MAP(S)/ PLAN(S)

SCANNED

SEPARATELY

England-Thims & Miller, Inc.
Consulting & Design Engineers
3131 St Johns Bluff Road S, Jacksonville, FL 32246
Tel (904) 642-8990 Fax (904) 646-9485

Principals
James E England, P E, Pres
Robert E Thims, Exec V P
Douglas C Miller, P E, Exec V P
N Hugh Mathews, P E, Exec V P

October 18, 1995

Mr. Francis D. Dayao
Waste Management Section
Department of Environmental Protection
7825 Baymeadows Way, Suite 200B
Jacksonville, Florida 32256

Reference: Trail Ridge Landfill - Phase IIIA
FDEP Permit No. SC16-184444
ET&M No. E95-12 (Certification File)

Dear Mr. Dayao:

Pursuant to your request and on behalf of Trail Ridge Landfill, Inc., we hereby provide the Quality Control Specification sheet for the 60 mil HDPE geomembrane liner as provided by the supplier, National Seal Company. As you can see, the specification sheet indicates a maximum Water Vapor Transmission of 0.024 g/day · m^2 for the geomembrane. Please note that Quality Control Certifications were submitted/ reviewed for the geomembrane and the geomembrane was conformance tested, prior to installation.

If you have any questions regarding this issue, please feel free give me a call.

Sincerely,

ENGLAND, THIMS & MILLER, INC.

Juanitta Bader Clem

Juanitta Bader Clem, P.E.
Project Manager

Attachment

cc: Greg Mathes w/attachments
Scott McCallister w/attachments
Chris Pearson w/attachments

HDPE GEOMEMBRANE
QUALITY CONTROL SPECIFICATIONS

60 mil

National Seal Company's High Density Polyethylene (HDPE) Geomembranes are produced from virgin, first-quality, high molecular weight resins and are manufactured specifically for containment in hydraulic structures. NSC HDPE geomembranes have been formulated to be chemically resistant, free of leachable additives and resistant to ultraviolet degradation.

The following properties are tested as a part of NSC's quality control program. Certified test results for properties on this page are available upon request. Refer to NSC's Quality Control Manual for exact test methods and frequencies.

All properties meet or exceed NSF Standard Number 54.

RESIN PROPERTIES	METHOD	UNITS	MINIMUM[1]	TYPICAL
Melt Flow Index[2]	ASTM D 1238	g/10 min	0.50	0.25
Oxidative Induction Time	ASTM D 3895, Al pan, 200°C, 1 atm O_2	minutes	100	120

SHEET PROPERTIES	METHOD	UNITS	MINIMUM[1]	TYPICAL
Thickness	ASTM D 751, NSF mod.			
Average		mils	60.0	61.5
Individual		mils	57.0	59.7
Density	ASTM D 1505	g/cm^3	0.940	0.948
Carbon Black Content	ASTM D 1603	percent	2.0-3.0	2.35
Carbon Black Dispersion	ASTM D 3015, NSF mod.	rating	A1, A2, B1	A1
Tensile Properties	ASTM D 638			
Stress at Yield		psi	2200	2550
		ppi	132	157
Stress at Break		psi	3800	4850
		ppi	228	298
Strain at Yield	1.3" gage length (NSF)	percent	13.0	16.9
Strain at Break	2.0" gage or extensometer	percent	700	890
	2.5" gage length (NSF)	percent	560	710
Dimensional Stability[2]	ASTM D 1204, NSF mod.	percent	1.5	0.4
Tear Resistance	ASTM D 1004	ppi	750	860
		lbs	45	53
Puncture Resistance	ASTM D 4833	ppi	1800	2130
		lbs	108	131
Constant Load ESCR, Single Point	GRI, GM-5a	hours	200	>400

[1] This value represents the minimum acceptable test value for a roll as tested according to NSC's Manufacturing Quality Control Manual. Individual test specimen values are not addressed in this specification except thickness.

[2] Indicates Maximum Value

NSC
NATIONAL SEAL COMPANY
1245 Corporate Blvd. • Suite 300
Aurora, IL 60504
(708) 898-1161 • (800) 323-3820
Fax: (708) 898-3461

HDPE GEOMEMBRANE
PHYSICAL PROPERTIES

60 mil

The properties on this page are not part of NSC's Manufacturing Quality Control program and are not included on the material certifications. Seam testing is the responsibility of the installer and/or CQA personnel.

