This Report

was Prepared by:

Golder Construction Services, Inc.
Redmond, Washington
for the Westinghouse Hanford Company
Richland, Washington
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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT

607385

2. To: (Receiving Organization) WRAP 1	3. From: (Originating Organization) WRAP 1	4. Related EDT No.: NA
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		10. System/Bldg./Facility: NA
11. Receiver Remarks:		12. Major Assm. Dwg. No.: IVA
		13. Permit/Permit Application No.: NA
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1	WHC-SD-W025-RPT-001	--	0	Construction Quality Assurance Report	Q,E	2	1	

16. KEY		
Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)										(G)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog. Eng. V. Roscha	<i>V. Roscha</i>	11/3/94	G3-15						
1	1	Cog. Mgr. DR Lucas	<i>DR Lucas</i>	11/3/94	G3-15						
1	1	QA JR McGee	<i>JA McGee</i>	11/3/94	G3-15						
		Safety									
1	1	Env. DJ Carrell	<i>DJ Carrell</i>	11/3/94	H6-22						
3		WRAP 1 DMC			G3-15						
1	1	WRAP 1 DMC	<i>2/2</i>	11/10/94							

18. V Roscha <i>V. Roscha</i> 11/3/94 Signature of EDT Originator Date	19. DR Lucas <i>DR Lucas</i> 11/3/94 Authorized Representative Date for Receiving Organization	20. DR Lucas <i>DR Lucas</i> 11/3/94 Cognizant Manager Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
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7. Abstract

This report provides a summary of the construction quality assurance (CQA) observation and test results, including:

- The results of the geosynthetic and soil materials conformance testing.
- The observation and testing results associated with the installation of the soil liners.
- The observation and testing results associated with the installation of the HDPE geomembrane liner systems.
- The observation and testing results associated with the installation of the leachate collection and removal systems.
- The observation and testing results associated with the installation of the working surfaces.
- The observation and testing results associated with in-plant manufacturing process.
- Summary of submittal reviews by Golder Construction Services, Inc.
- The submittal and certification of the piping material specifications.
- The observation and verification associated of the Acceptance Test Procedure results of the operational equipment functions.
- Summary of the ECNs which are incorporated into the project.

8. RELEASE STAMP

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1.0 INTRODUCTION

Golder Construction Services, Inc. (GCS) has performed quality assurance observation and testing for the construction of the Radioactive Mixed Waste Land Disposal Facility, Project W-025, located in the 200 West Property Protected Area of the Hanford Nuclear Reservation, approximately 30 miles north of Richland, Washington (Figures 1 and 2). This work was performed under Contract No. DE-ACOG-85RL11615 between the United States Department of Energy and Golder Associates Inc. (GAI).

This report provides a summary of the construction quality assurance (CQA) observation and test results, including:

- The results of the geosynthetic and soil materials conformance testing;
- The observation and testing results associated with the installation of the soil liners;
- The observation and testing results associated with the installation of the HDPE geomembrane liner systems;
- The observation and testing results associated with the installation of the leachate collection and removal systems;
- The observation and testing results associated with the installation of the working surfaces.

The engineering design basis for the Non-Drag-Off Landfill, Project W-025, are not included in this report, but are given in the following reports by Golder Associates Inc.:

- Site Investigation Report, Non-Drag-Off Landfill Site, Low Level Burial Area No. 5, 200 West Area, dated December 4, 1989.
- Soil Liner/Leachate Compatibility Testing in Support of Project W-025, Radioactive Mixed Waste Disposal Facility, not dated.
- Design Report, Project W-025, Radioactive Mixed Waste (RMW) Land Disposal Facility, Non-Drag-Off, Revision 1, dated November 12, 1992.

1.1 SCOPE OF SERVICES

The scope of GCS' services included CQA observation and testing of Project W-025 in accordance with the project Construction Quality Assurance Plan (CQAP). The CQA observation and testing services included in this report took place between September 7, 1993 and October 7, 1994. A schedule of CQA onsite personnel and specific construction activities is shown in Appendix A.

Construction documentation included daily field reports which were submitted by all field personnel. The CQA Engineer prepared and submitted summary weekly field reports to the DOE Contract Officer's Technical Representative (COTR), Westinghouse Hanford Company (WHC).

These reports are not included in this document, but are available for review at the COTR and at GCS's Redmond, Washington, office. In addition, photographs were taken on a regular basis during the construction. Copies of these photographs have been turned over to WHC.

Delhur Industries, Inc. (Delhur) of Port Angeles, Washington, was the prime contractor for the project. Delhur completed the Project W-025 excavation, subgrade preparation, general fill, soil liners, earthwork for the leachate collection and removal systems, and the protective layer for the Project W-025 construction project. Installation of the secondary and primary geosynthetic liner systems, and the geosynthetic materials for the secondary and primary leachate collection systems was performed by GeoPacific Lining Inc. (GeoPacific) of Seattle, Washington. The leachate temporary storage tank was fabricated by Quality Tank & Construction of Sandy, Oregon. Pumps and piping systems were installed by Pilchuck Mechanical, Inc. of Renton, Washington. Electrical systems were installed by JRT Electric, Inc. of Richland, Washington. Paving was installed by ACME Materials & Construction Co. of Richland, Washington. Surveying services were provided by Permit Surveying, Inc. of Kennewick, Washington. Permit Surveying, Inc. (Permit) was also the Surveyor of Record for this project.

GCS CQA personnel or GAI Design representatives reviewed contractors' submittals which proposed methods and materials to be used during construction of the Non-Drag-Off facility for compliance with the project specifications. A summary of the submittals reviewed by GCS and GAI is presented in Appendix B.

GCS also reviewed CQA verification surveys performed on GCS's behalf by Rogers Surveying Inc. of Richland, Washington, and record surveys performed by Permit, for the following:

- Subgrade Surface
- Secondary Soil Liner Surface
- Secondary Drainage Gravel Surface
- Primary Soil Liner Surface
- Primary Drainage Gravel Surface
- Operations Layer Surface

Record drawings, prepared by Permit, as well as the geomembrane liner as-built panel layout drawings, prepared by GCS, are included in Volume 2 of this report.

1.2 PROJECT DESCRIPTION

The Project W-025 Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, is a landfill which was designed to accept Low Level Radioactive Mixed Waste (LL-RMW). LL-RMW is the combination of hazardous constituent and low level radioactive material. The landfill consists of a double-lined, composite, soil liner/geosynthetic liner system, and a leachate collection and removal system. The layers of the lining system and the leachate collection system, from bottom to top, are as shown in Table 1.

Table 1. Lining and Leachate Collection Systems.

LAYER	FLOOR OF FACILITY	SLOPES OF FACILITY
Secondary Liner	3.1-ft thick soil liner	3.1-ft thick soil liner
	60-mil, smooth HDPE liner	60-mil, textured HDPE liner
Secondary Leachate Collection System	Geonet 16-oz/yd ² geotextile 1.0-ft thick layer of drainage gravel 16-oz/yd ² geotextile	Geonet-Geotextile Geocomposite
Primary Liner	1.5-ft thick soil liner	60-mil, textured HDPE liner
	60-mil, smooth HDPE liner	
Primary Leachate Collection System	Geonet 16-oz/yd ² geotextile 1.0-ft thick layer of drainage gravel 7-oz/yd ² geotextile	Geonet-Geotextile Geocomposite
Operations Layer	3.0-ft thick gravel/eolian sand	3.0-ft thick Eolian sand

The leachate removal systems included pumps, HDPE piping, stainless steel piping, and a leachate temporary storage tank.

1.3 PROJECT SPECIFICATIONS

The work performed for the Project W-025 construction project was completed according to the following documents, plans, and specifications:

- Material Specifications and Construction Requirements for the Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Project W025, Revision 2, prepared for the U.S. Department of Energy-Richland Operations Office, Contract No. DE-AC06-89RL11615, by Golder Associates Inc., dated May 26, 1993.
- Construction Plans for Radioactive Mixed Waste (RMW) Land Disposal Facility, Non-Drag-Off, Project W-025, prepared by Golder Associates Inc., dated May 21, 1993.

- Construction Quality Assurance Plan for Project W-025, Radioactive Mixed Waste (RMW) Land Disposal Facility - Non-Drag-Off, Revision 3, prepared for the U.S. Department of Energy - Richland Operations Office, Contract No. DE-AC06-89RL11615, by Golder Associates Inc., dated May 21, 1993.
- Quality Assurance Program Plan for Project W-025, Radioactive Mixed Waste (RMW) Land Disposal Facility - Non-Drag-Off, Revision 3, prepared for the U.S. Department of Energy - Richland Operations Office, Contract No. DE-AC06-89RL11615, by Golder Associates Inc., dated April, 1991.

Construction issues were discussed and clarified in a preconstruction meeting which was held at the offices of Kaiser Engineers Hanford on August 25, 1993. Minutes of the meeting, recorded by Kaiser Engineers Hanford, are included in Appendix C-1.

A second preconstruction meeting, with GCS and GeoPacific personnel in attendance, was held onsite on November 17, 1993, to discuss and clarify geosynthetics installation issues. Minutes of the meeting, recorded by GCS, are included in Appendix C-2.

During construction of the landfill, several issues regarding design and construction were encountered. These issues were discussed with the Design Engineer of record, Golder Associates Inc. (GAI), and resolutions to the issues were determined. An Engineering Change Notice (ECN) was prepared by the Design Engineer for each construction issue which warranted a design or specification change. These documents are included in Appendix C-3.

Engineering Change Notices (ECN) W-025-006 through W-025-026, W-025-028, W-025-029, W-025-031, and W-025-032 are summarized in Table 2. ECNs W-025-001 through W-025-005 were completed prior to the bidding date for this project, were incorporated to the specification package and Design Drawings prior to the bid date and are not included in Table 2. ECNs W-025-027 and W-025-030 involved the second landfill, Project W-025A, and are not included in Table 2.

Table 2. Engineering Change Notice Summary.

ECN No.	Description of Change
W-025-006	<p>Submit qualifications of organization and personnel who will serve as geosynthetics installer.</p> <p>Add section to specifications for Dry Type Transformers.</p> <p>Pole mounted transformers - change from 75 KV BIL to 95 KV BIL.</p> <p>Open fuse cutouts shall be extra heavy duty, 100 Amp continuous, 5600 Amp interrupting duty or better. Cutouts shall be fused with 2T fuses.</p> <p>Grounding shall be performed in accordance with NESC rules 96 & 97.</p>

ECN No.	Description of Change
W-025-007	<p>Change Instrumentation/Electrical Acceptance Test Procedure:</p> <p>Circuit breaker for pump W5P1 to be located on Panel A.</p> <p>Edit WP51 to W5P1.</p> <p>Measure phase currents for pumps prior to testing. Verify that overload devices are sized correctly.</p>
W-025-008	Editorial changes to Design Drawings and title blocks of Drawings.
W-025-009	Editorial changes to CQA Plan tables.
W-025-010	<p>Only two friction angle tests are required for each of the following interfaces:</p> <p>Textured geomembrane/soil liner</p> <p>Textured geomembrane/geocomposite</p> <p>Geocomposite/operations layer</p>
W-025-011	Clarified CQA Plan such that only two friction angle tests are required for the interfaces indicated in ECN #10 (W-025-010).
W-025-012	Move site access road northward approximately 10 ft to avoid an existing power pole.
W-025-013	<p>Nominal Transmissivity of geonet shall be a minimum of 0.001 m²/sec (4.8 gal/min/ft) at 10,000 psf normal load, and the Mass/Unit Area shall be a minimum of 22 oz/yd².</p> <p>Type A geotextile shall have Mass/Unit Area of 7.0 oz/yd² or greater, and Permittivity shall be 1.2 sec⁻¹ or greater.</p> <p>1.5-in diameter, SDR 11, HDPE pipe is acceptable for submersible pump discharge piping.</p>
W-025-014	Type B geotextile shall have a minimum thickness of 170 mils, a minimum Trap Tear Strength of 135 lbs, and a minimum permittivity of 0.40 sec ⁻¹ .
W-025-015	The first lift of admix material may be placed in a 12-inch thick loose lift.
W-025-016	<p>The minimum density of the resin used to manufacture the geomembrane material shall be 0.930.</p> <p>For Friction Angle tests, combinations of shear strength parameters, including such parameters as friction angle and cohesion, may be used in stability analyses to evaluate the static and dynamic factors of safety against slope failure to determine the acceptability of the materials.</p>

ECN No.	Description of Change
W-025-017	<p>If the installer elects to weld geomembrane seams in ambient temperatures below 40° F or above 104° F, the installer must certify that such seams will be comparable to seams welded in ambient temperatures between 40° F and 104° F, and additional coupons (from the ends of such seams) shall be tested to verify the quality of the welds.</p> <p>SDR 13.5 HDPE pipe or SDR 15.5 HDPE pipe may be used for the Collector Well.</p> <p>End caps shall be provided for the cleanout access pipes.</p> <p>"Valve" section of specifications shall be replaced with new section which includes specifications for a hose bib, and ball valves. Adds six valves to the valve schedule.</p> <p>Supply additional butterfly valves to allow recirculation of leachate.</p> <p>Supply two turbine meters to allow determination of the quantity of discharge from each the primary and secondary sumps.</p> <p>Mount a high level limit switch on the liquid level gauge.</p>
W-025-018	<p>Changed Design Drawings to incorporate valves, meters, piping, and switch indicated by ECN #17 (W-025-017).</p>
W-025-019	<p>Modified Acceptance Test Procedure. Major changes included testing spare pumps at the ground surface, testing flowmeters, and testing control panel heaters.</p>
W-025-020	<p>Heat trace cable can be either 120 volt or 240 volt. A 30-Amp, two pole circuit breaker shall be used for 240 volt heat trace cable.</p> <p>Provide control panel heaters to maintain temperature within operating range of components during cold weather.</p>
W-025-021	<p>Lower subgrade elevations of truck staging area and site entrance road to allow installation of eight inches of top course and four inches of asphalt.</p>
W-025-022	<p>Provide electric pump, accessories, and connections to allow removal of liquid from containment basin under leachate tank.</p> <p>Provide stairway and railing to enable access to containment basin.</p>

ECN No.	Description of Change
W-025-023	<p>On Drawings, add heat trace and insulation to piping system components between leachate tank and valves near crest wall.</p> <p>Add vacuum release valve to discharge pipe immediately upstream of leachate tank.</p> <p>Terminals shall be installed in junction boxes for transducers.</p> <p>Relay CR7 shall be a time-delay relay.</p> <p>Photocell on exterior of control building may be deleted if photocells are provided for each light pole.</p>
W-025-024	<p>Revise Acceptance Test Procedures to incorporate design changes made during construction.</p>
W-025-025	<p>Revise piping between headwall and leachate temporary storage tank to incorporate new meters and valves.</p>
W-025-026	<p>Revise design drawings:</p> <ol style="list-style-type: none"> 1. H-2-131587, Sheet 1, Rev. 2 2. H-2-131585, Rev. 2 3. H-2-131587, Sheet 2, Rev. 2
W-025-028	<p>Revise Acceptance Test Procedures to incorporate changes made as a result of previous ECNs.</p>
W-025-029	<p>Edit design drawings.</p> <p>Cross reference design drawings between Project W-025 and Project W-025A.</p> <p>List contractor's submittals on design drawings.</p> <p>Cross reference design drawings with as-built drawings contained in CQA report.</p>
W-025-031	<p>Remove and replace flowmeters, and modify the piping configuration near the crest wall.</p>
W-025-032	<p>Edit Acceptance Test Procedures to account for the changes in the sizes of the flowmeters.</p>

2.0 PRECONSTRUCTION TESTING AND CONFORMANCE TESTING

The Quality Assurance Program Plan and the CQA Plan required preconstruction testing of the soil materials and conformance testing of the geosynthetic materials proposed for use on this project. Testing of the proposed materials was performed to verify compliance with the project specifications. The frequencies and results of the preconstruction and conformance tests are presented below.

