TA73

DEPARTMENT OF ENERGY
National Nuclear Security Administration
Los Alamos Site Office
Los Alamos, New Mexico 87544

SEP 01 2006

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NMED Hazardous Waste Bureau

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Dear Mr. Bearzi:

Subject: Infiltration Layer Test Pad Results
Response to July 14, 2006 Request for Additional Information
Remedy Design Work Plan for the Los Alamos Site Office
TA-73 Airport Landfill, Revision 2
Los Alamos National Laboratory,
EPA ID #NM0890010515
HWB-LANL-05-015

Attached are two hard copies and one disk copy of the infiltration layer test pad results as requested in your " Request for Additional Information (July 14, 2006)" on the Remedy Design Work Plan for the Los Alamos Site Office, TA-73 Airport Landfill, Revision 2. Saturated hydraulic conductivity values reported for the infiltration layer range from 3.1E-07 cm/sec to 4.4 E-08 cm/sec, and are at least an order of magnitude below the required value of 1.0E-05 cm/sec. I anticipate test pad results for the MatCon Layer sometime in early October.

If you have questions, please contact Bob Enz (505) 667-7640, DOE's Project Manager for the Airport Landfills.

Sincerely,

David R. Gregory
Federal Project Director

ES: 9BE-003

cc: See page 2

cc w/o attachments:
Darlene Goering
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

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DOE-LASO TA-73 AIRPORT LANDFILL CLOSURE: INFILTRATION LAYER TEST PAD CONSTRUCTION PROCEDURE AND RESULTS

8/31/06

1.0 BACKGROUND AND OBJECTIVES

Portions of the final closure cover for the DOE-LASO TA-73 Airport Landfill include low-permeability soil layers (also called infiltration layer), as shown in RDWP Revision 2 Drawing 2005 and others. In response to comments by NMED in the "Notice of Disapproval for the Remedy Design Work Plan for the Las Alamos Site Office TA-73 Airport Landfill, Revision 1" (NMED 2006), DOE-LASO stated that as-built permeability for the low-permeability soil courses would be determined in a certified geotechnical laboratory on cores collected from test pads and verified against the design requirements. The materials and procedures used to construct the test pad to obtain the required permeability would then be used to construct the infiltration layer material. The design requirement for saturated hydraulic conductivity of the low-permeability soils is 1E-05 cm/sec, based on the value used in HELP code modeling to demonstrate RCRA Subtitle C Minimum Technology Guidance (MTG) closure cover equivalence.

An 18-inch thick low-permeability soil test pad was constructed in three lifts on 08/03/06, and core samples were collected and tested to meet the NMED request. Compaction requirements were determined before construction by laboratory testing of the material, and it was determined that 100% of the maximum dry density using Standard Proctor compaction was needed to achieve the required permeability. Construction and sampling of the test pad were witnessed by Philip Meehan, P.E. (Quality Control System Manager, North Wind, Inc) and Berg Keshian, P.E. (Engineer of Record, Weston). This report describes the construction methods used to construct the test pad, the procedure for collecting samples and the test results.

2.0 CONSTRUCTION AND TESTING

1. A 6-in minimum layer of interim cover material was placed and wetted. The surface of the interim cover material was compacted with a smooth drum vibratory compactor and then scarified by dozer tracking prior to placing infiltration material.

2. The infiltration layer soil stockpile was wetted. An 8 inch loose lift of infiltration material was placed and wetted. The lift was rolled with four passes of the sheep's foot compactor, followed by two additional passes with the smooth drum vibratory compactor.

3. The lift was tested for moisture content and density using a nuclear gauge. Results are reported in Table 1 and compared to optimum dry density and moisture content previously determined using ASTM D 698 (Attachment 1). Maximum dry density is 108.8 pcf and the optimum moisture content is 14.2%.

4. The next two lifts were placed, compacted and field tested as described for the first.

5. A core sample was obtained from each lift from the completed pad as per ASTM D 2937 "Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method". The

overlying material was excavated to access the top surface of the lift, at different locations on the test pad for the 6-11 inch sample and for the 11-16 inch sample. The 1-6 inch sample was obtained from the completed test pad surface, also at a separate location on the test pad.

