----</p>	10	270

Hazardous Waste Mt Consultation, No. 81-26-8263-81, Ft Wingate Depot, NM, 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Continued:		
Petrified Forest Member (upper part) - Continued:		
Siltstone, grayish-red (10 R 4/2) to pale-red (5 R 6/2); sandy; slightly calcareous; mica flakes and clear quartz grains common; claystone minor sandstone fragments common -----	10	130
Sandstone, pale-pink (5 RP 8/2) to pale red-purple (5 RP 6/2); silty; very fine- to fine-grained; poorly sorted; composed of subangular to rounded, clear to amber, quartz grains with dark accessory minerals common; moderately cemented; slightly cal- careous; minor white crystalline calcite; red claystone fragments common -----	10	140

<u>Stratigraphic unit and material</u>	<u>Thickness (feet)</u>	<u>Depth (feet)</u>
Triassic System - Continued:		
Chinle Formation - Continued:		
Petrified Forest Member (upper part) - Continued:		
Siltstone, grayish red-purple (5 RP 4/2); sandy; slightly calcareous; contains mica flakes; abundant pale red-purple (5 RP 6/2) sandstone fragments; red claystone fragments common	10	300
Sandstone, pale-red (5 R 6/2) to grayish orange-pink (10 R 8/2); silty; very fine- to fine-grained; moderately sorted; composed of angular to subrounded, clear to frosted, quartz grains; minor dark accessory minerals; moderately cemented, calcareous; abundant grayish-red (5 R 4/2) and light olive-gray (5 Y 5/2) claystone	10	310
Claystone, grayish-red (10 R 4/2); silty; calcareous; gray limestone and red silt- stone fragments common	20	330



Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Continued:		
Petrified Forest Member (upper part) - Continued:		
Claystone, grayish-red (10 R 4/2) to pale-olive (10 Y 6/2); silty; minor gray limestone and red siltstone fragments	10	340
Claystone, pale-red (5 R 6/2) to grayish- red (10 R 4/2); silty; slightly cal- careous; gray limestone and red siltstone minor to common; minor pink sandstone fragments; some of the claystone con- tains light colored "reduced" zones	10	380
Claystone, pale-red (5 R 6/2) to grayish- red (10 R 4/2); silty; calcareous; minor red siltstone; minor pale-olive (10 Y 6/2) claystone fragments	20	400
Claystone, pale-red (5 R 6/2) to grayish- red (5 R 4/2); silty; very calcareous; common to abundant white to dark-gray, subangular to rounded, limestone frag- ments; red siltstone fragments common; minor pale-olive claystone fragments	10	440

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Continued:		
Petrified Forest Member (upper part) - Continued:		
Siltstone, grayish red-purple (S RP 4/2) to grayish-red (10 R 4/2); clayey; contains rounded gray limestone fragments; very calcareous; red and grayish red-purple (S RP 4/2) claystone common to abundant	10	450
Claystone, grayish red-purple (S RP 4/2) to greenish-gray (S GY 6/1); silty; very calcareous; gray to white limestone fragments common; minor sandstone fragments	10	460
Sandstone, light brownish-gray (S YR 6/1); silty; very fine- to fine-grained; poorly sorted; composed of subangular to rounded clear to amber, quartz grains; dark accessory minerals common; minor mica flakes; moderately cemented, slightly calcareous; gray limestone and red claystone fragments common	30	490

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
---------------------------------	---------------------	-----------------

Triassic System - Continued:

Chinle Formation - Continued:

Patrified Forest Member (upper part) - Continued:

Claystone, grayish-red (10 R 4/2) to pale reddish-brown (10 R 5/4); silty; slightly calcareous; abundant light brownish-gray (5 YR 6/1) sandstone; gray limestone fragments common -----	20	510
Sandstone, light brownish-gray (5 YR 6/1); silty; very fine- to fine-grained; poorly sorted; composed of angular to subrounded, clear, quartz grains; dark accessory minerals common; minor mica flakes; moderately cemented; noncalcareous; red claystone common -----	10	520
Claystone, grayish-red (10 R 4/2) to grayish red-purple (5 RP 4/2); silty; calcareous; white to gray, angular to sub- rounded limestone common to abundant; brown sandstone common -----	20	540