2.1 EXCAVATION AND BACKFILL

During the excavation of Project W-025, GCS personnel visually classified the excavated soils at least once per shift, as specified. Two general soil groups: silty fine sand (eolian sand); and gravelly sand to sandy gravel, were segregated and stockpiled as the excavation progressed. The eolian sand was eventually used as a component in the admixture for the soil liner, as a general fill material, and as an operations layer material. The gravelly soil was eventually used as a general fill material and as an operations layer material.

Approximately 4,500 cubic yards of the eolian sand and gravelly sand materials were used for backfilling in and around the landfill excavation. Three samples of these soils were tested by GCS personnel in the onsite soils laboratory to evaluate the materials. The material evaluation testing frequency is summarized in Table 3.

Table 3. Excavation & Backfill Materials Evaluation - Preconstruction Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Excavation</u>			
One Test Per Shift	Visual Classification (ASTM D2487)	11	13
<u>Backfill</u>			
One Test Per 2,000 yd ³	Modified Proctor (ASTM D1557) Hydrometer and Sieve (ASTM D422) Atterberg Limits (ASTM D4318)	3	3*
* The tested soils were non-plastic, so Atterberg Limits tests were not possible.			

The specifications required that the proposed backfill soils conform to any one of the following Unified Soils Classification System classifications:

- GP - Poorly graded gravel
- GM - Silty gravel
- GC - Clayey gravel

- SW - Well graded sand
- SP - Poorly graded sand
- SM - Silty sand
- SC - Clayey sand

The results of the preconstruction materials evaluations indicated that the tested samples met the requirements of the specifications for both backfill materials and operations layer materials. The results of these tests are presented in Appendix D-1.

2.2 SOIL LINER

Approximately 20,000 cubic yards of soil liner material were prepared between October 4, 1993 and November 15, 1993 for use in the Project W-025 test fills, secondary soil liner, and primary soil liner. The soil liner material consisted of an admixture (admix) of eolian sand stockpiled during landfill excavation and imported bentonite. A nominal bentonite content of 12 percent with an allowable range of 11 percent to 14 percent (by weight) was required by the project specifications. American Colloid Company of Upton, Wyoming, supplied the bentonite used in the admix. Prior to mixing, preconstruction testing of the admix components was required.

2.2.1 Eolian Sand

Two sets of grain-size determinations were performed on samples of eolian sand before the sand was mixed with bentonite. During the excavation of Project W-025, the eolian sand was sampled and tested as the material was stockpiled. This first set of grain-size determinations was performed to verify that the stockpiled eolian sand was suitable for use as soil liner material, backfill material, or operations layer material. Just prior to mixing the stockpiled eolian sand with bentonite, a second set of grain-size determinations was performed. The second set of tests was performed to determine the percentage of fines (minus #200-sieve particles) in each sample. This percentage of fines in the sand was used, along with the percentage of fines in the sand-bentonite admix, to determine the bentonite content of the admix. Less than 20,000 cubic yards of eolian sand were admixed with bentonite, and the tests performed on the eolian sand resulted in an approximate frequency of one test for every 500 cubic yards of eolian sand used in the admix, exceeding the specified requirement of one test for every 1,000 cubic yards of eolian sand used. The frequency of the preconstruction tests performed on the eolian sand is summarized in Table 4.

Table 4. Eolian Sand Preconstruction Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Per 1,000 yd ³	Particle Size (ASTM D422)	20	40

The tests on the eolian sand were performed by GCS personnel in the onsite soils laboratory. The results of these tests are presented in Appendix D-2 and show that the tested samples met the project specifications.

2.2.2 Bentonite

As bentonite was delivered to the site, samples of the bentonite were periodically tested to verify that the bentonite's properties were consistent with the specified properties for 91-barrel yield bentonite. A total of 3,743.3 tons of bentonite were delivered to the jobsite, and nine samples were tested, resulting in an approximate frequency of one preconstruction test for every 416 tons of bentonite delivered to the site. This testing frequency exceeded the required frequency of one test for every 500 tons of bentonite delivered. A summary of tests performed on the bentonite is presented in Table 5.

Table 5. Bentonite Preconstruction Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Per 500 Tons	Fines Content (API 13A, Sec 4) Filtration (API 13A, Sec 4) Viscosity (API RP 13B, Sec 2.3)* Free Swell (USP-NF-XVII)	8	9
* Specifications indicated API 13A, Sec 4 (Direct indicating viscometer). American Colloid established a correlation between the direct indicating viscometer and the Marsh funnel viscosity. Therefore, API RP 13B, Sec 2.3 (Marsh funnel) was used to determine the viscosity. A copy of the correlation between the two methods of viscosity measurement is included in Appendix D-3.2.			

The bentonite preconstruction tests were performed by GCS personnel in the onsite soils laboratory. The results of the tests indicated that the tested bentonite samples met the requirements of the specifications. A summary of the bentonite test results is presented in Appendix D-3.1.

The specifications required the manufacturer to submit a bentonite yield certificate for every 500 tons of bentonite delivered to the site. Thirty-nine rail cars delivered a total of approximately 3,743 tons of bentonite, and the supplier submitted 31 certificates of analysis, resulting in an approximate frequency of one certificate of analysis for every 121 tons of bentonite delivered. GCS reviewed the certificates and verified that the bentonite conformed to the specifications. Copies of the certificates of analysis are included in Appendix D-3.3.

2.2.3 Admix

After the completion of the mixing of bentonite, eolian sand, and water, but prior to the placement of the material, preconstruction tests were performed on the admix. The specifications required an admix moisture content of 1 percent to 5 percent above the optimum moisture content, a bentonite content of 11 percent to 14 percent, and a hydraulic conductivity (permeability) of less than or equal to 1×10^{-7} cm/s.

Preconstruction moisture content tests were performed at an approximate frequency of one test for every 513 cubic yards of admix produced, exceeding the specification's requirement of one moisture test for every 1,000 cubic yards of admix produced. The admix was tested for bentonite

content at an approximate frequency of one test for every 833 cubic yards of admix produced, exceeding the specification's requirement of one bentonite content test for every 1,000 cubic yards of admix produced.

A suite of three tests, including a laboratory recompacted hydraulic conductivity test, a Standard Proctor moisture-density test, and an Atterberg Limits test was performed on each of six samples of the admixture, resulting in an approximate testing frequency of one suite of tests for every 3,333 cubic yards of admix produced, and exceeding the specification's requirement of one suite of these tests for every 5,000 cubic yards of admix produced. The recompacted hydraulic conductivity tests were performed by GAI's soils laboratory, located in Redmond, Washington. Standard Proctor and Atterberg Limits preconstruction tests were performed in GCS's onsite soils laboratory. The preconstruction testing frequency for the admix is summarized in Table 6.

Table 6. Admix Preconstruction Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Per 1,000 yd ³	Moisture Content (ASTM D2216)	20	39
	Bentonite Content (ASTM D422)	20	24
One Test Per 5,000 yd ³	Standard Proctor (ASTM D698) Atterberg Limits (ASTM D4318) Permeability (ASTM D5084)	4	6

The preconstruction test results indicated that the tested samples met the requirements of the project specifications. The results of these conformance tests are presented in Appendix D-4.

Preconstruction laboratory testing indicated that the designed admixture; when properly mixed, moisture conditioned, placed, and compacted; would meet the project permeability requirement of less than or equal to 1×10^{-7} cm/s. CQA tests on test fills and a Sealed Double-Ring Infiltrometer (SDRI) test demonstrated that the contractor's equipment and methods were capable of preparing, placing, and compacting the admix such that the specified permeability could be achieved. The results of tests performed on the test fills, and the results of the SDRI test are presented in GCS's report Quality Assurance Observation and Testing, Soil Liner Test Fill and SDRI Test, Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Project W-025, dated May, 1994, and presented in Appendix U.

2.3 GRANULAR DRAINAGE MATERIAL

Two types of granular drainage media were used in the drainage layers for both the secondary and primary leachate collection systems. Drainage gravel, generally a sandy pea-gravel, was used on the floor of each of the systems; and sump gravel, generally a clean, medium-sized gravel, was used in the sump of each system. Prior to the use of these materials, samples were obtained from the supplier, ACME Materials and Construction Co., of Richland, Washington, and preconstruction tests were performed. Preconstruction testing of the drainage gravel and sump gravel included a suite of

three tests: Sieve analysis; permeability; and slake durability. The suite of preconstruction tests was performed on four samples of the drainage gravel and one sample of the sump gravel, resulting in preconstruction testing frequencies of one suite of tests for every 450 cubic yards of drainage gravel, and one suite of tests for every 250 cubic yards of sump gravel. These preconstruction testing frequencies exceeded the specification's required testing frequency of one suite of tests for every 500 cubic yards of gravel. The sieve analyses were performed in GCS's onsite soils laboratory. Permeability tests were performed by GAI's soils laboratories located in Redmond, Washington, and Mt. Laurel, New Jersey. A simulated leachate was used during the slake durability tests, which were performed by GAI's soils laboratory located in Redmond, Washington. The preconstruction testing frequencies for the granular drainage materials are summarized in Table 7.

Table 7. Granular Drainage Material Preconstruction Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Drainage Gravel</u> One Test Per 500 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434) Slake Durability (ASTM D4644)	4	4
<u>Sump Gravel</u> One Test Per 500 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434) Slake Durability (ASTM D4644)	1	1

The preconstruction test results indicated that the sampled granular drainage materials met the requirements of the specifications. The results of these preconstruction tests are presented in Appendix D-5.

2.4 HDPE GEOMEMBRANE

The geomembrane liner delivered to the site was high density polyethylene (HDPE), manufactured by SLT North America, Inc. (SLT), of Conroe, Texas. Three types of this material were delivered between October 29, 1993, and January 12, 1994, and included the following:

- Textured, 60-mil thick, HDPE geomembrane liner (for use on the slopes and in the sump of the landfill)
- Smooth, 60-mil thick, HDPE geomembrane liner (for use on the floor of the landfill)
- Smooth, 80-mil thick, HDPE geomembrane liner (for lining beneath the truck unloading area and lining the concrete containment areas around the leachate tank)

During the manufacture of the above HDPE liner materials for Project W-025, a GCS representative visited SLT's manufacturing plant on four occasions to review the manufacturing

process, quality control, laboratory facilities, and testing procedures. During one visit, GCS's representative observed an excessive amount of recycled regrind being added to the resin, and brought this to the attention of the manufacturer. The manufacturer opted to prepare a new batch of resin for material production for Project W-025. The manufacturer certified that no more than two percent recycled regrind had been added to the resin for any of the HDPE liner material produced for this project. A Surveillance Inspection Report was written by the GCS representative for each of the four manufacturing plant visits. Copies of these reports are included in Appendix E-1.

Approximately 362,000 square feet of textured, 60-mil thick, HDPE geomembrane liner; 33,500 square feet of smooth, 60-mil thick HDPE liner; and 25,200 square feet of smooth, 80-mil thick HDPE liner were delivered to the site. These materials were sampled and tested by GCS for conformance with the project specifications. Ten rolls of the textured material were sampled and tested, resulting in an approximate frequency of one conformance test for every 36,200 square feet of textured HDPE geomembrane liner delivered to the site. One 60-mil thick roll of the smooth, HDPE liner material was sampled and tested, resulting in an approximate frequency of one conformance test for every 33,500 square feet of material delivered. Three samples, one from each resin lot delivered to the site, of the 80-mil thick, smooth, HDPE liner material were sampled and tested, resulting in an approximate frequency of one conformance test for every 8,400 square feet of material delivered. The conformance testing frequencies met or exceeded the specifications' requirement of a minimum of one conformance test for every 50,000 square feet of material delivered to the site, or a minimum of one conformance sample for each lot of material delivered.

Additional conformance testing of the material properties of the geomembrane included fingerprinting analyses and direct shear testing. Fingerprinting analyses, including tests of the material's specific gravity, melt index, and crystallinity were performed on two samples of the geomembrane. Two direct shear tests were performed on samples of the textured HDPE liner and the soil liner material as required by the specifications. A summary of the HDPE liner conformance testing frequency is presented in Table 8.

Table 8. HDPE Geomembrane Conformance Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Textured 60-mil</u>	Sp. Gravity (ASTM D792 or D1505)		
One Test per	Carbon Black Content (ASTM D1603)		
50,000 ft ² or	Carbon Black Dispersion (ASTM	10	10
One test/Lot	D1603)		
	Thickness (ASTM D1593)		
	Tensile Properties (ASTM D638)		
Two Tests Total	Friction Angle of Interface with Admix (Direct Shear Method)	2	2

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Smooth 60-mil</u> One Test per 50,000 ft ² or One test/Lot	Sp. Gravity (ASTM D792 or D1505) Carbon Black Content (ASTM D1603) Carbon Black Dispersion (ASTM D1603) Thickness (ASTM D1593) Tensile Properties (ASTM D638)	1	1
<u>Smooth 80-mil</u> One Test per 50,000 ft ² or One test/Lot	Sp. Gravity (ASTM D792 or D1505) Carbon Black Content (ASTM D1603) Carbon Black Dispersion (ASTM D1603) Thickness (ASTM D1593) Tensile Properties (ASTM D638)	3	3

The conformance samples were tested by GCS's geosynthetics laboratory located in Duluth, Georgia and the direct shear tests were performed at Golder Associates Ltd. soils laboratory located in Calgary, Alberta. The results of the direct shear tests were reviewed by GCS CQA personnel and the GAI Design Engineer. The direct shear test results met the requirements of the specifications. The remainder of the conformance test results were reviewed by GCS for compliance with the project specifications. With only one exception, the tested material met the requirements of the specifications. One roll of smooth, 80-mil thick, HDPE geomembrane liner from a different lot than those used was rejected because the conformance test results indicated that the density and carbon black content were lower than specified. This roll was rejected for use in Project W-025. The results of the conformance tests are presented in Appendix E-2. An inventory of the rolls of HDPE geomembrane liner delivered to the site is also included in Appendix E-2.