Samples were packaged and transported as per the specification. Samples were tested as per ASTM D 5084 “Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter:”

3.0 RESULTS AND DISCUSSION

Results for each sample are reported in Table 1 and the complete laboratory report is provided in Attachment 2. Saturated hydraulic conductivity (Ksat) values reported ranged from 3.1E-07 cm/sec to 4.4 E-08 cm/sec. All of these values are at least one order of magnitude below the required value of 1.0E-05 cm/sec.

Note that the 1 to 6 inch sample was reported as remolded by the lab, due to additional handling during preparation to hold the sample together. This sample showed the highest Ksat of the three samples, at 3.1E-07 cm/sec.

These results indicate that compaction of the infiltration layer material to a dry density greater than 109 pcf and at a moisture content of ±1% of optimum will ensure Ksat values well below the design criterion.

Table 1. Results for field density and moisture testing, and laboratory Ksat.

Lift	Field density		Field moisture, %	Ksat, cm/sec
	Density, pcf	Percent of optimum		
1-6 inches	119.4	109.7	11.8	3.1E-07
6-11 inches	111.0	102.0	14.2	6.8E-08
11-16 inches	109.0	100.2	15.3	4.4E-08

4.0 REFERENCES

NMED 2006, “Notice of Disapproval, Remedy Design Work Plan for the Los Alamos Site Office, TA-73 Airport Landfill, Revision 1”, Los Alamos National Laboratory, NM0890010515, HWB-LANL-05-015. January 4, 2006.

ASTM D 698-91, “Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort”

ASTM D 2937, “Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method”

ASTM D 5084-03, “Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter”, January 2004

Attachment 1-Standard Proctor Curve for Infiltration Layer Material

COMPACTION TEST REPORT

Curve No.: 06-102,103,104

Project No.: 71610 **Date:** 5/24/06

Project: TA 73 Los Alamos Landfill

Location: Composite of the Barrow Pit samples for Infiltraion Material

Elev./Depth: -1 0' to -5 0' **Sample No.** 06-102,103,104

Remarks:

MATERIAL DESCRIPTION

Description: Lean clay with sand

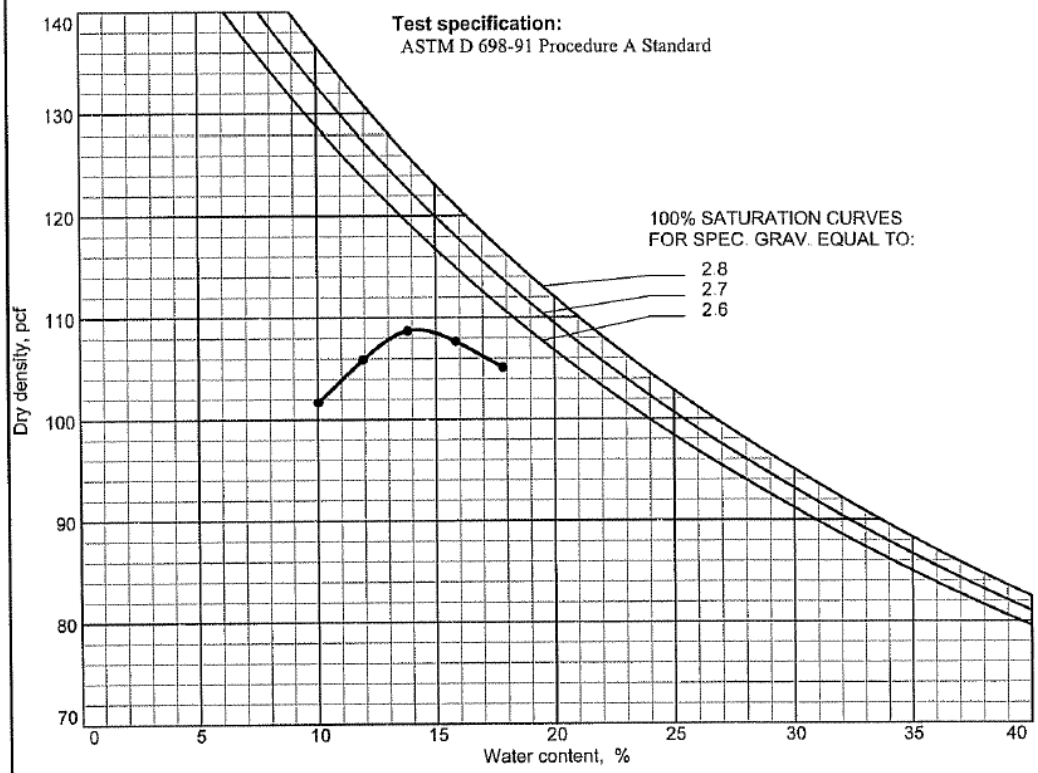
Classifications - **USCS:** CL **AASHTO:** A-4(4)