PROPERTIES	METHOD	UNITS	MINIMUM[1]	TYPICAL
Multi-Axial Tensile Elongation	GRI, GM-4	percent	20.0	28.0
Critical Cone Height	GRI, GM-3, NSC mod.	cm	1.0	1.5
Wide Width Tensile	ASTM D 4885			
Stress at Yield		psi	2000	2110
Strain at Yield		%	15.0	20.0
Brittleness Temp. by Impact[2]	ASTM D 746	°C	-75	<-90
Coef. of Linear Thermal Exp.[2]	ASTM D 696	$°C^{-1}$	1.5×10^{-4}	1.2×10^{-4}
ESCR, Bent Strip	ASTM D 1693	hours	1500	>10,000
Hydrostatic Resistance	ASTM D 751	psi	450	510
Modulus of Elasticity	ASTM D 638	psi	80,000	135,000
Ozone Resistance	ASTM D 1149, 168 hrs	P/F	P	P
Permeability[2]	ASTM E 96	cm/sec · Pa	2.3×10^{-14}	8.1×10^{-15}
Puncture Resistance	FTMS 101, method 2065	ppi	1300	1700
		lbs	78	105
Soil Burial Resistance[2]	ASTM D 3083, NSF mod.	% change	10	0
Tensile Impact	ASTM D 1822	$ft\ lbs/in^2$	250	420
Volatile Loss[2]	ASTM D 1203, A	percent	0.10	0.06
Water Absorption[2]	ASTM D 570, 23°C	percent	0.10	0.04
Water Vapor Transmission[2]	ASTM E 96	$g/day \cdot m^2$	0.024	0.009

SEAM PROPERTIES	METHOD	UNITS	MINIMUM[1]	TYPICAL
Shear Strength	ASTM D 4437, NSF mod.	psi	2000	2700
		ppi	120	166
Peel Strength	ASTM D 4437, NSF mod.	psi	1500	1870
(hot wedge fusion)		ppi	90	115
Peel Strength	ASTM D 4437, NSF mod.	psi	1300	1590
(fillet extrusion)		ppi	78	98

STANDARD ROLL DIMENSIONS

Length	1110 feet	Area	$16,650\ ft^2$
Width	15 feet	Weight	5,000 lbs

6H-0893

NSC

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Principals
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Robert E Thims, Exec VP
Douglas C. Miller, P.E, Exec VP
N Hugh Mathews, P.E, Exec VP

RECEIVED
JUN 1 1995
DEP JACKSONVILLE

May 31, 1995

Ms. Mary C. Nogas, P.E.
Waste Management Section
Department of Environmental Protection
7825 Baymeadows Way, Suite 200B
Jacksonville, Florida 32256

Reference: Trail Ridge Landfill
FDEP Permit No. SC16-184444
ET&M No. E95-12-1A

Dear Ms. Nogas:

On behalf of Trail Ridge Landfill, Inc., we hereby provide the following clarification to Section C - Bentonite Mat (Geosynthetic Clay Liner) of the Project - Specific Addenda to Quality Assurance Manual for construction of Phases IIIA, IIIB, IVA and IVB of the referenced project. Specifically, the standard for mass per unit area (ASTM D3776) of the sodium bentonite component of the bentonite mat shall be a minimum of 1.0 LB/FT^2 (4900 g/m^2). Attached is a revised copy of the Project - Specific Addenda with the clarification for your files.

If you have any questions regarding this issue, please feel free give me or Doug Miller a call.

Sincerely,

ENGLAND, THIMS & MILLER, INC.

Juanitta Bader Clem

Juanitta Bader Clem, P.E.
Project Manager

Attachments

cc: Greg Mathes w/attachments
Scott McCallister w/attachments
Chris Pearson w/attachments
Scott Callaway w/attachments

TRAIL RIDGE LANDFILL
PROJECT-SPECIFIC ADDENDA
TO QUALITY ASSURANCE MANUAL

This plan specifically addresses the quality assurance and quality control (QA/QC) for Trail Ridge Landfill, Phases IIIA, IIIB, IVA and IVB. This program delineates the quality procedures and standards for the construction.

In the context of this plan, quality assurance, quality control and the plan participants are defined as follows:

> Quality Assurance - A planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.
>
> Quality Control - Those actions which provide a means to measure and regulate the characteristics of an item or service to contract and regulatory requirements.
>
> Permittee - Trail Ridge Landfill, Inc.
>
> Owner - The City of Jacksonville
>
> Design Engineer - England, Thims & Miller, Inc.
>
> Contractor - J. B. Coxwell Contracting

The QA/QC Program for this project includes General QA/QC, Soils QA/QC, and Synthetic Liner System QA/QC. These QA/QC activities (including monitoring, sampling and testing) shall be directed and conducted by the following third parties whom are independent of the Contractor.