The manufacturer of the geomembrane (SLT North America) provided the following documentation for the HDPE liner materials delivered to the site:

- Fingerprinting analytical data
- A report, issued by Geosyntec Consultants, of Atlanta, Georgia, which presents the results of friction angle tests
- Certification that HDPE liner materials meet the requirements of the specifications
- Quality Control (QC) Roll Test Data Report for each roll of HDPE geomembrane liner
- Certificate of Analysis for each resin lot used to produce the delivered rolls
- Certification that the resin contains no reclaimed polymer and less than two percent of recycled trim

- Certification that the materials passed the 2000-hour Environmental Stress Crack Resistance test
- Certification that the materials meet the specification's requirements for Resistance to Soil Burial
- Certification that the welding extrudate (rod and resin) is manufactured from the same base resin type and will exhibit similar physical characteristics as the geomembrane
- Certification that the material contains only virgin polyethylene resin and carbon black
- Certification of the consistency of the material

GCS personnel and/or GAI Design Engineers reviewed the above documents for conformance to the project specifications. Copies of these certificates are included in Appendix E-3.

2.5 GEONET

The HDPE geonet delivered to the site was TENAX CE-2, manufactured by TENAX Corporation, of Jessup, Maryland. Approximately 50,700 square feet of geonet were delivered to the site on October 13, 1993. A total of two rolls were sampled and tested for conformance with the project specifications, resulting in an approximate testing frequency of one conformance test for every 25,350 square feet of material delivered to the site, exceeding the specification's requirement of one conformance test for every 50,000 square feet of geonet delivered to the site. The geonet conformance testing frequency is summarized in Table 9.

Table 9. Geonet Conformance Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test per 50,000 ft ²	Specific Gravity (ASTM D792 or D1505) Thickness (ASTM D1777) Transmissivity (ASTM D4716) Mass per Unit Area (ASTM D3776)	2	2

The conformance samples were tested by GCS's geosynthetics laboratory in Duluth, Georgia. GCS reviewed the conformance test results for compliance with the project specifications. The conformance tests indicated that the tested samples met the requirements of the project specifications. The conformance test results are given in Appendix F-1. An inventory of the rolls of geonet delivered to the site is also included in Appendix F-1.

The manufacturer of the geonet (TENAX Corporation) provided certification and quality control (QC) data for the material delivered to the site. GCS reviewed these documents for compliance with the specifications. With one exception, the documents indicated compliance with the specifications. The manufacturer's QC tests indicated that the specific gravity of the geonet was

0.946, whereas GCS's conformance tests indicated a geonet specific gravity of 0.940 to 0.941. The specifications require a geonet specific gravity less than that of the 60-mil thick HDPE geomembrane upon which the geonet was to be installed. GCS's conformance tests on the 60-mil geomembrane indicated specific gravities ranging from 0.942 to 0.945, and the geomembrane manufacturer's (SLT's) QC tests on the 60-mil geomembrane indicated specific gravities ranging from 0.942 to 0.947. GCS's conformance tests on the geonet indicated that the specific gravity of the geonet met the requirements of the specifications, whereas TENAX's QC tests indicated specific gravity of the geonet was greater than the specific gravity of the geomembrane. TENAX wrote a letter which clarified their position that interlaboratory precision and the accuracy of the standard test method were the most probable causes for the discrepancies. TENAX also indicated that valid comparisons of the specific gravities of the geonet and geomembrane can only be made if both materials are tested by the same testing laboratory. GCS personnel and GAI design personnel reviewed the data and the letter from TENAX, and determined that, based on the data from a common laboratory, the geonet's specific gravity met the requirements of the specifications. The manufacturer's quality control documents and the letter regarding the geonets' specific gravity are included in Appendix F-2.

2.6 GEOTEXTILE

The geotextile materials delivered to the site were Nicolon S700 (seven-oz/yd² fabric) and Nicolon S1600 (16-oz/yd² fabric) manufactured by Nicolon Corporation, of Norcross, Georgia. The geotextiles are non-woven, needle-punched, polypropylene. Approximately 72,000 square feet of S700 geotextile were delivered to the site on October 4, 1993, and on January 12, 1994, and 112,500 square feet of S1600 geotextile were delivered to the site on October 4, 1993. Two rolls of S700 fabric, and three rolls of the S1600 fabric were sampled and tested for conformance with the project specifications, resulting in approximate frequencies of one conformance test for every 36,000 square feet of seven-ounce material, and one conformance test for every 37,500 square feet of the 16-ounce material. These conformance testing frequencies exceed the specified minimum frequency of one conformance test for every 50,000 square feet of material. The geotextile conformance testing frequencies are summarized in Table 10.

Table 10. Geotextile Conformance Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Seven-oz/yd²</u> <u>Fabric</u> One Test per 50,000 ft ²	Mass per Unit Area (ASTM D3776) Grab Strength (ASTM D4632) Tear Strength (ASTM D4533) Burst Strength (ASTM D3786) Puncture Strength (ASTM D4833) Thickness (ASTM D1777) Permittivity (ASTM D4491) AOS (ASTM D4751)	2	2

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>16-oz/yd² Fabric</u> One Test per 50,000 ft ²	Mass per Unit Area (ASTM D3776) Grab Strength (ASTM D4632) Tear Strength (ASTM D4533) Burst Strength (ASTM D3786) Puncture Strength (ASTM D4833) Thickness (ASTM D1777) Permittivity (ASTM D4491) AOS (ASTM D4751)	3	3

The conformance samples were tested by GCS's geosynthetics laboratory in Duluth, Georgia. GCS reviewed the conformance test results for compliance with the specifications. The conformance test results indicated that the tested samples of the materials delivered to the site on October 4, 1993, including 48,000 square feet of S700 fabric and 112,500 square feet of S1600 fabric, met the requirements of the specifications. These materials were designated for use inside the landfill.

A conformance test result for a sample of the 24,000 square feet of S700 fabric delivered to the site on January 12, 1994, indicated that the sample did not meet the specification's minimum requirement for thickness. This material was rejected for use in Project W-025 where seven-oz/yd² geotextile was specified. Due to a shortage of S1600 fabric, which was specified for use as a cushion layer on the geomembrane liner in the truck unloading area, three layers of the deficient S700 fabric were designated for use as replacement material for the S1600 fabric in the truck unloading area by the Design Engineer (Appendix C-3). The use of S700 fabric was allowed in the truck unloading area because three layers of the deficient S700 fabric would provide a thicker cushion on the geomembrane than would a single layer of the S1600 fabric.

The conformance test results for the geotextiles are presented in Appendix G-1. An inventory of the rolls of geotextile delivered to the site is also included in Appendix G-1. In addition to reviewing conformance test results, GCS personnel reviewed manufacturer's certifications and QC data for compliance with the specifications for the geotextiles. The manufacturer's certification and quality control documents for the delivered materials are included in Appendix G-2. Additionally, GCS reviewed the manufacturer's certification of the thread used for sewing the geotextiles. This document is also included in Appendix G-2.

2.7 GEOCOMPOSITE

The geocomposite delivered to the site was SLT's GS-228. The geocomposite consisted of Nicolon S700 geotextile thermally bonded to the top and bottom of TENAX CE-2 geonet. Approximately 355,700 square feet of GS-228 geocomposite were delivered to the site between November 8, 1993 and January 12, 1994. Eight rolls of GS-228 were sampled, and the geotextile component was tested for Apparent Opening Size (AOS) to determine conformance with the project specifications. The resulting testing frequency was approximately one conformance test for every 44,500 square feet of geocomposite delivered to the site, exceeding the specification's requirement of one conformance test for every 50,000 square feet of geocomposite.

In addition to the above conformance testing of the geocomposite, two friction angle tests, using the direct shear method, were performed on the interface between the geocomposite material and the textured HDPE liner. Two friction angle tests were also performed on the interface between the geocomposite and the operations layer soil. The geocomposite conformance testing frequencies are summarized in Table 11.

Table 11. Geocomposite Conformance Test Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test per 50,000 ft ²	AOS (ASTM D4751)	8	8
Two Tests Total	Friction Angle of Interface with Textured HDPE (Direct Shear Method)	2	2
Two Tests Total	Friction Angle of Interface with Operations Layer (Direct Shear Method)	2	2

The AOS conformance tests were performed by GCS's geosynthetics laboratory, located in Duluth, Georgia. The direct shear tests were performed by Golder Associates Ltd. soils laboratory, located in Calgary, Alberta. The test results were reviewed for conformance to the specifications by GCS personnel and the GAI Design Engineer, and are presented in Appendix-H-1. The tested samples met the project specifications. An inventory of the rolls of geocomposite delivered to the site is included in Appendix H-1.

In addition to reviewing conformance test results, GCS reviewed manufacturer's certification and QC test results for the geocomposite. The manufacturer's information indicated that the first 50 delivered rolls of geocomposite were manufactured using a geotextile that did not meet the requirements of the project specifications. These 50 rolls of geocomposite were rejected. The manufacturer then produced geocomposite composed of the specified materials, and shipped the new geocomposite to the jobsite. The manufacturer's QC test data for the new material indicated that several rolls failed the manufacturer's QC tests. Assuming that the manufacturer tested samples from the trailing edge of each roll of material, and that the trailing edge of one roll is the same as the leading edge of the next consecutively produced roll of material, deficient material on the trailing edge (outside) of a roll of material would also indicate deficient material on the leading edge (inside) of the next consecutively produced roll. Therefore, GCS determined that the failing tests affected a total of eight rolls of the new material. All eight of these rolls of geocomposite were also rejected by GCS for use in Project W-025, and the contractor removed all of the rejected rolls from the jobsite. The manufacturer's QC test data and certification of the geocomposite are included in Appendix H-2.

Delhur arranged for the performance of two friction angle tests each for the interface between the geocomposite and the textured HDPE liner, and for the interface between the geocomposite and the operations layer material. GCS CQA personnel and GAI Design personnel reviewed the contractor's test results for conformance to the requirements of the specifications. The results of the contractor's friction angle tests for the geocomposite/textured geomembrane and

interfaces are included in Appendix E-3 with the friction angle data for the tests performed on the soil liner/textured geomembrane interface.

2.8 HDPE PIPE AND STAINLESS STEEL PIPE

The HDPE pipe delivered to the site was produced by Polaris Pipe Co., of Van Nuys, California, and was supplied by Industrial Plastics, Inc., of Washougal, Washington. The specifications required no QA conformance tests for these materials. However, the contractor was required to submit quality control certificates for the pipe, and qualifications of the pipe joining personnel. GCS reviewed these documents. The documents indicated that the pipe conforms to ASTM D1248, Type III, Class C, Category 5, Grade 34; cell classification 345434C per ASTM D3350; and that the proposed joining personnel's qualifications met the requirements of the specifications. All onsite joining of the HDPE pipe was performed by certified personnel. Copies of the manufacturer's certificates and the qualifications of the pipe joining personnel are included in Appendix I-1.

The stainless steel pipe delivered to the site was Schedule 40 Type 316, as required by the specifications. No QA conformance tests were required for the stainless steel pipe. However, manufacturers' certifications for the pipe are included in Appendix I-2.

2.9 TOP COURSE

Top course material for Project W-025 was supplied by ACME Materials and Construction Co., of Richland, Washington. The top course was used as a road-base material on the access ramp, the perimeter road, the truck staging area, the truck unloading area, and the site entrance. Prior to construction, GCS personnel obtained samples of the top course material from the supplier, and performed the required preconstruction tests. The top course preconstruction tests are summarized in Table 12.

Table 12. Top Course Preconstruction Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Prior to Construction	Particle Size (WSDOT 1991 Sec. 9-03.9.3) Mod. Proctor (ASTM D1557)	1	1

The results of the preconstruction tests on the top course material indicated that the tested sample met the requirements of the specifications. The test results are presented in Appendix D-6.

2.10 OPERATIONS LAYER

The operations layer materials for Project W-025 were segregated and stockpiled as excavation of the facility progressed. Eolian sand was stockpiled, and designated for use as operations layer material on the slopes of the facility, for use in the admix, and for use as general fill material. Sandy gravel to gravelly sand was stockpiled, and designated for use as operations layer material on the floor

of the facility, and for use as general fill material. GCS personnel performed 21 preconstruction sieve analyses and hydrometer tests on the eolian sand, and two preconstruction sieve analyses and hydrometer tests on the gravelly materials as they were stockpiled. Based on the Design Engineer's estimate of 15,690 cubic yards of soil required for use as operations layer material, the 23 preconstruction tests resulted in a frequency of one preconstruction test for every 682 cubic yards of operations layer material. This testing frequency exceeded the specification's requirement of one preconstruction test for every 2,000 cubic yards of operations layer material. The preconstruction tests are summarized Table 13.

Table 13. Operations Layer Preconstruction Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test per 2,000 yd ³	Hydrometer and Sieve (ASTM D422)	8	23

The specifications required that the operations layer material meet the specification's requirements for backfill material, previously discussed in Section 2.1 of this report. The results of the preconstruction tests indicated that the tested samples met these requirements. The preconstruction test results for the operations layer material are presented in Appendix D-7.

3.0 EXCAVATION/SUBGRADE PREPARATION

Project W-025 was excavated by Delhur Industries, Inc., of Port Angeles, Washington, in loose to compact eolian sand, and dense to very dense sand and gravel deposits. Delhur began the excavation on September 13, 1993, and completed the excavation on September 25, 1993. The following equipment was used during the excavation and subgrade preparation phases of construction:

- Hitachi EX 1000 Excavator
- 3 International, 50-ton, Payhauler, End-Dump Trucks
- Caterpillar D-9 Bulldozer
- Caterpillar D-5 Bulldozer
- John Deere (JD) 772A Grader
- 3500-Gallon Water Truck
- Ray Go Rascal 410A, Smooth-Drum, Vibratory Compactor
- Caterpillar 988B Loader

3.1 GEOLOGIC SITE CONDITIONS

The excavation of the Project W-025 Landfill was monitored to confirm the geological/geotechnical conditions described in the design report and to confirm that the excavated materials were placed in the proper stockpiles. Upon completion of the excavation, the landfill subgrade was geologically mapped. The results of the geological mapping are described below.

3.1.1 General

The Project W-025 Landfill is located within the 200 West area of the Hanford Nuclear Reservation. The Hanford Nuclear Reservation lies within the Columbia Plateau geological province. The Columbia Plateau province is defined by the lateral extent of the Columbia River Basalt Group, a sequence of Miocene basaltic lava flows that cover an estimated 63,000 square miles of the states of Washington, Oregon, and Idaho. Large-scale tectonic deformation in the plateau has resulted in the formation of several broad structural and topographic basins. The Hanford Reservation lies within the Pasco Basin.

The Pasco Basin represents a topographic low within the Columbia Plateau. The confluence of the Columbia, Snake, Yakima, and Walla Walla Rivers occurs in the Pasco Basin. Late Pleistocene catastrophic flooding and Holocene eolian processes have created an extensive system of channel bar deposits, flood plains, sand dunes, and loess deposits within the central portion of the basin. Significant geomorphic features within the central part of the basin include the Cold Creek Bar on which the 200 West area is located, the Central Hanford Sand Plain, and the Cold Creek-Dry Creek Alluvial Plain.