Hazardous Waste Mgt Consultation No. 81-26-3263-81, Ft Wingate Depot Activity,  
 No, 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Continued:		
. Petrified Forest Member (upper part) - Concluded:		
Claystone, grayish-red (S R 4/2) to yellowish-gray (S Y 8/1); silty; slightly calcareous; contains sub- rounded grains of yellowish-gray limestone; minor white crystalline calcite; light-brown sandstone common;	20	570
pale-red siltstone common Claystone, grayish red-purple (S RP 4/2) to grayish-red (10 R 4/2); silty; slightly calcareous; contains white limestone fragments; light-brown sandstone and siltstone fragments common	10	580

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
 NM, 14-15 May 81

<u>Stratigraphic unit and material</u>	<u>Thickness (feet)</u>	<u>Depth (feet)</u>
<b>Triassic System - Continued:</b>		
<b>Chinle Formation - Continued:</b>		
<b>Petrified Forest Member (Sonsela Sandstone Bed):</b>		
Sandstone, pinkish-gray (S YR 8/1) to very light-gray (N 8); clayey; very fine- to fine-grained; poorly sorted; composed of angular to subrounded, frosted to clear quartz grains; moder- ately cemented; slightly calcareous; rare dark accessory minerals; red silt- stone and claystone (cavings?) common -	40	620
<b>Petrified Forest Member (lower part):</b>		
Claystone, grayish red-purple (S RP 4/2) to grayish-purple (S P 4/2); silty; contains spots of pale greenish-yellow (10 Y 8/2) clay; calcareous; grayish- red siltstone and dark-gray limestone minor to common -----	30	650
Claystone, yellowish-gray (S Y 7/2) with minor grayish-red (10 R 4/2) fragments; silty; contains very fine-grained quartz grains; very slightly calcareous -----	10	660

Hazardous Waste Mgt Consultation No. 81-26-8253-81, Ft Wingate Depot Activity,  
 NM, 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
China Formation - Continued:		
Petrified Forest Member (lower part) - Continued:		
Claystone, grayish red-purple (S RP 4/2) with spots of pale yellowish-gray (10 Y 8/2) clay; silty; calcareous; minor dark-gray clay; minor grayish- red siltstone; clear quartz grains rare	30	590
Sandstone, yellowish-gray (S Y 8/1) to grayish orange-pink (10 R 8.0); silty; very fine- to medium-grained sand; poorly sorted; composed of angular to subrounded, clear to frosted, quartz grains; well cemented; noncalcareous; common dark accessory minerals; minor grayish purple claystone fragments --	20	710
Claystone, grayish red-purple (S RP 4/2) with pale greenish-yellow (10 Y 8/2) reduced zones; silty; slightly cal- careous; minor quartz grains; minor red siltstone	10	720

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
---------------------------------	---------------------	-----------------

Triassic System - Continued:

Chinle Formation - Continued:

Parrified Forest Member (Lower part) - Concluded:

Claystone, pale red-purple (S RP 6/2) with  
 pale greenish-yellow (10 Y 8/2) re-  
 duced zones; silty; slightly calcareous;  
 contains minor, amber, quartz grains — 10 700

Monitor Butte Member:

Claystone, grayish-red (10 R 4/2) to  
 moderate reddish-brown (10 R 4/6);  
 silty; calcareous; some fragments  
 contain very fine-grained, amber,  
 quartz grains; red siltstone  
 common ----- 60 700

Claystone, grayish red-purple (S RP 4/2)  
 to grayish-red (10R 4/2); silty; cal-  
 careous; contains some fragments of  
 pale greenish-yellow (10 Y 8/2) grayish-  
 red siltstone common; minor mica  
 flakes; minor brown sandstone ----- 90 800

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
 NM, 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Continued		
Monitor Butte Member - Continued:		
Siltstone, dark reddish-brown (10 R 3/4) to grayish-red (10 R 4/2); slightly calcareous; abundant grayish-red claystone fragments	20	900
Claystone, moderate-reddish-brown (10 R 4/6) to grayish-red (10 R 4/2); silty; very calcareous; reddish-brown siltstone common	20	920
Claystone, grayish-red (5 R 4/2); silty; light-gray (N 7) clay fragments common; very calcareous; minor reddish- brown siltstone	20	940
Claystone, variegated grayish red- purple (5 RP 4/2), grayish-purple (5 P 4/2), grayish-red (10 R 4/2), and light-gray (N 6); silty; cal- careous; reddish-brown siltstone fragments common; minor gray lime- stone fragments	80	1,020