> General Quality Assurance/Quality Control - England, Thims & Miller, Inc.
>
> Soils Quality Assurance/Quality Control - Law Engineering
>
> Synthetic Liner System Quality Assurance/Quality Control - Golder Associates

The General QA/QC includes full-time services to periodically observe the contractor's work to verify substantial compliance with permits, plans, specifications and design concepts.

General Quality Control Monitor - shall monitor the construction for compliance with the permits, plans, specifications and design including construction to proper lines and grades, maintain daily logs and weekly progress reports of the construction (including observation data sheets, problem identification and correction logs), make note of construction deviations, coordinate qualifying and testing of materials, and monitor filling. This individual shall be experienced in civil site construction and solid waste regulations.

General Quality Assurance Engineer - shall supervise the construction monitoring to verify compliance with permits, plans, specification and design concepts. This individual shall be experienced in civil site construction and solid waste regulations and shall be a registered Professional Engineer.

The General QA/QC Program includes monitoring the following activities:

1. General Earthwork
2. Storm Drainage Installation
3. Perimeter Roadway Construction
4. Concrete Structure Installations
5. Leachate Pump System Installation
6. Leachate Forcemain Installation
7. Overall Liner System Installation
8. General Construction Quality Control

The Soils QA/QC for this project includes soil material qualifying, sampling and testing to verify substantial compliance with the material standards.

Soils Quality Control Monitor - shall pre-qualify soil materials, monitor the installation of soil materials, determine where in-place soil materials shall be tested, and test the in-place soil materials. This individual shall be responsible for assuring that all soil materials have been pre-qualified and have a chain-of-custody from the pre-qualified source to the project site, prior to installation. This individual shall be experienced in civil site construction and soil testing standards and procedures.

Soils Quality Assurance Engineer - shall supervise the soil material pre-qualifying and testing of in-place soil materials to assure compliance with the test standards and testing frequency requirements, and verify compliance with the plans, specification and design. This individual shall be experienced in civil site construction and soil testing procedures and shall be a registered Professional Engineer.

The QA/QC Plan shall include monitoring and testing of the following:

A. SUBGRADE

Prior to construction of the liner system including the clay subbase, a subgrade shall be prepared. The subgrade shall be placed and compacted in 12" lifts.

1. Subgrade

a. Location - The Soils Quality Control Monitor shall visually inspect the fill material and test the material in-place.

b. Standard - Soil shall be free of brush, weeds, and other litter; and free of roots 3/8" diameter or greater, stumps, stones 1" diameter or greater and any other extraneous or toxic matter.

The soil shall be cohesionless soil with a fines content of 15% or less.

Compacted to 96%* of Modified Proctor maximum dry density (ASTM D 1557) and a firm unyielding surface. Testing by Drive Cylinder (ASTM D2937), Nuclear (ASTM D2922) or Sand Cone (ASTM D1556) Methods

* If the required densities are achieved at a moisture content exceeding 2% of optimum moisture content, the soil will be proof rolled and visually inspected by the Soils Quality Control Monitor to determine if it is unyielding and not pumping. Clay subbase shall not be placed on a yielding subgrade.

c. Frequency - Density tests shall be conducted at the frequency of four tests per acre of finished subgrade including the same frequency for each 12-inch lift of fill.

B. CLAY SUBBASE

Prior to placement of the synthetic liner system, a clay subbase shall be prepared. The subbase shall be a minimum of 6" in thickness.

1. Clay Subbase

   a. Borrow Source - Prior to clay subbase installation, an appropriate borrow source shall be located. Suitability of the subbase construction materials from that source shall be determined in accordance with the following:

      (1) If demonstrated field experience is available from at least three prior successful projects of five or more acres each to document that a given borrow source can meet the requirements of the project specifications, then extensive laboratory testing of the borrow source will not be required. However, the source of material shall be geologically similar to and the methods of excavating and stockpiling the material shall be consistent with those used on the prior projects. Furthermore, a minimum of three representative samples from the appropriate thickness of the in-situ stratum or from stockpiles of the borrow material proposed for subbase construction shall be submitted to the Soils Quality Assurance Engineer to document through index testing that the proposed material is consistent with the material used on prior successful projects. At a minimum, index testing shall consist of percent fines, Atterberg limits and moisture content determinations.