The geology of the Pasco Basin is dominated by a thick sequence of tholeiitic basalt flows collectively known as the Columbia River Basalt Group. These flows erupted during the Miocene Epoch, between 6 to 17 million years before the present. Interbedded with the basalt flows are a series of epiclastic and volcanoclastic sediments generally referred to as the Ellensburg Formation. Overlying the Columbia River Basalt Group within the Pasco Basin are Miocene to Holocene fluvial, glaciofluvial, and eolian sediments. These sediments make up the Miocene-Pliocene Ringold

Formation and the informally named Pleistocene Hanford formation. Unconsolidated, Holocene fluvial sediments, sand dune, and loess are the predominant surficial deposits.

3.1.2 Geologic Mapping

The geologic mapping of the Project W-025 excavation was performed by an engineering geologist with GCS who was familiar with the geology of the Hanford region. The field geologic mapping was performed between October 15 and October 28, 1993. The base map for the geologic mapping was Drawing No. H-2-131589, revision 2, "Subgrade Grid Points, RMW Land Disposal Facility, Non-Drag-Off", prepared by Golder Associates Inc., dated May 21, 1993. Stratigraphic contacts were located in the field by measuring directly from marked survey grid points in the Project W-025 excavation. The survey grid points were spaced every 25 feet and allowed for relatively accurate location of stratigraphic contacts in the excavation.

In general, the geologic units were well exposed in the excavation side walls and floor. Minor cleaning of the exposure using a shovel was required in several instances to accurately locate the stratigraphic contacts or to collect representative samples of the geologic units for description.

The geologic map for the Project W-025 excavation is shown in Figure 3 and the cross-sections for the cell are shown on Figure 4.

3.1.3 Geologic Units Encountered

The geologic units exposed in the Project W-025 excavation, from youngest to oldest, are as follows:

- Recent Eolian Sand: Quaternary, wind deposited, loose to compact, olive gray, silty, fine sand was encountered in the upper portion of the excavation. The unit had a basal elevation ranging from approximately 691 on the west end to 683 on the east end. A six-inch thick volcanic ash layer was observed interbedded with the eolian sand in the northeast corner of the excavation. The volcanic ash layer ranged in elevation from approximately 691 to 693.
- Glaciofluvial Flood Deposit: Underlying the Recent Eolian Sand was dense to very dense, olive black, gravelly, fine to coarse sand. This, in turn was underlain by dense, moderate olive brown, fine sandy silt, which was underlain by dense to very dense, fine to coarse sand in which the Project W-025 excavation was terminated. The base of the gravelly sand unit ranged from approximately 677 on the west to 672 on the east. The base of the sandy silt unit ranged from approximately 675 on the west to 670 on the east.

3.2 SUBGRADE PREPARATION AND BACKFILL PLACEMENT

The subgrade of the Project W-025 excavation was prepared for installing the secondary lining system by grading and recompacting the excavation surfaces. Delhur used Caterpillar D-9 and D-5 bulldozers, and a JD 272A grader to scarify the subgrade to a depth of approximately eight inches. A water truck was used to moisture condition the scarified soils. The subgrade soils were then

compacted to at least 90 percent of their Modified Proctor maximum dry density (ASTM D1557) using a Ray Go Rascal 410A, smooth-drum, vibratory roller. In a few areas on the lower sideslopes of the excavation, the contractor experienced difficulty achieving the required compaction of clean, sandy gravels. In these areas, Delhur used relatively fine-grained soils as fill material to provide a firm surface upon which the secondary lining system could be installed. The fill materials were moisture conditioned and compacted in the same manner as the subgrade soils.

Field moisture-density tests were performed by GCS personnel on the compacted subgrade using a Troxler Model 3440 Nuclear moisture-density gauge (ASTM D2922 and ASTM D3017). At least one side-by-side rubber-balloon test (ASTM D2167) was performed each day, or once for every 20 Troxler tests per day, to verify the accuracy of the nuclear densometer tests. At the completion of each nuclear moisture-density test, a sample of the soil at the test location was obtained and sealed in a plastic bag for laboratory water content determination using the oven-dried method (ASTM D2216). In areas where the test results indicated that the compaction did not meet the requirements of the specifications, the contractor was required to rework and recompact the soil until passing test results were achieved. The specifications required moisture-density tests on the subgrade at a minimum frequency of one test per 10,000 square feet of surface area. The surface area of the excavation was approximately 160,000 square feet, and 32 moisture-density tests (excluding retests) were performed on the subgrade soils, resulting in an approximate frequency of one moisture-density test for every 5,000 square feet of subgrade surface area. A summary of the test results is included in Appendix J.

An as-built survey of the excavation was performed by Permit Surveying, Inc. A CQA survey was performed by Rogers Surveying, Inc. to verify Permit's survey. GCS reviewed data from both surveys, and concluded that the CQA survey data reasonably verified Permit's data. Permit's survey indicated that all surveyed grid points were within the tolerances required by the project plans and specifications. Rogers' CQA survey data are included in Appendix T-1. Permit's Record Drawing, Subgrade As-Built, Sheet 1 of 6, is included in Volume 2 of this report.

On the periphery of the excavation, subgrade preparation was required in the footprint of the perimeter road, the truck unloading area, the truck staging area, and the site entrance road. Delhur used similar equipment and methods to compact these subgrade areas to at least 90 percent of the soil's Modified Proctor maximum dry density (ASTM D1557). The peripheral area of the excavation was approximately 80,000 square feet in size, and GCS personnel performed 14 moisture-density tests. The resulting approximate frequency of one moisture-density test for every 5,714 square feet of peripheral subgrade area exceeded the specification's requirement of one test for every 10,000 square feet of subgrade area. A summary of these test results is included in Appendix J.

The placement and compaction of approximately 4,500 cubic yards of backfill were required to establish the design grade of the site entrance, the truck staging and unloading areas, and segments of the perimeter road. Backfill material was hauled by an International, 50-ton, Payhauler, end-dump truck, or by a Caterpillar 988B front-end loader. The material was spread in maximum loose-lift thicknesses of eight inches by a JD 272A grader. The backfill was moisture conditioned using a 3,500-gallon water truck, and then compacted to 90 percent of the material's Modified Proctor maximum dry density (ASTM D1557) by a Ray Go Rascal 410A smooth-drum, vibratory roller.

Field moisture-density tests were performed on each lift of backfill material. A total of 58 moisture-density tests were performed, resulting in a frequency of one test for every 78 yards of backfill, exceeding the specifications' requirement of one moisture-density test for every 500 cubic yards of backfill placed. A summary of the backfill moisture-density test results is included in

Appendix J. The locations of the field moisture-density tests for the subgrade, general fill, and top course materials are shown on Figure 5.

4.0 SECONDARY LINER SYSTEM

The secondary liner system for the Project W-025 landfill consisted of a soil liner, geomembrane liner, and leachate collection and removal system (LCRS).

4.1 SOIL LINER

4.1.1 Construction

The soil liner admix was prepared using onsite eolian sand and imported bentonite. The sand for the soil liner was obtained from the eolian sand stockpile located on the west side of the site. The eolian sand had been stockpiled during the excavation of the landfill. Preconstruction testing indicated that the eolian sand and the bentonite met the requirements of the specifications for use as soil liner constituents (See Sec. 2.1). The eolian sand, bentonite, and water were mixed in a pug mill to produce an admixture which contained approximately 11 percent to 14 percent by dry-weight bentonite, and a moisture content of 1 percent to 5 percent above the admixture's optimum moisture content, as determined by ASTM D698. After the soil liner was mixed in the pug mill, the placement of the soil liner was generally completed in the following stages:

- The soil liner was stockpiled around the edge of the excavation and allowed to moisture cure for approximately 24 hours.
- Water was applied to the subgrade just prior to the placement of the soil liner.
- The first lift of soil liner was spread in a loose-lift thickness of approximately 12 inches, using a Caterpillar D-6 dozer and a JD 450 dozer.
- The soil liner was compacted to at least 90 percent of the material's Standard Proctor maximum dry density (ASTM D698), using four, one-way passes of a Caterpillar 825C self-propelled wedgefoot compactor.
- Five additional lifts of soil liner were placed and spread in maximum loose-lift thicknesses of approximately 10 inches. Compaction of each lift was achieved using four passes of the Cat 825C compactor.
- The top lift of the soil liner was trimmed using a D-6 dozer equipped with low ground pressure (LGP) tracks.
- The surface of the soil liner was prepared for geomembrane deployment by rolling with a Ray Go Rascal smooth-drum vibratory roller.
- The soil liner was watered as necessary during dry weather to prevent excessive drying.

The placement and compaction of the first lift of soil liner commenced in the northwest corner of the landfill, and generally proceeded in a clockwise direction. Delhur completed this circular cycle six times during the placement and compaction of the six lifts of soil liner. To enable large trucks to

haul admix to the floor of the facility, the access ramp was not covered with soil liner material until just prior to the completion of the soil liner in the rest of the landfill.

A total of approximately 20,000 cubic yards of admix material was produced by the pug mill. Approximately 15,150 cubic yards of this material were placed and compacted on the floor and slopes of the Project W-025 Landfill during the construction of the secondary soil liner.

Following the completion of the placement, compaction, and trimming of the secondary soil liner, an as-built survey of the soil liner surface was performed by Permit Surveying, Inc., and a CQA survey was performed by Rogers Surveying, Inc. GCS reviewed the data from both surveys, and determined that Rogers' survey data reasonably verified Permit's survey data. The specifications required a minimum secondary soil liner thickness of 3.1 feet, measured perpendicular to the subgrade surface. Permit's survey data indicated that three of the surveyed grid points did not meet the tolerance requirements of the specifications, and that four grid points had not been surveyed. Delhur was required to rework the three areas which were initially out of tolerance. Permit then surveyed the four grid points which were missed during the first survey, and resurveyed the three areas which had been reworked. A review of the new survey data indicated that a minimum of 3.1 feet of soil liner had been installed at each of the surveyed grid points. Permit's Record Drawing, Top of Secondary Admix As-Built, Sheet 2 of 6, is included in Volume 2 of this report. Roger's CQA survey data for the secondary soil liner are included in Appendix T-2.

The trench for the secondary slope riser pipe was excavated using a Case 580 backhoe. The trench was trimmed using hand tools. The anchor trench in the access ramp and the anchor trench around the perimeter of the landfill were excavated using the Hitachi EX1000 excavator. The anchor trench in the access ramp was prepared for geomembrane deployment by rolling with a Ray Go Rascal 410A smooth-drum vibratory roller and a Bomag hand operated smooth-drum vibratory roller. GCS observed the excavation of the anchor trenches, and confirmed that the trenches had been constructed per the project plans.

After the surface of the secondary soil liner had been prepared for geomembrane deployment by rolling with a smooth-drum vibratory roller, cold weather caused the top lift of soil liner to freeze. When the soil liner thawed, a sheen of mud remained on the surface. Due to concerns regarding the friction angle of the interface between the geomembrane and the muddy surface of the soil liner, the contractor was required to dry the muddy surface before deployment of the geomembrane liner was allowed to begin. Delhur used propane fueled weed-burners, mounted on a D-6 dozer, to dry the surface of the soil liner.

4.1.2 Testing

A total of 162 field moisture-density tests were performed at a frequency of at least one test per 250 cubic yards of soil liner placed. All field moisture-density tests were conducted using a Troxler Model 3440 Nuclear density gauge (ASTM D2922 and D3017). At least one side-by-side rubber balloon test (ASTM D2167) was conducted each day, or once for every 20 nuclear density tests per day, to verify the accuracy of the nuclear densometer tests.

After completion of the nuclear moisture-density test, a sample of the soil from the density test location was obtained and sealed in a plastic bag for laboratory water content determination using the oven-dried method (ASTM D2216) or the microwave oven method (ASTM D4643). Upon completion of the test, the hole was backfilled with soil liner material and compacted by hand. Using

moisture content data obtained during construction of the test fill and during the admix preparation, a statistical analysis (regression method) was performed to determine the correction factor for correcting the microwave oven moisture content to the equivalent of the conventional oven moisture content. The microwave oven moisture method was used to allow quick determinations as to whether compaction tests were passing or failing. Conventional oven moisture determinations require approximately 24 hours for a result. Microwave oven moisture determinations require only approximately five minutes for a result. For this reason, the correlation was established. At least one side-by-side microwave moisture and conventional oven moisture test were performed each day to continually update the regression analysis.

Four of the 162 moisture-density tests indicated that the moisture content of the soil liner was too dry. Delhur reworked the affected areas of the soil liner, and retests indicated acceptable moisture-density test results. The results of field moisture-density tests are summarized in Appendix K-1. Test locations are shown in Figure 6.

In addition to the field tests, Shelby tubes were used to obtain relatively undisturbed samples of the compacted soil liner. Laboratory tests were performed on the Shelby tube samples. The ends of the Shelby tubes were sealed in the field with plastic caps and were later sealed in the on-site laboratory with wax. The samples were shipped to the GAI soils laboratory located in Redmond, Washington, for permeability testing. Hydraulic conductivity tests (ASTM D5084) were performed at a frequency of at least one test for every 5,000 cubic yards of soil liner placed. Hydrometer and sieve tests (ASTM D422) and Atterberg Limits tests (ASTM D4318), were performed on samples of the soil taken immediately adjacent to the location of the Shelby tube samples. These index tests were performed at GCS's onsite soils laboratory.

The specifications required a hydraulic conductivity less than or equal to 1×10^{-7} cm/s. The hydraulic conductivity test results indicated that the permeabilities of the Shelby tube samples ranged 5×10^{-8} cm/s to 5×10^{-9} cm/s, with the exception of one Shelby tube sample taken in the southwest corner of the landfill that had a hydraulic conductivity of 1×10^{-6} cm/s. To determine the reason for the higher permeability of this sample, a test pit was excavated at the location at which the sample was obtained. The admix in the test pit contained lenses of sandy soil which likely caused the poor permeability test result. To determine the extent of the contaminated admix, four additional test pits were excavated in the soil liner approximately 15 ft to the north, south, east, and west of the original test pit. No sandy lenses were observed in the additional test pits. Having bracketed the extent of the contaminated soil liner, all of the soil liner between the four additional test pits was removed and replaced with new admix material. Shelby tube samples were then taken in the replacement soil liner area, adjacent to the replacement area, and in the northwest corner of the landfill. The results of hydraulic conductivity tests on the three new Shelby tube samples indicated permeabilities that met the requirements of the specifications.

The most likely reason for the contamination of the admix in the southwest corner of the landfill involved trucks hauling soil liner material to the floor of the landfill. At the time of the contamination, approximately three lifts of soil liner had been installed on the slopes and floor of the facility, but the access ramp had not been covered with soil liner. The ramp was left bare to enable easy access to the floor of the facility. Trucks hauling admix to the floor would travel down the bare access ramp and turn sharply into the southwest corner of the landfill. The trucks turned into the corner to enable them to back onto the floor of the facility to dump their loads of admix. The trucks likely tracked sand from the bare access ramp onto the admix in the southwest corner of the landfill.