Nat. Moist. = 13.6 % **Sp.G. =**

Liquid Limit = 27 **Plasticity Index =** 9

% > No.4 = % **% < No.200 =** 77.1 %

TEST RESULTS
Maximum dry density = 108.8 pcf
Optimum moisture = 14.2 %



PLATE

Kleinfelder, Inc.

Attachment 2- Laboratory Results for Saturated Hydraulic Conductivity for Infiltration Layer Material

71610.2 - ALB06TD016.pdf

KLEINFELDER
An employee owned company

8300 Jefferson NE, Suite B, Albuquerque, NM 87113
Telephone 505-344-7373 / Fax 505-344-1711

CONTROLLED DOCUMENT TRANSMITTAL/RECEIPT AND READ ACKNOWLEDGEMENT FORM

CMT LAB REPORT DISTRIBUTION						Pages:	4
1	Steve Matier smatier@northwind-inc.com	2		3			

Transmittal Date: 08/25/06	**Transmittal DCN: 71610.2 – ALB06TS016**	
Project No.: 71610	**Task No.: 2**	**File Index No.: 4.9**

SUBJECT: 71610.2 – ALB06TD016 TA73 Los Alamos Landfill Lab Reports

ITEM	DATE	LAB REPORT NO.
Hydraulic Test Pad Results	8/14/06	71610HC 003/004/005

INSTRUCTIONS/REMARKS

Please sign both copies of this Transmittal form. Keep one copy for your records and mail the other copy to Kleinfelder, Inc at the address referenced at the top of this form

NOTES

Perry Hampel
Project Manager

08/25/06
Date

RECEIPT AND READ ACKNOWLEDGEMENT
PLEASE COMPLETE AND RETURN WITHIN 5 WORKING DAYS TO:

DOCUMENT CONTROL SPECIALIST
KLEINFELDER, INC.
8300 JEFFERSON NE, SUITE B
ALBUQUERQUE, NM 87113

Recipient Signature

Date

Print Name

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HYDRAULIC CONDUCTIVITY TEST REPORT

ASTM D5084

Project Name	TA 73 Los Alamos Landfill	*Project No.*	71610
Client Name	Kleinfelder	*Date Received*	8/8/2006 12:30
Client Address	Albuquerque, New Mexico	*Date Tested*	8/14/2006 16:40
		Date Issued	8/17/2006 9:45
Boring No.	Infiltration Test Pad		
Sample Type	Remolded Sample		
Sample Depth	1"-6"		
Sample Description	Lean Clay with Fine Sand, Brown		

	Before	*After*	*Units*
Moisture Content, w	14.9	18.4	%
Dry Unit Weight, Dd	106.9	107.2	pcf
Height, L	2.81	2.41	Inches
Diameter, d	2.82	2.82	Inches
Degree of Saturation, Sr	69.7	86.9	%

Chamber Pressure:	60.0	psi
Applied Pressure (influent):	57.0	psi
Applied Pressure (effluent):	55.0	psi
Consolidation Pressure:	3	psi