<u>Stratigraphic unit and material</u>	<u>Thickness (feet)</u>	<u>Depth (feet)</u>
Triassic System - Continued:		
Chinle Formation - Continued		
Monitor Butte Member - Concluded		
Claystone, medium light-gray (N 6) to grayish red-purple (S RP 4/2); silty; calcareous; minor grayish-red silt- stone -----	30	1,050
Claystone, medium light-gray (N 6) to medium-gray (N 5); slightly cal- careous; minor grayish red-purple siltstone -----	10	1,060
Claystone, grayish-red-purple (S RP 4/2) to grayish-purple (S P 4/2); silty; slightly calcareous -----	20	1,080
Shinarump Member:		
Claystone, grayish-purple (S P 4/2); silty; slightly calcareous; grayish- pink (4 R 8/2) sandstone common to abundant; silty; very fine-grained, moderately sorted; composed of sub- angular to subrounded, clear quartz grains; moderately cemented; non- calcareous -----	20	1,100

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Triassic System - Continued:		
Chinle Formation - Concluded:		
Shinarump Member - Concluded:		
Sandstone, grayish-pink (5 R 8/2) to white (N 9); medium to very coarse sand; moderately sorted; composed of subangular to rounded, clear to amber, quartz grains; moderately cemented, dark accessory minerals common; grayish-purple claystone minor to common	40	1,140
Conglomerate, pale-red (10 R 6/2) to grayish-pink (5 R 8/2); coarse sand to fine gravel; composed of sub- angular to rounded, clear to amber quartz grains; minor feldspar and dark accessory minerals; greenish- gray (5 GY 6/1) claystone common; sample not consolidated, mostly individual grains	10	1,150

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
<b>Triassic System - Concluded</b>		
Moensipi(?) Formation (may be part of Chinle Formation)		
Siltstone, pale reddish-brown (10 R 5/4);		
clayey; slightly calcareous; clear to amber		
quartz grains common; light-gray (N 7)		
claystone common to abundant; silty;		
slightly calcareous ----- 20 1,170		

**Permian System:**

San Andres Limestone: (not present in this hole) (?)

**Glorieta Sandstone:**

Sandstone, light-brown (5 YR 6/4) to moderate orange-pink (5 YR 8/4); very fine- to fine-grained; moderately sorted; composed of subangular to rounded, clear to amber, quartz grains; moderately cemented, slightly calcareous; rare dark accessory minerals; light-gray claystone fragments common to abundant ----- 50 1,220

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
 Vol. 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
Permian System - Continued:		
San Andres Limestone - Continued:		
Glorieta Sandstone - Continued:		
Sandstone, moderate orange-pink (3 YR 8/4); very fine- to fine-grained; moderately sorted; composed of subangular to rounded, clear, quartz grains; moderately cemented, very slightly calcareous; rare dark accessory minerals; grayish-purple (5 P 4/2) claystone (cavings?) common to abundant	70	1,290
Sandstone, moderate orange-pink (5 YR 8/4); same as 1,270-1,290 but samples contain no claystone	10	1,300
Sandstone, pale-red (5 R 6/2) to grayish- red (10 R 6/2); silty; very fine- to fine-grained; poorly sorted; composed of angular to subrounded, embac, quartz grains; well cemented; very slightly calcareous; grayish-purple claystone fragments minor to common	10	1,310

Hazardous Waste Mgt Consultation No. 81-26-8263-81, Ft Wingate Depot Activity,  
NM, 14-15 May 81

Stratigraphic unit and material	Thickness (feet)	Depth (feet)
---------------------------------	---------------------	-----------------

Permian System - Concluded:

San Andres Limestone - Concluded:

Glorieta Sandstone - Concluded:

Sandstone, moderate orange-pink (S TR 8/4):

fairly well sorted; composed of sub-  
angular to subrounded, clear to amber,  
quartz grains; well cemented; contains  
white clay in matrix; minor white clay-  
stone fragments

40 1,350

Hazardous Waste Mgt Consultation No. 81-16-8263-81, Ft Wingate Depot Activity,  
M. 14-5 May 81