Following the completion of the installation of the secondary soil liner, cold weather caused the top lift of the soil liner to freeze. Due to concerns that freezing and thawing could adversely affect the permeability of the soil liner, three Shelby tube samples were taken while the soil was frozen. Hydraulic conductivity tests were performed on the Shelby tube samples. The results of the tests indicated that the permeability of each sample met the requirements of the specifications. The locations of all Shelby tube samples taken in the secondary and primary soil liners are shown on Figure 7. After the soil liner thawed, and the muddy sheen on the surface of the soil liner was mechanically dried by the contractor, the installation of the secondary geomembrane liner was allowed to begin.

With the exceptions noted above, all field and laboratory tests met the requirements of the specifications. Corrective measures were taken to rectify the noncompliances indicated by the failing tests. A summary of the field tests and laboratory tests performed on the secondary soil liner is presented in Table 14. The results of the laboratory tests are presented in Appendix D-4, and the results of the field moisture-density tests are presented in Appendix K-1.

Table 14. Secondary Soil Liner Field and Laboratory Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Per 250 yd ³	Moisture-Density (ASTM D2922, D3017, D2216, & D4643)	61	162
One Test Per 5,000 yd ³	Hydraulic Conductivity (ASTM D5084)	4	11
None required	Sieve and Hydrometer (ASTM D422)	0	12
	Atterberg Limits (ASTM D4318)	0	11

4.2 HDPE GEOMEMBRANE LINER INSTALLATION

Material used in the construction of the Project W-025 Landfill secondary geomembrane liner consisted of 60-mil thick, smooth, HDPE geomembrane, and 60-mil thick, textured, HDPE geomembrane. The smooth geomembrane was used on the floor of the facility, and the textured geomembrane was used on the sideslopes and in the sump area of the facility. The HDPE liner material was manufactured by SLT North America, of Conroe, Texas.

The geomembrane liner installer for this project was GeoPacific Lining Co. (GeoPacific) of Seattle, Washington. Installation of the secondary geosynthetic liner commenced on November 19, 1993, and was completed on January 20, 1994. The installation of the geomembrane started in the northeast corner of the landfill, and generally proceeded around the landfill in a counterclockwise direction.

4.2.1 HDPE Geomembrane Liner Deployment

Prior to deployment of the geomembrane liner, a panel layout drawing was submitted by GeoPacific showing the number and orientation of the various panels comprising the Project W-025 Landfill geosynthetic liner. The HDPE liner was generally installed per the panel layout drawing with slight deviations to allow for correct joining of panels in the field. During deployment, GCS documented the as-built locations of the actual panels deployed. The approximate as-built geomembrane liner panel layouts are shown on Sheet S-1.

Prior to deployment of the geomembrane liner, GCS and the installer observed the subgrade for conformance with the project specifications. A subgrade acceptance certificate was issued and signed by the installer for each area where geomembrane was to be deployed. Copies of these subgrade acceptance certificates are presented in Appendix L.

The rolls of geomembrane material were mounted on a spreader bar and deployed from the crests of the landfill's sideslopes. The geomembrane liner panels were deployed using either hand labor or a 4-wheel, all terrain vehicle (ATV). Both deployment methods minimized subgrade disturbance. During deployment of the geomembrane liner panels, the following services were provided by GCS personnel:

- Measurement of the panel thickness;
- Confirmation of panel overlap;
- Visual observation of overall sheet quality; and
- Assignment of a unique identification number to each panel deployed.

A nominal overlap of five inches was maintained between adjoining panels. The average panel thickness was determined by averaging five measurements made along each of the leading edge, trailing edge, and one side of the panel. Approximately 187,700 square feet of secondary geomembrane liner were deployed. A summary of GCS' deployment observations is presented in Appendix M-1.

4.2.2 HDPE Geomembrane Liner Seaming

Trial seams were made by each welding apparatus to be used and by each welding technician who was going to operate a welding apparatus (welder), at the start of each seaming period and at least once every four hours while seaming was being performed. Sample coupons were cut from each end of each trial seam and tested in the peel and shear test modes using a calibrated tensiometer supplied by GeoPacific. If a trial seam failed the field testing, the welder and welding apparatus associated with the failing trial seam were not allowed to weld on the geomembrane liner until a passing trial seam had been made in accordance with the specifications. A summary of the trial seam results is presented in Appendix M-2.

The geomembrane liner panel seaming process proceeded concurrently with the panel deployment. The majority of the seams were made using a double hot-wedge fusion welding apparatus. Repairs, corner seams, and some of the butt-seams between panels were made using an extrusion welding apparatus. The seaming operations were observed and documented by GCS personnel. The entire length of all seams, patches, or other repairs were observed and documented by GCS. A portion of the seaming was completed when the ambient temperature was less than 40° Fahrenheit. The specifications required the installer to certify the quality of seams welded in ambient

temperatures less than 40° Fahrenheit. GeoPacific certified that such seams were equivalent to seams welded in temperatures ranging from 40° Fahrenheit to 104° Fahrenheit. A copy of this certification is included in Appendix E-3. GCS also increased the frequency of destructive testing of seams welded at temperatures below 40° Fahrenheit.

Approximately 10,103 feet of seams were welded on the secondary geomembrane liner, including 9,366 feet of fusion welded seams and 737 feet of extrusion welded seams. A summary of seaming operations is presented in Appendix M-3. The locations of the secondary geomembrane liner seams are shown on Sheet S-1.

4.2.3 Destructive Testing

A total of 35 destructive test samples, excluding retests, were obtained from seams on the secondary HDPE liner, resulting in an average frequency of one destructive test sample for each 289 feet of welded seam. This frequency exceeded the project specification's requirement of at least one sample per every 500 feet of seam welded. Of the 35 destructive test samples, 31 were obtained from fusion welded seams, and 4 were obtained from extrusion welded seams and caps. The test locations were selected by GCS personnel based on the completion of approximately 500 feet of welding, on observations of the welded seams, or on the general performance of the seaming crew. Destructive samples were tested onsite by GCS personnel using GCS's calibrated tensiometer.

The destructive testing consisted of cutting ten test coupons from each destructive test sample. Five coupons were tested for adhesion (peel test mode) and five coupons were tested for bonded seam strength (shear test mode). The specified acceptance criteria for destructive tests are summarized in Table 15. Destructive test codes are shown in Figures 8 and 9.

Table 15. Destructive Test Criteria.

Seam Type	Peel Test Mode	Shear Test Mode
Fusion Weld	1. Each of the five test coupons must not fail in the weld on either the inside or outside track of the weld. (FTB)*	1. Each of the five test coupons per track have a minimum yield strength of 135 pounds per inch width. 2. Each of the five test coupons per track must not fail in the weld. (FTB)*
Extrusion Weld	1. Each of the five test coupons must not fail in the weld. (FTB)*	1. Each of the five test coupons have a minimum yield strength of 135 pounds per inch width. 2. Each of the five test coupons must not fail in the weld. (FTB)*
* FTB = Film Tear Bond		

In the event a destructive test sample failed, the path of the welder was traced in both directions from the location of the failed test sample and the seam was resampled and retested at intervals that generally ranged from 10 to 50 feet until the deficient portion of the seam was bounded in both directions by passing test samples. A total of 19 additional destructive test samples were obtained to bracket deficient portions of seams. The section of seam between the passing test samples was then either reconstructed or capped. The destructive test locations are shown on Sheet S-1. A summary of the destructive test results is presented in Appendix M-4.

4.2.4 Nondestructive Seam Continuity Testing

All nondestructive seam continuity testing was performed by GeoPacific personnel and observed and documented by GCS personnel. Two types of nondestructive testing were used for this project:

- Vacuum box testing on extrusion welds and some short double hot-wedge fusion welds; and
- Air pressure testing on double hot-wedge fusion welds.

A vacuum box is a rigid-wall box with a clear plexiglass top and a neoprene gasket around the bottom of the box that forms a seal between the box and the HDPE geomembrane. Vacuum box testing consisted of:

- Applying a soapy water solution to the seam;
- Placing the vacuum box over the seam;
- Applying a vacuum of at least five-inches of mercury to the inside of the box for at least 10 seconds;
- Observing the seam for bubbles, which would indicate a discontinuity in the seam.

Air pressure testing consisted of:

- Sealing off of the air channel between the inside and outside tracks of the fusion weld;
- Inserting a needle with a pressure gauge attached into the air channel;
- Using an air pump, inflating the air channel to 25 to 30 psi; and
- Observing the pressure gauge over a five minute period. A pressure drop of greater than two psi during this period indicated a possible discontinuity in the seam.

Any leaks or discontinuities detected in the seams were marked and subsequently repaired in accordance with the project specifications. Documentation summarizing the nondestructive testing of the seams and repairs is presented in Appendix M-3 and Appendix M-5, respectively.

4.2.5 HDPE Geomembrane Liner Repairs

In accordance with the specifications, defects in the geomembrane liner were assigned a unique identification number by GCS. These defects were located and marked in the field by GCS personnel for repair. The defects were repaired and nondestructively tested by GeoPacific in accordance with the project specifications. A summary of the defects and repairs is presented in Appendix M-5. Defect repair locations are shown on Sheet S-1.

4.3 LEACHATE COLLECTION AND REMOVAL SYSTEM

The secondary leachate collection and removal system (LCRS) system consisted of geosynthetic transmission media and granular drainage material to collect leachate, and a submersible pump and HDPE piping to remove leachate.

On the floor of the Non-Drag-Off Landfill, geonet was installed directly on top of the secondary geomembrane liner. The geonet was overlain by 16-oz/yd² geotextile. The geotextile was overlain by a 1.0 foot thick layer of drainage gravel, and the gravel was covered by a layer of 16-oz/yd² geotextile.

On the sideslopes and in the sump of the landfill, geocomposite material was installed directly on the surface of the secondary geomembrane liner. In the sump, the geocomposite was overlain by 16-oz/yd² geotextile, the sump was filled with sump gravel, and the sump gravel was covered with a layer of 16-oz/yd² geotextile, as shown in the project drawings.

4.3.1 Geonet Installation

The geonet panels were oriented similar to the geomembrane panels shown on Sheet S-1. All geonet was deployed manually by uncoiling rolls of the geonet which had been positioned on the floor of the landfill. Adjacent geonet panels were overlapped approximately four inches, and the panels were connected with plastic net ties along the length of each seam at the following intervals:

- Longitudinal seams (lengthwise) across the floor - a tie every five feet
- End-to-end seams (butt seams) - two rows of ties, the ties in each row spaced every six-inches, the rows spaced three-inches apart, and the ties staggered between the rows

Repairs to any damaged geonet were patched with geonet extending two feet beyond the edges of the hole or tear, orienting the ribs in the patch parallel to the ribs in the existing geonet, and tying every six inches. The installation and repair of the geonet was observed by GCS personnel.

4.3.2 Geotextile Installation

The geotextile installation was completed concurrently with the installation of the geonet, such that the geonet was covered the same day it was deployed. All the geotextile was deployed in an orientation similar to the geomembrane panels shown on Sheet S-1. The geotextile was deployed by manually uncoiling rolls of the material which had been positioned on the floor of the landfill. Adjacent geotextile panels were overlapped approximately three inches. All geotextile seams were

sewn with a locking-stitch sewing machine. To enable complete encapsulation of the gravel which was to be installed on top of the geotextile, the geotextile was extended up the sideslopes approximately six feet to eight feet. The installation of the geotextile was observed by GCS personnel. None of the geotextile was damaged, so no repairs were necessary. The installed geotextiles were exposed to sunlight for less than 15 days before being covered by the next consecutive layer of the LCRS.

4.3.3 Geocomposite Installation

Geocomposite was installed on the sideslopes of the landfill by manually deploying the material from a roll mounted on a spreader bar at the crest of the slope. The geocomposite panels were deployed in an orientation similar to the textured geomembrane liner panels. During deployment of the geocomposite, a temporary rub sheet was used between the geocomposite and the textured geomembrane liner to prevent damage to the geotextile component, and to prevent a reduction of the friction at the interface between the geocomposite and the geomembrane. Geocomposite panels were positioned such that the geonet component of adjacent panels overlapped approximately three to four inches. Along end-to-end seams and longitudinal seams, the geonet overlaps were secured by tying in accordance with the guidelines followed for geonet (See Section 4.3.2). In the anchor trenches, the geonet overlaps were secured with ties spaced six inches apart. The geotextile components of adjacent geocomposite panels were overlapped approximately eight inches, and the overlapping top layers of geotextile were carefully heat seamed.

The geocomposite was tied-in to the geonet and geotextile materials on the floor of the landfill. Tie-in seams were located at least three feet from the toe of the slope. The geonet materials were secured with ties in accordance with the guidelines indicated in Section 4.3.2 of this report. Geotextile materials were secured by continuously heat-bonding the bottom of the geotextile on the floor to the top of the geocomposite. The geocomposite was exposed to sunlight for a period of less than 15 days prior to being covered by the next consecutive layer of the lining system.

4.3.4 Granular Drainage Material

4.3.4.1 Installation. Two types of granular drainage material were installed in the secondary leachate collection system. Drainage gravel was installed on the floor of the landfill, and sump gravel was installed in the sump. Both materials were supplied by ACME Materials and Construction Co., of Richland, Washington.

Delhur used Payhauler end-dump trucks to haul the drainage gravel to the toe of the access ramp. The access ramp in the landfill had been completed prior to the installation of the granular drainage materials. The drainage gravel was spread toward the sump using a D-6 dozer equipped with LGP tracks. The dozer spread the gravel such that a three feet thick access pad was constructed from the toe of the access ramp to the secondary sump. A Caterpillar 988 loader was then used to transport sump gravel to the sump. A JD 450 dozer then spread the sump gravel in the sump. The D-6 dozer and the JD 450 dozer then spread the drainage gravel from the three feet thick access pad to the remainder of the floor, forming a one-foot thick lift of drainage gravel. Approximately 800 cubic yards of drainage gravel and 100 cubic yards of sump gravel were placed in the secondary leachate collection system.

The granular drainage materials were track-walked and trimmed using the D-6 and JD 450 dozers. Permit Surveying performed an as-built survey of the gravel surface, and Rogers Surveying performed a CQA survey of the gravel surface. GCS personnel reviewed the data from each of the surveys. Rogers' survey reasonably verified Permit's survey. Permit's survey data indicated that a minimum gravel thickness of 1.0 foot had been installed at each surveyed grid point. Roger's CQA survey data are included in Appendix T-3. Permit's Record Drawing, Top of Secondary Gravel As-Built, Sheet 3 of 6, is included in Volume 2 of this report.

Following the completion of the surveys, the secondary gravel surface was covered with 16-oz/yd² geotextile. The geotextile was installed and sewn as described in Section 4.3.2 of this report. To completely enshroud the gravel layer, the geotextile which was installed on top of the gravel was sewn, near the toe of each sideslope, to the geotextile which had been previously installed on the secondary geonet.