      (2) If demonstrated field experience as defined above is not available or cannot be documented, then the following requirements shall be met.

         (a) A field exploration and laboratory testing program shall be conducted by the Soils Quality Assurance Engineer to document the horizontal and vertical extent and the homogeneity of the soil strata proposed for use as subbase material. A sufficient number of index tests from each potential borrow stratum shall be performed to quantify the variability of the borrow materials and to document that the proposed borrow material complies with specifications. At a minimum, the index tests shall consist of percent fines (ASTM D1140), Atterberg limits (ASTM D4318) and moisture content (ASTM D2216) determinations.

         (b) Sufficient laboratory hydraulic conductivity tests shall be conducted on samples representative of the range invariability of the proposed borrow source (ASTM D5084). At a minimum, the tests shall be taken once per 20,000 cubic yards of soil. For each such sample, test specimens shall be prepared and tested to cover the range of molding conditions (moisture content and dry density) required by project specifications. The hydraulic conductivity tests shall be conducted in triaxial type permeameters. The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D5084). The borrow source will only be considered suitable if the hydraulic conductivity of the material, as documented on laboratory test specimens, can be shown to meet the requirements of the project specifications at the 98 percent confidence level.

(3) The Soils Quality Assurance Engineer shall review the pre-qualification data and shall approve or reject the material for use.

b. Test Strip - Prior to full-scale clay subbase installation, a field test section or test strip shall be constructed at the site above a prepared subgrade. The test strip shall be considered acceptable if the measured hydraulic conductivities of undisturbed samples from the test strip meet the requirements of the project specifications at the 98 percent confidence level. If the test section fails to achieve the desired results, additional test sections shall be constructed in accordance with the following requirements:

(1) The test section shall be of sufficient size (20' x 50' minimum) such that full-scale clay subbase installation procedures can be duplicated within the test section;

(2) The test section shall be constructed using the same equipment for spreading, kneading and compaction and the same construction procedures (e.g., number of passes, moisture addition and homogenization, if needed) that are anticipated for use during full-scale clay subbase installation;

(3) At a minimum, the clay subbase test section shall be subject to the following field and laboratory testing requirements by the Soils Quality Control Monitor:

(a) A minimum of five random samples of the clay subbase construction material delivered to the site during test section installation shall be tested for moisture content (ASTM D2216), percent fines (ASTM D1140) and Atterberg limits (ASTM D4318);

(b) At least five field density and moisture determinations shall be performed on the compacted clay subbase test section;

(c) Upon completion of the test section, the thickness of the section shall be measured at a minimum of five random locations to check for thickness adequacy; and

(d) A minimum of five Shelby tube or drive cylinder (ASTM D2937) samples shall be obtained from each test section for laboratory hydraulic conductivity testing. Laboratory hydraulic conductivity testing shall be conducted in triaxial type permeameters (ASTM D5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D5084).

(e) The test strip shall meet or exceed the standards established below except the field density which shall be established by the Soils Quality Assurance Engineer based upon the test strip results. If the test strip fails to meet these standards, the construction methods and/or material will be rejected and the test strip shall be performed again.

c. Clay Subbase Installation - Full scale clay subbase installation may begin only after completion of a successful test section. During clay subbase construction, quality control testing shall be provided to document that the installed clay subbase conforms to project specifications. The testing frequency for quality control testing are specified below. <u>However, during construction of the first five acres of the clay subbase, the frequencies shall be doubled.</u> The clay subbase shall be installed in one 6" lift.

(1) Location - The clay subbase shall be tested in-place at random locations. These locations of tests shall be determined by the Soils Quality Control

Monitor. If there are indications of a change in product quality or construction procedures during clay subbase construction, additional tests shall be performed to determine compliance.

(2) Standard

(a) Subgrade - Compacted to 96% of Modified Proctor maximum dry density (ASTM D1557) (See Subgrade).

(b) Field Density - The field density shall be established by the Soils Quality Assurance Engineer based upon the test strip results and shall be determined by Standard Proctor Density (ASTM D698). In no case shall the field density be less than 80% of Standard Proctor Density (ASTM D698).

(c) Thickness - The clay subbase shall have a minimum in-place thickness of 6"

(d) Hydraulic Conductivity - The compacted clay subbase shall have an in-place hydraulic conductivity no greater than 1×10^{-7} cm/sec (ASTM D5084).