APPENDIX C

LITHOLOGIC LOGS FOR MONITORING WELLS  
AROUND THE LEACHING BEDS

(Source: Environmental Survey, Fort Wingate  
Depot Activity, New Mexico, Environmental  
Science and Engineering Inc., under contract to  
the US Army Toxic and Hazardous Materials  
Agency, 1981)

Hazardous Waste Management Consultation No. 81-26-8263-81, Ft Wingate Depot Activity  
WM, 14-15 May 81

DRILLING LOG

Boring No. - FW 10 Diameter - 4" ID  
Hole Size - 8" OD Slot - 0.010 Date Start - 20 Nov 80 Finish - 20 Nov 80  
Screen Length - 40' Mat'l - Sch 40 PVC Filter Materials - Silica sand #20  
Diameter - 4" ID Grout Type - Sand cement  
Casing Length - 11' Mat'l - Sch 40 PVC Static Water Level - Water not encountered  
(2' above ground)

Depth (feet)	Lithology, Color
0 - 1.5	SM-MC roots (15%) rock fragments (15%) slightly plastic, loose, moisture: dry, granular, alluvium
1.5 - 3.0	SM-MC w/ rock fragments (15%) slightly plastic, loose, moisture: dry, granular, alluvium
3.0 - 4.5	SM non-plastic, very slightly packed, moisture: less than 2%, granular, alluvium
4.5 - 6.0	SM non-plastic, very slightly packed, moisture: less than 2% granular, alluvium
6.0 - 7.5	SM-SC slightly plastic, very slightly cohesive, moisture: less than 5%, granular, alluvium
7.5 - 9.0	SM-SC slightly plastic - plastic, slightly packed - cohesive, moisture: 5% interbedded clay and sand-rich zones, alluvium, distinct color bands
9.0 - 10.5	SM-SC slightly plastic-plastic, slightly packed-cohesive, moisture: 5%, interbedded clay and sand-rich zones, alluvium, distinct color bands
15.0 - 16.5	SM-SC very slightly plastic, very slightly cohesive, moisture: 5% interbedded clay, and sand-rich zones, distinct color bands, alluvium
20.0 - 21.5	SM-SC slightly plastic, very slightly cohesive, moisture: 5%, interbedded clay and sand-rich zones, distinct color bands, alluvium. Lower portion of sample has brown mottling
25.0 - 26.5	SM-SC slightly plastic, slightly cohesive, moisture: less than 5%, granular, alluvium, some gravel present (10%)
30.0 - 31.5	SP-SM non-plastic, moderately packed, moisture: dry, granular, alluvium

Hazardous Waste Management Consultation No. 81-26-8263-81, Ft Wingate Depot Activity  
NM, 14-15 May 81

Depth (feet)	Lithology, Color
35.0 - 36.5	CL very sandy (40%) plastic, cohesive, moisture: 5%, interbedded with sand-rich zones, alluvium many color bands
40.0 - 41.5	CL sandy (15%), very plastic, very cohesive, moisture: dry, massive, interbedding with sand-rich zones, alluvium
45.0 - 46.5	CL v. slightly sand (5%), v. plastic, v. cohesive, moisture: less than 2%, massive, alluvium
50.0 - 51.5	CL sandy (15%), very plastic, v. cohesive, moisture: 5%, massive, alluvium



Hazardous Waste Management Consultation No. 81-25-8263-81, Ft Wingate Depot Activity  
NM, 14-15 May 81

DRILLING LOG

Boring No. - FW 11 Diameter - 4" ID  
Hole Size - 8" 00 Slot - 0.010 Date Start - 20 Nov 80 Finish - 20 Nov 80  
Screen Length - 20' Mat'l - Sch 40 PVC Filter Materials - Silica sand #20  
Diameter - 4" ID Grout Type - Sand cement 2:1  
Casing Length - 10' Mat'l - Sch 40 PVC Static Water Level - Water not encountered  
(2' above ground)