4.3.4.2 Testing. GCS personnel obtained samples of the granular drainage materials as the gravels were installed. Laboratory tests were performed on four samples of the drainage gravel, resulting in a frequency of one set of laboratory tests for every 200 cubic yards of secondary drainage gravel. One set of laboratory tests was performed on a sample of the sump gravel, resulting in a frequency of one set of laboratory tests for every 100 cubic yards of secondary sump gravel. These testing frequencies exceed the specified construction testing frequency of one set of laboratory tests for every 250 cubic yards of material placed. The laboratory tests completed during construction are summarized in Table 16.

Table 16. Secondary Granular Drainage Material Construction Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Drainage Gravel</u> One Test Per 250 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434)	4	4
<u>Sump Gravel</u> One Test Per 250 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434)	1	1

The permeability tests were performed by GAI's soils laboratory located in Redmond, Washington. The particle size analyses were performed in GCS's onsite soils laboratory. The results of these tests indicated that the tested samples met the requirements of the specifications. A summary of the test results is presented in Appendix D-5.

4.3.5 Leachate Removal System

The secondary leachate removal system consists of HDPE piping and a submersible pump. An eight inch diameter, HDPE slope riser pipe was installed horizontally on the floor of the secondary sump, and extends up the east sideslope of the landfill. Two 2-inch diameter, HDPE pipes were

installed adjacent to the eight inch diameter pipe in the sump and on the sideslope. HDPE geomembrane liner boots were installed around the HDPE pipes at the crest of east slope where the pipes penetrate the secondary HDPE liner. In the sump, the end of each of the three pipes is perforated. The eight inch diameter pipe houses a 1.5-horsepower submersible pump attached to a 1.5-inch diameter HDPE discharge pipe. The pump discharges through the 1.5-inch diameter pipe to the leachate temporary storage tank, located near the crest of the east sideslope. One of the two inch diameter pipes contains a transducer which monitors the water level in the secondary sump. The second two inch diameter pipe is a spare level sensor pipe. The system was designed such that the submersible pump will automatically begin pumping when the transducer indicates a leachate level 12 inches above the bottom of the secondary sump. The submersible pump will automatically shut-off when the leachate level is drawn-down to six inches above the bottom of the sump. This system was designed to maintain the leachate level (in the secondary sump) between six inches and 12 inches above the bottom of the secondary sump.

5.0 PRIMARY LINER SYSTEM

The primary liner system consisted of a soil liner on the floor of the landfill, geomembrane liner, and a leachate collection and removal system.

5.1 SOIL LINER

5.1.1 Construction

Construction of the primary soil liner was conducted in a manner similar to that used to install the secondary soil liner. However, the primary soil liner was only placed on the floor of the landfill, and in the anchor trench on the access ramp.

On the floor of the landfill, the minimum thickness of the primary soil liner was 1.5 feet. The first lift of soil liner material was placed in a loose-lift thickness of approximately 18 inches to 20 inches, resulting in a compacted lift thickness of approximately 14 inches to avoid damaging the underlying secondary geosynthetic liner system.

In the anchor trench on the access ramp, a 1.0-foot thick layer of compacted soil liner was installed on the secondary geosynthetic liner system, and a 1.0-foot thick layer of compacted soil liner was installed on the primary geosynthetic liner system. Both layers of soil liner were compacted by track walking with a D-6 dozer (equipped with LGP tracks) and by rolling with a smooth-drum roller. Figure 10 depicts the manner in which the lining system on the access ramp was tied-in to the lining system at the toe of the ramp.

Approximately 1,700 cubic yards of admix were placed in the primary soil liner. After compacting and trimming. The surface of the primary soil liner was surveyed by Permit Surveying. A CQA verification survey was performed by Rogers Surveying. Rogers' survey data reasonably verified Permit's survey data. However, Permit's data indicated that the primary soil liner thickness was out-of-tolerance at three survey grid points. Delhur was required to rework the soil liner in the affected areas, and Permit was required to resurvey the reworked areas. A review of the new survey data indicated that a minimum thickness of 1.5 feet of soil liner had been installed at each survey grid point. Permit's Record Drawing, Top of Primary Admix As-Built, Sheet 4 of 6, is included in Volume 2 of this report. Rogers' CQA survey data are included in Appendix T-4.

5.1.2 Testing

Testing of the primary soil liner was also conducted in a manner similar to the secondary soil liner. A total of 16 field moisture-density tests were conducted at a frequency of at least one test per 250 cubic yards of soil liner placed. The field moisture-density test locations are shown in Figure 11 and the test results are given in Appendix K-2.

In addition to the field tests, a laboratory permeability test was performed on a Shelby tube sample of the primary soil liner. The Shelby tube sample location is shown on Figure 7. The field and the laboratory tests performed on the primary soil liner are summarized in Table 17.

Table 17. Primary Soil Liner Field and Laboratory Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
One Test Per 250 yd ³	Moisture-Density (ASTM D2922, D3017, D2216, & D4643)	7	16
One Test Per 5,000 yd ³	Hydraulic Conductivity (ASTM D5084)	1	1

All test results met the project specifications. A summary of the laboratory test results is included in Appendix D-4.

5.2 HDPE GEOMEMBRANE LINER

The materials, methods, and equipment used to install the primary HDPE geomembrane liner were generally the same as those used to install the secondary HDPE geomembrane liner. GeoPacific began installing the primary HDPE liner on December 19, 1993, and completed the installation on January 27, 1994. GCS performed the same CQA services for the construction of the primary geomembrane liner system as on the secondary system.

Included in the primary geomembrane lining system is the 80-mil thick HDPE geomembrane liner installed in the truck unloading area. The 80-mil thick HDPE geomembrane liner was installed on a prepared subgrade consisting of eolian sand.

5.2.1 HDPE Geomembrane Liner Deployment

Deployment of the primary geomembrane in the landfill was completed in a manner similar that used during the installation of the secondary geomembrane liner. Deployment of the HDPE panels started on the south slope and proceeded clockwise around the landfill. Approximately 180,100 square feet of 60-mil thick, HDPE, geomembrane were deployed in the landfill's primary geosynthetic liner system.

Deployment of the 80-mil thick, smooth, HDPE, geomembrane liner in the truck unloading area was completed using similar equipment and methods as those used to install the secondary lining system. Approximately 11,900 square feet of 80-mil thick HDPE liner were deployed in the truck unloading area. The approximate as-built geomembrane liner panel layouts for the primary HDPE liner in the landfill and in the truck unloading area are shown on Sheet P-1. A summary of the deployment observations is presented in Appendix N-1.

5.2.2 HDPE Geomembrane Liner Seaming

Seaming of the primary geomembrane liner took place concurrently with deployment of the primary HDPE panels, and was performed in a manner similar to that used during the installation of

the secondary lining system. Trial seaming was performed as indicated in Section 4.2.2, and a summary of the trial seam results is presented in Appendix N-2.

Approximately 8,853 feet of seam were welded during the installation of the primary geomembrane liner in the landfill, including 8,790 feet of fusion welded seam, and 63 feet of extrusion welded seam. Approximately 494 feet of seam were welded during the installation of the primary geomembrane liner in the truck unloading area, including 446 feet of fusion welded seam, and 48 feet of extrusion welded seam. The 80-mil thick, smooth, HDPE geomembrane liner in the truck unloading area was tied-in to the 60-mil thick, textured, HDPE geomembrane liner in the southeast corner of the landfill, by seaming with an extrusion welder. A summary of the seaming records is presented in Appendix N-3. The locations of the primary geomembrane liner seams are shown on Sheet P-1.

5.2.3 Destructive Testing

Destructive testing of the primary HDPE geomembrane seams was performed in a manner similar to that used during the installation of the secondary system. A total of 24 destructive test samples, excluding retests, were initially obtained from seams on the primary HDPE geomembrane liner in the landfill. This resulted in an average frequency of one destructive test sample for each 369 feet of welded seam. This testing frequency exceeded the specification's requirement of one destructive test for every 500 feet of seam. Of the 24 destructive test samples, 19 were obtained from fusion welded seams, and five were obtained from extrusion welded seams and caps. In the event that a destructive test sample failed to meet the requirements of the specifications, additional samples were obtained to bracket the deficient portion of the seam. A total of five samples were obtained to bracket deficient portions of seams.

A total of three destructive test samples were obtained from seams welded on the HDPE geomembrane liner in the truck unloading area, resulting in an average frequency of one destructive test sample for every 165 feet of welded seam. One of the samples was obtained from a fusion welded seam, and the other two samples were obtained from extrusion welded seams. One of the extrusion weld samples failed the destructive test, and all seaming performed by the apparatus which welded the seam was capped. The test locations were selected by GCS personnel based on the completion of approximately 500 feet of welding, on observations of the welded seams, or on the general performance of the seaming crew. Destructive test samples were tested onsite by GCS personnel using GCS's calibrated tensiometer. The destructive test locations are shown on Sheet P-1. A summary of the destructive test results is presented in Appendix N-4.

5.2.4 Nondestructive Seam Continuity Testing

Nondestructive testing of the geomembrane seams and repairs was completed in a manner similar to that used during the installation of the secondary liner system. Any leaks or discontinuities detected in the seams were marked and subsequently repaired in accordance with the project specifications. Documentation summarizing the nondestructive testing of the seams and repairs is presented in Appendix N-3 and Appendix N-5, respectively.

5.2.5 HDPE Geomembrane Liner Repairs

In accordance with the specifications, defects in the geomembrane liner were assigned a unique identification number by GCS. These defects were located and marked in the field by GCS personnel for repair. The defects were repaired and nondestructively tested by GeoPacific in accordance with the project specifications. A summary of the defects and repairs is presented in Appendix N-5. Defect repair locations are shown on Sheet P-1.

5.3 LEACHATE COLLECTION AND REMOVAL SYSTEM

The primary leachate collection system consists of geosynthetic transmission media, and granular drainage material, a leachate collection piping system, and a leachate collection well. The leachate removal portion of the primary system consisted of a submersible pump, a self priming pump, and HDPE piping.

On the floor of the Project W-025 Landfill, geonet was installed directly on top of the primary geomembrane liner. The geonet was overlain by 16-oz/yd² geotextile. The geotextile was overlain by a 1.0 foot thick layer of drainage gravel, and the gravel was covered by a layer of seven-oz/yd² geotextile.

On the sideslopes and in the sump of the landfill, geocomposite material was installed directly on the surface of the primary geomembrane liner. In the sump, the geocomposite was overlain by 16-oz/yd² geotextile, a collector well was installed, the sump was filled with sump gravel, and the sump gravel was covered with a layer of seven-oz/yd² geotextile.

5.3.1 Geonet Installation

The geonet installation was completed in a manner similar to that used to install the geonet in the secondary system. The orientation of the geonet panels is similar to that of the geomembrane panels shown in Sheet P-1. Repairs to any damaged geonet were made with geonet patches and net ties in accordance with the project specifications. The installation and repair of the geonet was observed by GCS personnel.

5.3.2 Geotextile Installation

The geotextile installation was completed concurrently with the installation of the geonet, such that the geonet was covered the same day it was deployed. All geotextile was deployed parallel to the orientation of the geonet panels. The geotextile was deployed by manually uncoiling rolls of the material which had been positioned on the floor of the landfill. Adjacent geotextile panels were overlapped approximately three inches. All geotextile seams were sewn with a locking-stitch sewing machine. To enable complete encapsulation of the gravel which was to be installed on top of the geotextile, the geotextile was extended up the sideslopes approximately six feet to eight feet. Geotextile boots were formed around slope riser pipes which protruded through the material. The geotextile boots were secured to the HDPE pipes using stainless steel banding. The installation of the geotextile was observed by GCS personnel. None of the geotextile was damaged, so no repairs were necessary. The geotextile was exposed to sunlight for a period of less than 15 days before being covered by the next consecutive layer of the lining system.

In the truck unloading area, three layers of seven-oz/yd² geotextile were installed as a cushion layer on top of the 80-mil thick, HDPE, geomembrane liner. Each of the three layers was installed perpendicular to the underlying layer of geosynthetic material. Adjacent panels of geotextile were overlapped approximately six inches, and seamed by heat bonding using a leistering device.

5.3.3 Geocomposite Installation

The geocomposite installation was completed in a manner similar to that used to install the secondary geocomposite materials. Geocomposite material was installed on the sideslopes and in the sump area of the primary system. The geocomposite materials were tied-in to the geonet and geotextile on the floor of the landfill as described in Section 4.3.3.

5.3.4 Leachate Collection Piping

A leachate collection piping system was installed on the floor of the primary system prior to the installation of granular drainage materials. An HDPE, 30-inch diameter, leachate collection well, mounted on a four-foot square by one-inch thick slab of HDPE flatstock, was installed in the primary system sump. The bottom of the collection well is perforated, and wrapped with two layers of geonet. A perforated, HDPE, four-inch diameter, leachate collection piping system was installed around the edges and in the center of the floor of the primary system. The piping system drains to the leachate collection well, and the piping is connected to the collection well. Non-perforated, HDPE, four-inch diameter, cleanout riser pipes, connected to the four-inch diameter perforated pipes at strategic locations, provide for cleanout access to the leachate collection piping system. During the assembly of the piping system, the HDPE pipes and fittings were joined by butt fusion welding.

In addition to the HDPE piping noted above, a four-inch diameter, perforated, HDPE pipe was installed on the surface of the primary geosynthetic materials in the center of the truck unloading area, and along the south edge of the access ramp. This drainage pipe is continuous from the truck unloading area to the toe of the access ramp, at which point the pipe connects to the primary drainage system piping. The perforated pipe in the truck unloading area and on the access ramp was covered by top course material.

5.3.5 Granular Drainage Material

The installation and testing of the primary granular drainage materials were similar to the installation and testing of the secondary granular drainage materials.

5.3.5.1 Installation. Two types of granular drainage material were installed in the primary leachate collection system. The installation methods were similar to those used during the installation of the secondary granular drainage materials. Approximately 1,000 cubic yards of drainage gravel were installed in the primary system on the floor of the landfill. The gravel was placed by hand around the HDPE piping system. Approximately 150 cubic yards of sump gravel were installed in the primary sump area. The sump gravel was placed by hand around the leachate collection well.

Permit Surveying performed an as-built survey of the gravel surface, and Rogers Surveying performed a CQA survey of the gravel surface. GCS personnel reviewed the data from each of the surveys. Rogers' survey confirmed Permit's survey. Permit's survey data indicated a minimum

gravel thickness of 1.0 foot had been installed at each surveyed grid point. Roger's CQA survey data are included in Appendix T-5. Permit's Record Drawing, Top of Primary Gravel As-Built, Sheet 5 of 6, is included in Volume 2 of this report.

Following the completion of the surveys, the primary gravel surface was covered with seven-oz/yd² geotextile. The geotextile was installed and sewn as described in Section 4.3.2 of this report. To completely enshroud the gravel layer the geotextile which was installed on top of the gravel was sewn near the toe of each sideslope to the geotextile which had been previously installed on the primary geonet.