(3) Field Testing Frequency

(a) Prior to the laying of the clay subbase materials, the subgrade shall be compacted to the specified density. Density tests shall be conducted at a minimum rate of four tests per acre of finished subgrade.

(b) A minimum of two moisture content and field density determinations shall be conducted per acre of compacted clay subbase. The degree of compaction shall be checked using the one-point field Proctor test or other appropriate test procedures; and

(c) A minimum of four thickness measures shall be conducted per acre of the compacted clay subbase.

(4) Laboratory Testing Frequency

(a) Percent fines (ASTM D1140) of the subbase construction material shall be determined at a minimum frequency of two tests per acre of installed clay subbase;

(b) Atterberg limits determinations shall be performed on one sample per acre of installed clay subbase; and

(c) Hydraulic conductivity testing of Shelby tube or drive cylinder (ASTM D-2937) samples of the compacted clay subbase shall be performed at a minimum frequency of one test per acre. Laboratory hydraulic conductivity tests shall be conducted in triaxial type permeameters (ASTM D-5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured.

(5) Deficiency - If the test data from a clay subbase section does not meet the requirements of the project specifications, additional random samples shall be tested from that clay subbase section. If such additional testing demonstrates that the thickness and hydraulic conductivity meet the requirements of the project specifications at the 95 percent confidence level, that clay subbase section will be considered acceptable. If not, that clay subbase section shall be reworked or reconstructed so that it does meet these requirements.

C. BENTONITE MAT (Geosynthetic Clay Liner)

A bentonite mat shall be installed as part of the synthetic liner system. In addition to the requirements of the "Quality Assurance Manual For the Installation of Lining Systems", the bentonite mat shall be monitored and tested as follows:

1. Bentonite Mat

a. Location - Upon delivery of the bentonite mat rolls to the site (prior to installation) samples shall be obtained.

b. Standard

(1) Hydraulic Conductivity - The hydraulic conductivity (GRI GCL-2) shall be no greater than 1×10^{-9} cm/sec at a confining stress of 30 psi.

(2) Moisture Content - The moisture content (ASTM D4643) shall be no greater than 10 percent.

(3) Mass - The mass per unit area (ASTM D3776) of the sodium bentonite component of the bentonite mat shall be a minimum of 1.0 lb/ft^2 (4900 g/m^2).

c. Frequency - The bentonite mat shall be tested for moisture content, hydraulic conductivity and mass per unit area at least once per 40,000 square feet or once per lot, whichever is more frequent.

D. PROTECTIVE SAND BLANKET

After the synthetic liner system has been installed, it shall be covered with a protective sand blanket. The protective sand blanket shall be a minimum of 24" in thickness.

1. Protective Sand Blanket

a. Location - Material shall be pre-qualified by hydraulic conductivity, particle size, and calcium carbonate content testing at the borrow location.

Truck tickets shall be utilized for chain of custody to site.

Thickness shall be verified by as-built survey.

b. Standard - Sand shall be reasonably free of brush, weeds, and other litter; and relatively free of roots, stumps, stones and any other extraneous or toxic matter. The Soils Quality Control Monitor shall visually inspect the sand during placement.

Hydraulic Conductivity shall be greater than $1x10^{-3}$ cm/sec at a density of 96 percent Modified Proctor maximum dry density (ASTM D1557). Hydraulic Conductivity testing by Constant Head Method (ASTM D2434).

Thickness shall be no less than 24 inches at each location.

The sand shall be non-calcareous (ASTM D3042).

Compatibility of protective sand cover grain size with geotextile to be determined, prior to initial placement.

c. Frequency - Hydraulic Conductivity testing shall be on-going as necessary to support fill borrow operations with minimum of one test per 500 cubic yards.

Prior to placement, the sand shall be tested for particle size and calcium carbonate content. The test shall be taken at least once per 5,000 cubic yards and for each change in material source.

d. Miscellaneous - The material shall be placed loose and spread on top of the liner system to a minimum depth of 24 inches. No equipment shall come in direct contact with liner. Low ground pressure equipment shall be used for the placement and spreading of the sand cover. Temporary haul roads and access roads over the liner for the delivery of material shall include a minimum of 36 inches of sand cover depth. These temporary facilities shall be removed during the finish grading of the protective sand blanket.

The leading edge of sand placement over the synthetic liner system shall be by vertical placement versus pushing sand horizontally.

E. CLAY ANCHOR BERM

A clay anchor berm shall be constructed in accordance with the Contract Drawings.