Depth (feet)	Lithology, Color
0 - 1.5	CL w/ roots (10%), sandy (30%), plastic, cohesive, moisture: dry, granular to blocky, alluvium
1.5 - 3.0	SM-SC w/ roots (5%), slightly plastic, loose, moisture: dry, granular, alluvium
3.0 - 4.5	SM-SC v. slightly plastic, loose, moisture: dry, granular, alluvium
4.5 - 6.0	SM-SC slightly plastic, loose, moisture: dry, granular to blocky, alluvium w/ roots (10%), color bands evident
6.0 - 7.5	SM non-plastic, slightly packed, moisture: dry, granular, alluvium, faint color bands
7.5 - 9.0	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular, alluvium, faint odor when sampler opened (earthy)
9.0 - 10.5	SM non-plastic, loose moisture: dry, granular, alluvium
15.0 - 16.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular, alluvium
20.0 - 21.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular, alluvium, some brown mottling through sample
25.0 - 26.5	SM-SC slightly plastic, v. slightly cohesive, moisture: dry, granular to blocky, alluvium, very faint color bands
30.0 - 31.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular to blocky, alluvium, color bands, brown mottling

Hazardous Waste Management Consultation No. 81-26-8263-81, Ft Wingate Depot Activity  
WM, 14-15 May 81

DRILLING LOG

Boring No. - FW 12 Diameter - 4" ID  
Hole Size - 3" OD Plot - 0.010 Date Start - 22 Nov 80 Finish - 22 Nov 80  
Screen Length - 20' Mat'l - Sch 40 PVC Filter Materials - Silica sand #20  
Diameter - 4" ID Grout Type - Sand cement 2:1  
Casing Length - 11' Mat'l - Sch 40 PVC Static Water Level - Water not encountered  
(2' above ground)

Depth (feet)	Lithology, Color
0 - 1.5	ML-CL slightly plastic, slightly cohesive, moisture: dry, blocky, alluvium
1.5 - 3.0	SM, non-plastic, loose, moisture: dry, granular, alluvium
3.0 - 4.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular to blocky, alluvium
4.5 - 6.0	SM-SC slightly plastic, slightly cohesive, moisture: dry, blocky, alluvium, color bands visible
6.0 - 7.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, blocky to granular, alluvium, very faint color bands
7.5 - 9.0	CL sandy 10%, plastic, cohesive, moisture: dry, massive to blocky, alluvium
9.0 - 10.5	CL sandy 10%, plastic, cohesive, moisture: dry, massive to blocky, alluvium
15.0 - 16.5	SM non-plastic, loose, moisture: dry, granular, alluvium
20.0 - 21.5	CL black spots (5%), plastic, cohesive, moisture: dry, blocky, alluvium
25.0 - 26.5	ML-CL plastic, cohesive, moisture: dry, blocky to massive, alluvium
30.0 - 31.5	ML-CL plastic, cohesive, moisture: dry, blocky, alluvium

Hazardous Waste Management Consultation No. 81-26-8263-01, Ft. Lauderdale, Florida  
4/14-15 May 81

### DRILLING LOG

Logging No. - FW 13 Diameter - 4" ID  
Hole Size - 3" OD Clog - 0.010 Date Start - 22 Nov 80 Finish - 22 Nov 80  
Screen Length - 20' Casing - Sch 40 PVC Filter Materials - Silice sand #30  
Casing Diameter - 4" ID Grout Type - Sand cement 2:1  
Casing Length - 12' Casing - Sch 40 PVC Static Water Level - Water not encountered  
(1.5' above ground)

Depth (feet)	Lithology, Color
0 - 1.5	SM non-plastic, loose, moisture: dry granular, alluvium
1.5 - 3.0	SM non-plastic, loose, moisture: dry, granular, alluvium
3.0 - 4.5	SM w/ gravel (10%), non-plastic, loose, moisture: dry, granular, alluvium
4.5 - 6.0	SM-SC w/ gravel (5%), v. slightly plastic, very slightly cohesive, moisture: dry, granular, alluvium
6.0 - 7.5	SM-SC slightly plastic, very slightly cohesive, moisture: dry, granular, alluvium, color bands and brown mottling
7.5 - 9.0	CL, plastic, cohesive, moisture: dry, blocky, alluvium, brown mottling
9.0 - 10.5	CL plastic, cohesive, moisture: dry, blocky, alluvium
10.5 - 16.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular to blocky, alluvium
20.0 - 21.5	CL plastic, cohesive, moisture: dry, blocky, alluvium
25.0 - 26.5	SM-SC slightly plastic, slightly cohesive, moisture: dry, granular, alluvium
30.0 - 31.5	CL sandy 20%, plastic, cohesive, moisture: dry, blocky, alluvium