5.3.5.2 Testing. GCS personnel obtained samples of the granular drainage materials as they were stockpiled or installed. Laboratory tests were performed on four samples of the primary drainage gravel, resulting in a frequency of one set of laboratory tests for every 250 cubic yards of primary drainage gravel. One set of laboratory tests was performed on a sample of the primary sump gravel, resulting in a frequency of one set of laboratory tests for every 150 cubic yards of primary sump gravel. These testing frequencies met or exceeded the specified construction testing frequency of one set of laboratory tests for every 250 cubic yards of material placed. The laboratory tests completed during construction are summarized in Table 18.

Table 18. Primary Granular Drainage Material Construction Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Drainage Gravel</u> One Test Per 250 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434)	4	4
<u>Sump Gravel</u> One Test Per 250 yd ³	Particle Size (ASTM C136) Permeability (ASTM D2434)	1	1

The permeability tests were performed by GAI's soils laboratory located in Redmond, Washington. The particle size analyses were performed in GCS's onsite soils laboratory. The results of these tests indicated that the tested samples met the requirements of the specifications. A summary of the test results is presented in Appendix D-5.

5.3.6 Leachate Removal System

The primary leachate removal system consists of HDPE piping, a submersible pump, and a self-priming pump. An eight-inch diameter, HDPE pipe was installed on the floor of the primary sump. The eight-inch HDPE pipe is connected to the leachate collection well and extends up the eastern sideslope of the landfill. Two, two-inch diameter, HDPE pipes were installed adjacent to the eight-inch diameter pipe in the sump and on the sideslope. The two-inch diameter pipes are also connected to the 30-inch diameter leachate collection well. HDPE geomembrane liner boots were installed

around the pipes at the crest of the eastern slope, the point at which the pipes penetrate the primary geomembrane liner.

A 1.5-horsepower submersible pump attached to a 1.5-inch diameter HDPE discharge pipe was installed in the sump end of the eight-inch diameter pipe. The pump discharges through the 1.5-inch diameter pipe to the leachate temporary storage tank, located near the crest of the eastern sideslope. One of the two-inch diameter pipes contains a transducer which monitors the water level in the primary sump. The second two-inch diameter pipe is a spare level sensor pipe. The system was designed such that the submersible pump will automatically begin pumping when the transducer indicates a leachate level 12 inches above the bottom of the primary sump. The submersible pump will automatically shut-off when the leachate level is drawn-down to six inches above the bottom of the sump.

A five-horsepower self-priming pump is mounted near the top of leachate collection well. The suction intake for this pump is located at the bottom of the collection well. The pump discharges through a three-inch diameter, HDPE pipe to the leachate temporary storage tank. The three-inch diameter HDPE pipe was pressure tested at 50 psi for at least one hour. GCS personnel observed the pressure test. See Appendix R-3 for pressure test documentation.

A float switch, located 30 inches above the bottom of the primary sump, is designed to automatically start the self-priming pump if the leachate reaches the level of the float switch. A second float switch, located six inches above the bottom of the primary sump, is designed to automatically shut off the self-priming pump when the leachate level drops below this float switch.

6.0 WORKING SURFACES

The working surfaces for the Project W-025 Landfill include the operations layer; the top course surfacing on the perimeter road and access ramp; the asphalt surfacing on the truck staging and unloading areas; and the concrete installed for the containment basin, crest pad and crest, and control building slab.

6.1 OPERATIONS LAYER

The operations layer is a protective soil cover installed on the surface of the landfill. The operations layer provides insulation for the soil liner and provides a protective cushion for the lining systems.

6.1.1 Construction

Two general soil types were used for the operations layer. Eolian sand was used on the slopes of the landfill, and gravelly sand to sandy gravel was used on the floor of the landfill. Both materials were stockpiled during excavation of the landfill. Delhur used a D-6 dozer, equipped with LGP tracks, to spread the operations layer materials in a lift of three feet. On the sideslopes, the eolian sand was spread up the slopes. Approximately 15,690 cubic yards of operations layer material, including both eolian sand and gravelly soils, were installed on the surface of the landfill.

To provide access through the operations layer to the leachate collection well, a 48-inch diameter, concrete, vertical riser pipe was installed over the top of the collection well. The vertical riser pipe protrudes through the operations layer, and is secured to a six feet square by six inch thick, reinforced concrete base. The base rests on the surface of the primary sump gravel. A 32-inch diameter hole in the base allows the leachate collection well to protrude through the base, and the annulus between the well and the base will allow for future settlement of the vertical riser. Four 4-foot long segments of vertical riser pipe have been installed to provide access through future layers of waste. The vertical riser pipe segments and base were coated with Tnemec Series 61 primer and coating. The assembled vertical riser was wrapped with a layer of 60-mil thick, smooth, HDPE, geomembrane liner material. The HDPE liner was wrapped around the vertical riser to provide a smooth surface which will reduce friction when waste settles around the riser in the future.

Permit Surveying, performed an as-built survey of the operations layer surface and Rogers Surveying, performed a CQA verification survey. GCS reviewed data from both surveys, and determined that Rogers' survey data confirmed Permit's survey data. Permit's data indicated that the operations layer was slightly thinner than the specified 3.0 feet thickness at several grid points. Delhur reworked the areas in question, and Permit resurveyed these areas. The new survey data indicated that a minimum thickness of 3.0 feet had been installed at each of the surveyed grid points. Permit's Record Drawing, Top of Operations Layer As-Built, Sheet 6 of 6, is included in Volume 2 of this report. Rogers' CQA survey data are presented in Appendix T-6.

Shortly after the completion of the installation of the operations layer, wind erosion removed a few inches of operations layer material from the sideslopes of the landfill. Delhur used a D-6 dozer to regrade the sideslopes to re-establish the 3.0 feet thickness of the operations layer. A mixture of water and lignosite was then sprayed in the sideslopes to stabilize the surface and inhibit future wind

erosion of the operations layer. GCS personnel observed the regrading and the application of the lignosite mixture.

6.1.2 Testing

During the installation of the operations layer, GCS personnel obtained samples of the operations layer soils. Hydrometer and sieve analyses (ASTM D422) were performed on eight samples of the operations layer soil, resulting in a frequency of one sieve analysis for every 1,961 cubic yards of material placed, exceeding the specification's requirement of one sieve analysis for every 2,000 cubic yards of material placed. The tests were performed in GCS's onsite soils laboratory. The specifications required that the operations layer material meet the specification's requirements for backfill materials, previously indicated in Section 2.1, and that the material used on the sideslopes should have a maximum diameter of one inch. The test results indicated that the sampled materials met the requirements of the specifications for operations layer materials. A summary of the laboratory tests performed on the operations layer materials is presented in Appendix D-7.

6.2 TOP COURSE

Top course material was used for surfacing the perimeter road and the access ramp in the landfill, and was used as a base course material for the asphalt paving in the truck unloading and staging areas, and the site entrance.

6.2.1 Construction

Top course material was supplied by ACME Materials and Construction Co. (ACME). Delhur installed the top course for the perimeter road and the access ramp. ACME installed the top course in the areas requiring asphalt paving. In the truck unloading area, three layers of seven-oz/yd² geotextile were installed on the surface of the HDPE liner prior to the placement of top course. On the access ramp, a layer of 16-oz/yd² geotextile was installed on the surface prior to the placement of top course. Both contractors used similar methods of spreading and compacting the top course material. A grader was used to spread the material in the truck staging area and on the perimeter road. A D-4 dozer was used to spread the top course material in the truck unloading area, and a JD 450 dozer was used to initially spread the material on the access ramp. Top course was placed by hand around the four-inch diameter, perforated HDPE pipe in the truck unloading area and on the access ramp. A water truck was used to saturate the material, and a smooth drum, vibratory roller was used to compact the material to at least 95 percent of the material's Modified Proctor (ASTM D1557) maximum dry density. The top course material was installed in a three foot thick layer on the landfill access ramp, and in an eight-inch thick layer elsewhere. Approximately 760 cubic yards of top course were installed on the access ramp, and approximately 1,975 cubic yards of top course material were installed on the perimeter road, the truck staging and unloading area, and the site entrance.

6.2.2 Testing

During the installation of the top course material, GCS personnel performed field moisture-density tests (ASTM D2922 and D3017), and obtained samples of the placed material for laboratory testing.

Three field moisture-density tests were performed on the compacted top course material on the landfill access ramp, resulting in a frequency of one moisture-density test for every 2,274 square feet of top course surface area, exceeding the specification's requirement of one moisture-density test for every 10,000 square feet of surface area. Sixteen moisture-density tests were performed on the top course on the perimeter road, site entrance road, and truck staging and unloading areas, resulting in a frequency of one moisture-density test for every 123 cubic yards of top course placed in these areas, exceeding the specifications' requirement of one test for every 500 cubic yards of top course placed in these areas. The test results indicated that the top course had been compacted to at least 95 percent of the material's Modified Proctor maximum density as determined by ASTM D1557. The top course moisture-density test results are presented in Appendix O.

Laboratory testing included sieve analyses (ASTM C136) and Modified Proctor compaction tests (ASTM D1557). Two sieve analyses and two Modified Proctor tests were performed during the installation of the top course, resulting in a frequency of one sieve analysis and one Modified Proctor test for every 1,367 cubic yards of top course placed, exceeding the specification's requirement of sieve analysis and one Modified Proctor test for every 2,000 cubic yards of top course placed. The laboratory testing was performed in GCS's onsite soils laboratory. The results of the tests indicated that the sampled top course material met the requirements of the specifications. The top course laboratory test results are presented in Appendix D-6. A summary of the construction tests performed during the installation of the top course material is shown in Table 19.

Table 19. Top Course Material Construction Testing Summary.

MINIMUM FREQUENCY	TESTS	TESTS REQUIRED	TESTS PERFORMED
<u>Access Ramp</u> One Test Per 10,000 ft ²	Moisture-Density (ASTM D2922, D3017, & D2216)	1	3
<u>Perimeter Road*</u> One Test Per 500 yd ³	Moisture-Density (ASTM D2922, D3017, & D2216)	4	16
One Test Per 2,000 yd ³	Sieve Analysis (ASTM C136) Modified Proctor (ASTM D1557)	2	2
* Includes perimeter road, truck unloading area, truck staging area, and site entrance road.			

6.3 ASPHALT

A liquid asphalt primer, MC-250, was applied by ACME Materials and Construction, to the surface of the top course on the site entrance road, the truck staging area, and the truck unloading area, prior to paving these areas with asphalt concrete. After a curing period of five days, ACME installed asphalt paving on the treated areas. ACME placed and compacted the asphalt in two,

approximately two-inch thick lifts. The asphalt was compacted to at least 93 percent of the material's theoretical maximum density using a smooth-drum vibratory roller.

CQA laboratory tests and field density tests were performed by Intermountain Materials Testing, Inc. (Intermountain) of Pasco, Washington. Laboratory testing included sieve analysis (ASTM C136 and C117), extraction test (ASTM D2172), maximum density (ASTM D2041), and specific gravity. During compaction of the asphalt, Intermountain performed field density tests on the asphalt. Four field density tests (ASTM D2922) were performed on each lift of compacted asphalt, resulting in an approximate frequency of one field density test per 7,500 square feet per lift of asphalt placed, exceeding the specification's requirement of one density test for every 25,000 square of asphalt placed.

Following the completion of the asphalt installation, Permit Surveying, Inc. performed an as-built survey of the asphalt surface. GCS reviewed the survey data. The surface of the asphalt was out-of-tolerance at a majority of the surveyed grid points. The survey data indicated that the asphalt had generally been installed approximately 0.1 foot thicker than specified, and that the drainage pattern on the north edge and in the southwest corner of the truck unloading area did not meet the intent of the project design. The Design Engineer determined that the thickness discrepancy would be tolerable, but that the drainage pattern would have to be corrected so that runoff from the truck unloading area will drain into the landfill. A copy of the Design Engineer's memo addressing the drainage issue is included in Appendix P-2. ACME subsequently rectified the drainage problems by placing and compacting additional asphalt in the southwest corner, and by installing a curb on the north edge of the truck unloading area to correct the drainage pattern. Intermountain performed laboratory tests on the additional asphalt, and GCS performed field density tests on the compacted paving. The results of all asphalt laboratory tests and field density tests indicated that the material met the requirements of the specifications, and are included in Appendix P-1.

A performance test was performed to demonstrate that the drainage in the truck unloading area had been corrected. A 2,000-gallon water truck was used to spread water on the asphalt surface. The water drained into the landfill as designed. GCS personnel observed the demonstration. See Appendix P-1 for documentation of all CQA observations related to the construction and testing of the unloading area asphalt paving. The reworked asphalt surface was resurveyed by Permit Surveying, Inc. These survey data are included in the Record Drawing, Top of Operations Layer As-Built, Sheet 6 of 6, included in Volume 2 of this report.

6.4 CONCRETE

Several small concrete pours were completed for structures on the east side of the Project W-025 Landfill. The concrete pours are summarized in Table 20.

Table 20. Summary of Concrete Pours.

DATE OF POUR	STRUCTURE
10-27-93	Base Slab for Leachate Tank Containment Basin
10-29-93	Walls for Leachate Tank Containment Basin

DATE OF POUR	STRUCTURE
11-09-93	Base Slab for Control Building - (Slab was rejected)
12-01-93	Replacement Base Slab for Control Building, Steps and Pump Platform in Containment Basin
02-10-94	Base Slab for Crest Wall
02-14-94	Crest Wall

GCS observed the forming and rebar installation for each of the concrete pours. All rebar was epoxy coated prior to delivery. Intermountain Materials Testing performed CQA testing of samples of the concrete as it was placed. A set of four concrete cylinders was cast for each pour, and laboratory tests were performed by Intermountain to determine the seven-day, 14-day, and 28-day compressive strength of each set of cylinders. The specified 28-day strength of 3,000 psi was exceeded by the test results for each pair of 28-day tests performed for each pour. The results of Intermountain's tests are included in Appendix Q.

The concrete pour which was made on November 9, 1993, was rejected because the pour was completed earlier than the scheduled time, prior to the arrival of Intermountain personnel onsite to perform CQA sampling and testing. The rejected pour was intended for use as the base slab for the control building. The Design Engineer determined that a replacement slab could be poured directly on the surface of the rejected slab. The replacement slab was poured on December 1, 1993.

7.0 OPERATIONAL FEATURES

7.1 LEACHATE TEMPORARY STORAGE TANK, PIPING, AND TRANSFER PUMP

The leachate temporary storage tank was constructed by Quality Tank and Construction, of Sandy, Oregon. Carbon steel, Type A36 was used to construct the 10,000-gallon tank. The tank was ASME Code stamped, rated for 25 psi. A manufacturer's data report/certificate of compliance, required by the provisions of the ASME Code rules, is included in Appendix R-1. A Registered Professional Engineer's statement regarding the integrity of the tank system is included in Appendix R-2.

Coatings were applied to the interior and exterior of the tank, in accordance with the specifications. A GCS representative observed the interior and exterior of the tank prior to coating. After the tank was coated, GCS's representative measured the thickness of the interior and exterior coatings. The thickness of the exterior coating met the requirements of the specifications. The interior coating was thinner than specified, so an additional coating application was required on the interior of the tank. Subsequent measurements indicated that the interior coating thickness met the requirements of the specifications.