1. Clay Anchor Berm

a. Location - The clay anchor berm shall be sampled in place. Hydraulic conductivity testing shall be conducted in the laboratory.

b. Standard - Hydraulic conductivity shall be less than 1×10^{-7} cm/sec. Hydraulic conductivity testing by Falling Head Method (ASTM D5084).

c. Frequency - One testing location per 100 linear feet of anchor trench.

F. LEACHATE COLLECTION TRENCH AND SUMP AGGREGATE

Aggregate shall be placed in leachate collection trenches and sumps.

1. Aggregate

    a. Location - The aggregate shall be sampled on site, prior to placement.

    b. Standard - Gradient shall meet AASHTO No. 3 coarse aggregate (ASTM D448). Testing by Sieve Analysis (ASTM C136).

    The aggregate shall be non-calcareous (ASTM D3042).

    c. Frequency - Prior to placement, one gradation test per sump plus one testing location per trench with a minimum of one test per 500 cubic yards of aggregate.

    Prior to placement, the aggregate shall be tested for calcium carbonate content. The test shall be taken once for 2,600 LF of trench or once per change in material source.

England-Thims & Miller, Inc.
Consulting & Design Engineers
3131 St Johns Bluff Road S, Jacksonville, FL 32246
Tel (904) 642-8990 Fax (904) 646-9485

Principals
James E England, PE, Pres
Robert E Thims, Exec VP
Douglas C Miller, PE, Exec VP
N Hugh Mathews, PE, Exec VP

May 17, 1995

Ms. Mary C Nogas, P E
Waste Management Section
Department of Environmental Regulation
7825 Baymeadows Way, Suite 200B
Jacksonville, Florida 32256

Reference: Trail Ridge Landfill
FDEP Permit No. SC16-184444
ET&M No. E95-12-1A

Dear Ms Nogas:

On behalf of Trail Ridge Landfill, Inc, we hereby notify the Department that the installation of the synthetic liner system for Phase IIIA of the referenced facility will commence on May 22, 1995. In accordance with Specific Condition 2 b of the referenced permit, we hereby provide the names of the Quality Assurance Engineer and supporting personnel for the Quality Assurance/Quality Control of the synthetic liner system installation The qualifications of these individuals are provided in the attached resumes.

INDIVIDUAL	PROJECT INVOLVEMENT
Frank Adams ✓	Certifying Engineer (QAE)
Robert Turton ✓	Senior Level Support
Hugh Armitage ✓	Senior Level Support
Scott Callaway ✓	Project Manager
Billy Carruth	Resident Site Manager (QARE)
Brian Perino ✓	Assistant Resident Site Manager
Mark Blackmon	Geosynthetic QA Monitor
Joel Byerly	Geosynthetic QA Monitor
Chris Magaldi	Geosynthetic QA Monitor

If you have any questions regarding this submittal, please feel free to call me or Doug Miller

Sincerely,

ENGLAND, THIMS & MILLER, INC.

Juanitta Bader Clem

Juanitta Bader Clem, P.E.
Project Manager

Attachments

cc: Greg Mathes w/attachments
Scott McCallister w/attachments
Chris Pearson w/attachments

Golder Construction Services, Inc.

Francis T. Adams

Education M.S.C.E., Geotechnical Engineering, Purdue University, Lafayette, Indiana, 1984.
B.S.C.E., Civil Engineering, Drexel University, Philadelphia, Pennsylvania, 1982.

Affiliations Registered Professional Engineer, Pennsylvania, New York, Virginia, and Florida (Florida Certificate Number 46417, 1993).
Member, American Society of Civil Engineers.

Experience

1987 to Date **Golder Associates Inc. and Golder Construction Services, Inc.** **Mt. Laurel, New Jersey**

Geotechnical, Project, then Senior Engineer.

Responsibilities have included the management of designs, permit applications, construction quality assurance (CQA), record documentation, and remediation of municipal solid waste, construction and demolition debris, and hazardous waste handling and disposal facilities in Pennsylvania, New York, Virginia, Ohio, Maryland, and New Jersey. Responsible for designs of recycling facilities in New Jersey and Virginia. Also responsible for RCRA Part B Application, impoundment closures, analysis of leachates and sludges, and a delisting petition to U.S. EPA.

1984-1986 **United States Peace Corps** **Dominican Republic**

Water Resource Engineer Volunteer.