Test Number		*Temp. Deg. C*	*Time (sec)*	*Influent Reading*	*Effluent Reading*	*Hydraulic Conductivity (cm/sec) @ Test Temp.*	*Hydraulic Conductivity (cm/sec) @ 20° C*	*Hydraulic Gradient h/L*
1	Start	20.7	0	15.80	21.80	3.30E-07	3.2E-07	19.98
	Finish	20.7	7980	18.00	19.70			
2	Start	20.7	7980	18.00	19.70	3.12E-07	3.1E-07	19.47
	Finish	20.7	15060	19.80	18.00			
3	Start	20.7	15060	19.80	18.00	3.11E-07	3.1E-07	19.19
	Finish	20.5	19200	20.80	17.00			
4	Start	20.5	19200	20.80	17.00	2.99E-07	2.9E-07	18.86
	Finish	20.4	24120	21.95	15.90			

Average Hydraulic Conductivity "k" (cm/sec) @ Test Temp 3.1E-07

Average Hydraulic Conductivity "k" (cm/sec) @ 20° C 3.1E-07

Assumed Specific Gravity SG 2.7

Area of Tube (cm^2), a (pipette) 0.9721

Permeant : Dealred Tap Water

Formulas:

Permeability (Falling Head-Rising Tailwater Test)

$k = [(a*L/(2*A*t)] \ln(ho/h1)$

k = Hydraulic Conductivity (cm/sec)

a = Area of Tube (cm^2)

L = Height or Length of Sample (cm)

A = Area of Sample (cm^2)

t = Time of Test Interval (sec)

h_o = Height of Head at Start of Test Interval (cm)

h_1 = Height of Head at End of Test Interval (cm)

Degree of Saturation

$Sr = w*SG/e$ $Dd = (SG/1+e)Dw$

Therefore:

$Sr = (w*SG)/((SG*Dw/Dd)-1)$

Sr = Degree of Saturation (%)

w = Moisture Content (%)

SG = Specific Gravity

e = Void Ratio

Dd = Dry Unit Weight (pcf)

Dw = Unit Weight of Water (62.4 pcf)

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KLEINFELDER

AUG-21-2006 MON 11:27 AM FAX NO. P. 02

HYDRAULIC CONDUCTIVITY TEST REPORT

ASTM D5084

Project Name	TA 73 Los Alamos Landfill	*Project No.*	71610
Client Name	Kleinfelder	*Date Received*	8/08/2006 12:30
Client Address	Albuquerque, New Mexico	*Date Tested*	8/14/2006 16:40
		Date Issued	8/17/2006 9:45
Boring No.	Infiltration Test Pond		
Sample Type	Drive Cylinder		
Sample Depth	6"-11"		
Sample Description	Lean to Fat Clay with Fine Sand, Brown		

	Before	*After*	*Units*
Moisture Content, w	15.5	17.0	%
Dry Unit Weight, Dd	108.4	110.5	pcf
Height, L	1.76	1.73	inches
Diameter, d	2.78	2.77	inches
Degree of Saturation, Sr	75.5	87.4	%

Chamber Pressure:	60.0	psi
Applied Pressure (influent):	57.0	psi
Applied Pressure (effluent):	55.0	psi
Consolidation Pressure:	3	psi

Test Number		*Temp. Deg. C*	*Time (sec)*	*Influent Reading*	*Effluent Reading*	*Hydraulic Conductivity (cm/sec) @ Test Temp.*	*Hydraulic Conductivity (cm/sec) @ 20° C*	*Hydraulic Gradient h/L*
1	Start	20.6	0	9.00	23.40			
	Finish	21.3	53340	14.70	18.20	7.82E-08	7.6E-08	32.24
2	Start	21.3	53340	14.70	18.20			
	Finish	20.8	56340	15.00	17.95	7.30E-08	7.1E-08	32.11
3	Start	20.8	56340	15.00	17.95			
	Finish	20.7	61920	15.45	17.50	6.45E-08	6.3E-08	31.90
4	Start	20.7	61920	15.45	17.50			
	Finish	20.7	69900	16.10	16.90	6.32E-08	6.2E-08	31.62

Average Hydraulic Conductivity "k" (cm/sec) @ Test Temp. 7.0E-08

Average Hydraulic Conductivity "k" (cm/sec) @ 20° C 6.8E-08

Assumed Specific Gravity, SG 2.7

Area of Tube (cm^2), a (pipette) 0.9721

Permeant : Desired Tap Water

Formulas:

Permeability (Falling Head-Rising Tailwater Test)

k = [(a*L/(2*A*t)] ln(ho/h1)

k = Hydraulic Conductivity (cm/sec)

a = Area of Tube (cm^2)

L = Height or Length of Sample (cm)

A = Area of Sample (cm^2)

t = Time of Test Interval (sec)

h_o = Height of Head at Start of Test Interval (cm)

h_1 = Height of Head at End of Test Interval (cm)

Degree of Saturation

Sr = w*SG/e Dd = (SG/1+e)Dw

Therefore:

Sr = (w*SG)/((SG*Dw/Dd)-1)

Sr = Degree of Saturation (%)

w = Moisture Content (%)

SG = Specific Gravity

e = Void Ratio

Dd =Dry Unit Weight (pcf)

Dw = Unit Weight of Water (62.4 pcf)

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KLEINFELDER

AUG-21-2006 MON 11:27 AM FAX NO. P. 03

HYDRAULIC CONDUCTIVITY TEST REPORT
ASTM D5084

Project Name	TA 73 Los Alamos Landfill	*Project No.*	71610
Client Name	Kleinfelder	*Date Received*	8/08/2006 12:30
Client Address	Albuquerque, New Mexico	*Date Tested*	8/16/2006 16:40
		Date Issued	8/21/2006 15:10
Boring No.	Infiltration Test Pond		
Sample Type	Drive Cylinder		
Sample Depth	11"-16"		
Sample Description	Lean to Fat Clay with Fine Sand, Brown		

	Before	*After*	*Units*
Moisture Content, w	12.1	16.9	%
Dry Unit Weight, Dd	107.8	110.2	pcf
Height, L	1.69	1.65	inches
Diameter, d	2.78	2.76	inches
Degree of Saturation, Sr	57.9	86.4	%

Chamber Pressure:	60.0	psi
Applied Pressure (influent):	57.0	psi
Applied Pressure (effluent):	55.0	psi
Consolidation Pressure:	3	psi

Test Number		*Temp. Deg. C*	*Time (sec)*	*Influent Reading*	*Effluent Reading*	*Hydraulic Conductivity (cm/sec)* @ Test Temp.	*Hydraulic Conductivity (cm/sec)* @ 20° C	*Hydraulic Gradient h/L*
1	Start	21.4	0	9.35	16.95			
	Finish	21.5	2940	9.55	16.75	5.02E-08	4.8E-08	34.44
2	Start	21.5	2940	9.55	16.75			
	Finish	21.1	5880	9.70	16.60	3.77E-08	3.6E-08	34.37
3	Start	21.1	5880	9.70	16.60			
	Finish	20.8	10680	10.00	16.30	4.64E-08	4.5E-08	34.22
4	Start	20.8	10680	10.00	16.30			
	Finish	20.8	16380	10.40	15.95	4.90E-08	4.8E-08	34.04

Average Hydraulic Conductivity "k" (cm/sec) @ Test Temp 4.6E-08

Average Hydraulic Conductivity "k" (cm/sec) @ 20° C 4.4E-08

Assumed Specific Gravity, SG 2.7
Area of Tube (cm^2), a (pipette) 0.9721
Permeant : Deaired Tap Water
Formulas:
Permeability (Falling Head-Rising Tailwater Test)
k = [(a*L/(2*A*t)] ln(ho/h1)
k = Hydraulic Conductivity (cm/sec)
a = Area of Tube (cm^2)
L = Height or Length of Sample (cm)
A = Area of Sample (cm^2)
t = Time of Test Interval (sec)
h_0 = Height of Head at Start of Test Interval (cm)
h_1 = Height of Head at End of Test Interval (cm)

Degree of Saturation L:\Quality\Lscreports\Nowcomm.xls
Sr = w*SG/e Dd = (SG/1+e)Dw
Therefore:
Sr = (w*SG)/((SG*Dw/Dd)-1) Page 1 of 1
Sr = Degree of Saturation (%)
w = Moisture Content (%)
SG = Specific Gravity
e = Void Ratio
Dd =Dry Unit Weight (pcf)
Dw = Unit Weight of Water (62.4 pcf)

KLEINFELDER