Supervised potable water well projects for a rural church parish and C.A.R.E. Activities included site selection; community organization; and hand pump installation, repair and maintenance at over 30 sites in the southwestern Dominican Republic. Fluent in Spanish with a 4.0/5.0 in the Foreign Service Institute (FSI) Examination.

1982-1984 **Purdue University** **West Lafayette, Indiana**

Graduate Research Instructor.

Prepared engineering soils map and report for Lawrence County, Indiana and M.S.C.E. thesis and report based on research of the state-of-the-art geotechnical practice applied to engineering problems in karst (limestone) regions.

1980-1981 **The Earth Technology Corporation** **Long Beach, California**

Engineering Analyst.

Performed field soil tests and inspections of various earthworks projects in southern California. Prepared client reports and computer programs for organizing test data. Worked in the laboratory performing various soil index and strength tests.

1978-1979 **Philadelphia Water Department** **Philadelphia, Pennsylvania**

Engineering Technician.

Monitored wastewater effluent from over 100 industries in Philadelphia. Responsible for maintenance and data processing for the city rain gauge network. Maintained flow meters and collected water samples for an urban stormwater run-off study.

Publications "Mapping and Prediction of Limestone Bedrock Problems," Transportation Research Record, Coauthor C.W. Lovell. Presented at 1984 TRB Conference, Washington, D.C.

Discussion of "Undrained Shear Strength Anisotropy of Normally Consolidated Cohesive Soils," Soils and Foundations, Coauthors G.A. Leonards et. al., 1984.

Hugh H. Armitage

Education

Diploma, Civil Engineering Technology, St. Lawrence College, Kingston, Ontario, 1977.
B.E.Sc., Civil Engineering, The University of Western Ontario, 1982.
M.E.Sc., Geotechnical Engineering, The University of Western Ontario, 1985.

Affiliations

Registered Professional Engineer, Georgia
Licensed Professional Engineer, Ontario, Canada.
Associate Member, American Society of Civil Engineers.

Experience

1992 to date **Golder Construction Services, Inc.** **Duluth, Georgia**

Senior Engineer.

Responsibilities include project management associated with third party construction quality assurance services provided during construction of composite liner systems for solid waste landfill projects in Virginia, Georgia, North Carolina, and South Carolina. Project Manager for third party construction quality assurance services provided for the closure of surface impoundment basins at a hazardous waste facility in Illinois and new landfill construction at a hazardous waste facility in Alabama. Duties have included management of project budgets, review of field and laboratory testing and monitoring data for soil and geosynthetic liner construction, report preparation, coordination of quality assurance plant visits during manufacture of High Density Polyethylene (HDPE) geomembrane and client contact during construction. Served as the project manager for a number of geosynthetic in-plant factory quality assurance and laboratory testing projects involving the monitoring and conformance testing during the manufacture of geomembrane, geonet and drainage geocomposite materials. Duties included overall coordination of in-plant monitoring personnel, review of manufacturers Quality Control documentation and conformance test results and assembly of data and preparation of reports. Also served as resident quality assurance manager during construction of a composite clay/geosynthetic lined solid waste landfill in Mississippi.

1985 - 1992 **Golder Associates Ltd.** **London, Ontario, Canada**

Geotechnical Engineer.

Responsibilities include supervision of subsurface investigations and quality control testing for various municipal and residential servicing and earthworks projects in southwestern Ontario. Supervision of geotechnical engineering investigations and report preparation for soil retaining structures, building foundations for both new and expansion of existing commercial, industrial and institutional facilities. Geotechnical investigation and report preparation for slope stability studies, flood control works, groundwater monitoring, pavement design and evaluation, sewage lagoon restoration projects and sewage treatment facilities.

1982 - 1984 **University of Western Ontario** **London, Ontario, Canada**

Graduate Student.

Performed an analytical study, using the finite element method, to investigate the behavior of socketed pile (pier) foundations in rock. A thesis entitled "Some Aspects of the Design of Rock Socketed Pile Foundations" was submitted in partial fulfillment of the degree of Master of Engineering Science. Held position as laboratory and teaching assistant for undergraduate soil mechanics and civil engineering courses.

Hugh H. Armitage

PROJECT RELATED EXPERIENCE - SOLID WASTE MANAGEMENT

Emelle Hazardous Waste Facility — Emelle, Alabama

Project Manager for full time quality assurance services provided for the construction of a 14 acre double lined waste cell and associated leachate collection systems at one of the largest hazardous waste landfill facilities in North America. The secondary and primary liner systems typically comprised alternating layers of on-site, low permeability chalk material, 60-mil HDPE geomembrane, geotextile and granular drainage materials. The double liner system is underlain by a granular pressure relief layer constructed above a prepared in-situ chalk subgrade. Responsibilities included management of field soil and geosynthetic materials data and site Construction Quality Assurance (CQA) monitoring personnel, review of geosynthetic material conformance testing, preparation of project related documentation including letters and reports and management of field soil and geosynthetic materials data and site QA monitoring personnel, review of geosynthetic material conformance testing, preparation of project related documentation including letters and reports and management of project CQA budgets.

Chicago Incinerator Facility — Chicago, Illinois

Project Manager for full time third party construction quality assurance monitoring of the interim closure construction of four hazardous surface impoundment basins comprising some 3 acres at the hazardous waste treatment facility. The project included monitoring the treatment of surface liquids and solidification of existing sludge at the bottom of the basins, construction of a low permeability clay layer, installation of a 40-mil HDPE geomembrane liner, geosynthetic drainage layer and overlying protective cover and vegetative cover layers. Responsibilities included management of the field soil and geosynthetic materials data and site QA monitoring personnel, review of site survey information, review of geosynthetic material conformance test and soil material laboratory test results, preparation of project related documentation including letters and reports, management of the project CQA budget and communications with the owner's and design engineer's project representatives.

City of Huntsville Ash Monofill Addition — Huntsville, Alabama

Project Manager for CQA services provided to the City of Huntsville during construction of a vertical landfill expansion. GCS provided field assistance to the primary CQA consulting firm's monitoring personnel during installation of 60 and 80-mil textured HDPE geomembrane liner. The geomembrane liner was installed above a 2 foot thick, low permeability soil liner and a geosynthetic reinforced granular soil layer which, in turn, were constructed above the compacted/consolidated waste in an existing landfill. Duties included providing assistance to the certifying CQA consultant with the review of geosynthetic quality control documentation and field monitoring results, attendance at project meetings and preparation of correspondence pertaining to CQA related aspects of the project

Kersey Valley Road Balefill — High Point, North Carolina

Project Manager for the quality assurance monitoring services provided to the City of High Point during installation of the geosynthetic components of the composite liner and leachate collection system at the city's new 16 acre municipal solid waste facility. The geosynthetic installation included a 60-mil HDPE geomembrane on the floor of the landfill and textured 60-mil HDPE geomembrane of the interior sideslopes. The geomembrane liner was installed above a compacted soil-bentonite liner. A synthetic drainage layer comprising geonet and geotextile was installed above the geomembrane liner. Responsibilities included review of manufacturers quality control documentation for the rolls of geomembrane, review of field geosynthetic installation monitoring data, preparation of a CQA report and budget management for the CQA services

Hugh H. Armitage

Maplewood Disposal Facility — Amelia County, Virginia

Project Manager for construction quality assurance services provided during the installation of a Geosynthetic Clay Liner (GCL) overlain by a 60-mil HDPE geomembrane liner for a new solid waste landfill cell. The liner system was overlain by a geosynthetic drainage layer on the 3 horizontal to 1 vertical sideslopes. The sideslopes and floor of the cell were then overlain by a layer of drainage/protective cover sand. Responsibilities included review of geosynthetic field data, geosynthetic conformance test results, soils laboratory testing results, CQA certification report preparation and management of project CQA budget.

Oakridge Sanitary Landfill — Dorchester, South Carolina

Resident QA Manager/Project Manager for CQA services during the construction of three solid waste and ash monofill landfill cells comprising a total of about 15 acres. The landfill construction projects comprised composite lined systems consisting of 2 feet of low permeability clay overlain by 60-mil HDPE geomembrane liner which in turn was overlain by a geosynthetic drainage layer and a 2 foot thick protective soil layer. Duties included performing field compaction testing and field laboratory tests on the soil liner material during construction, inventory of geosynthetic materials, review of all soils and geosynthetic materials laboratory testing, coordination of in-plant factory QA services during manufacture of geomembrane materials, review of survey record drawings, preparation of project related correspondence and CQA certification reports and budget management.

Pine Ridge Sanitary Landfill — Meridian, Mississippi

Resident CQA Manager during construction of a 7.5 acre composite lined cell at a solid waste landfill. Duties included performing field compaction and on-site soils laboratory testing during soil liner construction, assisting with a borrow search to identify suitable drainage sand to be placed above the geosynthetic liner materials, preparation of daily and weekly CQA summary reports and attendance at site progress meetings with the owner and contractor's representatives.