The temporary storage tank receives the discharge of leachate from the submersible pumps located in the landfill's secondary and primary sumps, and from the self-priming pump located in the primary sump. A series of valves and turbine meters located between the crest wall and the tank allow the measurement of the quantity of leachate pumped from each the primary sump and the secondary sump.

The leachate temporary storage tank is equipped with a high level, float-actuated shutoff switch that deactivates the pumps to prevent tank overflow. The tank is also equipped with a high, high level shutoff switch to deactivate the pumps in the event that the high level switch fails.

A high capacity transfer pump, mounted inside the containment basin for the leachate tank, enables the transfer of the leachate from the tank to a tanker truck, and also allows recirculation of the leachate in the tank.

Piping associated with the leachate temporary storage tank includes the HDPE discharge piping from the sump pumps, recirculation HDPE piping, and stainless steel suction and discharge pipes for the high capacity transfer pump. The discharge pipes from the sump pumps direct flow into the tank. Suction and discharge piping for the transfer pump allow the removal of leachate from the tank. Recirculation valves and piping, attached to transfer pump and the tank, enable recirculation of the liquid in the tank. The HDPE piping, valves, and meters located between the valves near the crest wall and the leachate tank were pressure tested at 33 psi for hour. Simultaneously, the recirculation piping and valves, and the valves and stainless steel piping associated with the transfer pump were pressure tested at 33 psi for one hour. GCS observed the pressure testing and documentation can be found in Appendix R-4.

The manufacturer of the stainless steel pipes provided certification of the pipes. The certification is included in Appendix I-2. The tank, associated piping, and transfer pump were wrapped with electrical heat trace cable and insulated per the specifications.

Heat trace cable and insulation were not required for the discharge pipes between the sump pumps and the crest wall, because the piping system was designed such that these pipes contain no water

when the pumps are not operating. Factory installed check valves have been removed from the submersible pumps to cause liquid in the subject discharge pipes to back-drain to the sumps during non-pumping periods. The discharge pipe for the self-priming pump is equipped with drain-down valves which cause liquid in this pipe to back-drain to the sump during non-pumping periods.

7.2 CONTAINMENT BASIN AND CREST PAD

The containment basin for the leachate tank was lined with 80-mil thick, smooth, HDPE geomembrane liner, by GeoPacific. The geomembrane was installed and tested in a similar manner to that described for the secondary and primary liner systems. After the tank was installed in the lined containment basin, a leak test was conducted to verify the performance of the HDPE liner. A quantity of water, slightly greater than the capacity of the tank, was placed in the containment basin, and the water level was monitored by GCS for 48 hours. Measurements of the water level were measured to the nearest 0.004 inch. The measurements indicated no change in the water level during the 48-hour test. See Appendix R-5 for leak testing documentation. After the 48-hour period, the water was removed from the basin, and GCS observed the floor of the HDPE-lined basin for signs of water accumulated beneath the liner. GCS observed no evidence of soft spots beneath the liner that would indicate leaking.

The concrete pad at the crest of the east slope was lined with 80-mil, smooth, HDPE geomembrane liner, by GeoPacific. The geomembrane was installed and tested in a similar manner to that described for the secondary and primary liner systems. The crest pad was lined to contain drips or leaks from the array of pipes, valves, and meters installed immediately above the pad. The lined pad drains into the containment basin for the leachate temporary storage tank. Only a few minor extrusion welds were required to install the HDPE liner on the crest pad. The welds on the floor of the crest pad were nondestructively tested using a vacuum box.

7.3 CONTROL BUILDING AND ELECTRICAL SYSTEM

The control building was supplied by Par Construction, of Kennewick, Washington, and installed by Delhur. The control building is a metal structure which measures approximately 12 feet long by 9 feet wide by 8.5 feet high. The building houses electrical equipment and control panels for the leachate collection and removal system pumps and ancillary equipment.

JRT Electric, Inc. (JRT) installed the electrical system for Project W-025. A Pump Control Panel Layout drawing, Sheet E1, and Pump Control Wiring Diagrams, Sheets E2 and E3, were provided by JRT and are included in Volume 2 of this report. The electrical system installation included overhead service, a transformer, site lighting, and pump controls. The pump control panel was assembled by Technical Systems, Inc. of Lynnwood, Washington. The face of the main electrical control panel door contains displays which indicate the leachate levels in each the primary and the secondary lining system sumps. The digital readings are in inches, and are transmitted through a signal cable from a transducer installed in each sump. Automatic switching equipment activates the submersible pump in the secondary sump when the secondary sump transducer indicates that the leachate level has risen to 12 inches above the floor of the sump. The pump is deactivated when the transducer indicates that the leachate level in the sump has fallen to six inches. Automatic switching equipment operates the submersible pump in the primary sump in the same manner, based on the level of leachate indicated by the primary system transducer.

The self-priming pump in the primary system is automatically activated by a float switch. For the purpose of the initial calibration, the switch was set to activate the pump when the liquid level reached a depth of 30 inches and shut the pump off when the depth was reduced to six inches (as measured from the floor of the primary sump). During the operation of the landfill, the float switch can be set to activate the pump before the leachate head on the geomembrane liner reaches one foot (as measured from the lip of the sump).

To prevent overfilling of the leachate temporary storage tank, the submersible pumps and the self-priming pump are automatically shut-off when a float switch in the leachate temporary storage tank indicates that the leachate level in the tank is within 12 inches of the top of the tank. In the event that this float switch fails to deactivate the pumps, a high level limit switch on the tank will shut-off the pumps if the leachate level in the tank rises to within 10 inches of the top of the tank.

A flashing beacon is mounted on the roof of the control building. The beacon is energized when a sump pump fails, or when the leachate temporary storage tank is nearly full as indicated by the high level switches in the tank.

The heat trace cable is controlled by a thermostat mounted on the outside of the control building. The thermostat energizes the heat trace cable when the ambient temperature drops below 40° Fahrenheit.

The electrical system was reviewed by the Design Engineer's consultant, Sparling, Inc., during the Acceptance Test Procedures. Sparling's representative indicated that the electrical system performed as designed. A copy of Sparling's report is included in Appendix S.

7.4 LIGHTING

The indoor and outdoor lighting systems were installed by JRT Electric, Inc. Indoor lighting was provided for the inside of the control building. The outdoor lighting system included lights mounted on four 40-foot long wooden poles. The poles were set in holes drilled approximately six feet deep. Two 180-watt, low-pressure sodium (LPS) lamps are mounted on the pole nearest the control building. One 180-watt LPS lamp was installed on each of other three poles. Each of the outdoor lights is equipped with a photocell. The outdoor lighting system was tested by covering the photocells, and the system performed as required. GCS observed the testing.

7.5 DRAINAGE FEATURES

The drainage for Project W-025 was designed and installed such that the paved truck unloading area drains into the landfill, and all other areas beyond the crest of the landfill drain outward, away from the landfill. The pavement in the truck staging area drains away from the landfill. Between the landfill crest and the perimeter road, the area was graded to provide drainage toward the perimeter road. The perimeter road is sloped outward, at a grade of approximately one percent, to provide drainage away from the landfill. On the outside of the perimeter road, on the north and west sides of the landfill, drainage ditches were excavated as required to provide drainage away from the landfill.

8.0 ACCEPTANCE TEST PROCEDURES

The Acceptance Test Procedures (ATPs), outlined in the project specifications, were performed to demonstrate that the electrical and instrumentation systems function as intended by the design. The following is a list of the components tested:

- Heat trace system
- Transducers and meter/controllers — primary and secondary sumps
- Submersible pumps and spare — primary and secondary sumps
- Self priming pump — primary sump
- Transfer pump and spare — leachate tank
- Flow meters
- Leachate tank high level switches
- Control building power and lighting
- Outdoor lighting
- Control panel heaters

The ATPs were initially performed on April 14, 1994, and were observed by GCS, the Design Engineer, and the COTR. The results of the ATPs indicated that the electrical and instrumentation systems function as intended by the Design Engineer, with a few minor exceptions. The exceptions included discrepancies in flow meter readings, minor dripping from vacuum release valves, and occasional sticking of the high-level limit switch. The three minor discrepancies were included as punch list items to be reconciled in the near future. Documentation of the results of the initial ATPs were presented in a report prepared by Westinghouse Hanford Company, Acceptance Test Report, WHC-SD-W025-ATR-001, Rev. 0, dated May, 1994.

Engineering Change Notices subsequently required the replacement of the flow meters, the replacement of the vacuum release valves, and modifications to the piping configuration near the flow meters. Acceptance Test Procedures were performed on October 4, 1994 to demonstrate that the new components function as intended by the design. These ATPs were observed by GCS, WHC-Operations, and the COTR. The results of these ATPs indicated that the new flow meters, piping, and vacuum/air release valves function properly. Documentation of the results of these ATPs were presented in a report prepared by Westinghouse Hanford Company, Acceptance Test Report, WHC-SD-W025-ATR-001, Rev. 1, dated October, 1994.

9.0 CONCLUSION

The activities described above associated with the construction of the Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Project W-025, in the 200 West Area of the Department of Energy's Hanford Nuclear Reservation, near Richland, Washington, were observed by GCS personnel. Based on GCS's observations and the results of testing reported herein, it is GCS' opinion that the above mentioned system has been constructed in substantial compliance with the design drawings and project specifications, including the engineering changes documented in this report.

FIGURES

NOTE: The 600 Area consists of all portions of the Hanford Site not otherwise designated.

FIGURE 1
HANFORD 200-WEST AREA LOCATION
DOE/NDO-CQA

FIGURE 2
PROJECT W-025 LOCATION
IN 200 WEST AREA
DOE/NDO-CQA

EXPLANATION

Quaternary	Recent	Lolion Sand		Eolian Sand - Compact, olive gray (SY 3/2), silty fine SAND
			Loose to compact, pale yellowish brown (10YR 6/2) ASH
	Hanford formation	Culd Creek Bar Member		Dense to very dense, Olive black (SY 2/1), gravelly fine to coarse SAND
			Dense, moderate olive brown (SY 4/4), fine sandy SILT
			Dense to very dense, light olive gray (SY 5/2), fine to coarse SAND

Approximate stratigraphic unit contact location.
Direction of Slope.

CREST OF SLOPE

FIGURE 3
 GEOLOGIC MAP OF W-025
 DOE/NDO CQA/WA

SECTION
DETAIL

SECTION
DETAIL

EXPLANATION

Quaternary	Recent Eolian Sand		Eolian Sand - Compact, olive gray (5Y 3/2), silty fine SAND
		Loose to compact, pale yellowish brown (10YR 6/2) ASH
	Harford Formation Cold Creek Bar Member		Dense to very dense, Olive black (5Y 2/1), gravelly fine to coarse SAND
		Dense, moderate olive brown (5Y 4/4), fine sandy SILT
		Dense to very dense, light olive gray (5Y 5/2), fine to coarse SAND

— — — Approximate stratigraphic unit contact location.

FIGURE 4
GEOLOGIC CROSS SECTIONS
DOE/NDO CQA/WA

FIGURE 5

Subgrade, General Fill, and Top Course Moisture-Density Test Locations
DOE/NDO/WA

Explanation

+ Approximate Moisture-Density Test Location

FIGURE 6
Secondary Soil Liner Moisture-Density Test Locations
DOE/NDO CQA/WA

Explanation

- Secondary Soil Liner Shelby Tube Sample Number and Approximate Sample Location
- ◆ Primary Soil Liner Shelby Tube Sample Number and Approximate Sample Location

FIGURE 7
SHELBY TUBE SAMPLE LOCATIONS
DOE/NDO CQA/WA

Untested specimen
Extrusion weld

	<u>Pass/Fail code</u>	<u>Description</u>
	FAIL 1	Adhesion Failure
	FAIL 2	Adhesion Failure
	FAIL 3	Adhesion Failure

	PASS 1	FTB welded seam edge
	PASS 2	FTB welded seam edge
	PASS 3	FTB heat seam edge
	PASS 4	FTB heat seam edge
	PASS 5	FTB welded seam edge
	PASS 6	FTB in sheeting

FIGURE 8
HDPE WELD DESTRUCTIVE TEST
CODES EXTRUSION WELD
DO/ENDO CQA/WA

Untested specimen
Fusion weld

Pass/Fail code

Description

(F 1)

Adhesion Failure

(F 2)

FTB break at seam edge

(F 3)

FTB break at second seam edge

(F 4)

FTB break at second seam edge

(P 1)

FTB break in sheeting

(P 2)

FTB break at seam edge

FIGURE 9
HDPE WELD DESTRUCTIVE TEST
CODES FUSION WELD
DOE/NDO CQAWA

ACCESS RAMP SECTION

TYPE A GEOTEXTILE

GEONET/GEOCOMPOSITE
AND PRIMARY HDPE

TYPE B GEOTEXTILE

GEONET/GEOCOMPOSITE
AND SECONDARY HDPE

SECTION

TYPE A GEOTEXTILE

GEONET/GEOCOMPOSITE
AND PRIMARY HDPE

TYPE B GEOTEXTILE

GEONET/GEOCOMPOSITE
AND SECONDARY HDPE

GEOCOMPOSITE AND PRIMARY HDPE
FROM SIDESLOPE TO THIS INTERFACE

GEOCOMPOSITE AND SECONDARY HDPE
FROM SIDESLOPE TO THIS INTERFACE

SECTION

ION

16

-A

-B

FIGURE 10
TOE OF ACCESS RAMP TIE-IN DETAIL
DOE/NDO CQA/WA

FIGURE 11
PRIMARY SOIL LINER MOISTURE-DENSITY TEST LOCATIONS
DOE/NDO CQA/WA

APPENDIX A
CONSTRUCTION SCHEDULE AND GCS ONSITE STAFF

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 933-1354

		SEPTEMBER, 1993																													
DAY		W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CONSTRUCTION ACTIVITY																															
EXCAVATION																															
PRODUCE ADMIX																															
CONSTRUCT TEST FILL																															
INSTALL SDRI																															
SDRI TEST																															
GENERAL FILL																															
CONCRETE																															
SECONDARY SOIL LINER																															
GCS ONSITE CQA STAFF																															
SCOTT MATTHEES - CQA ENGINEER																															
NANCY EVANS - TECHNICIAN																															
DAVE MATHIS - LEAD TECHNICIAN																															
CLIFF KNITTER - CQA MANAGER																															
ALLAN MACLEOD - SENIOR GEOLOGIST																															

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF GCS PROJECT NO. 933-1354

		NOVEMBER, 1993																														
DAY		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T								
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
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CONTAINMENT BASIN HDPE LINER																																
GCS ONSITE STAFF																																
SCOTT MATTHEES - CQA ENGINEER																																
NANCY EVANS - TECHNICIAN																																
DAVE MATHIS - LEAD TECHNICIAN																																
STEVE MILKA - TECHNICIAN																																
CLIFF KNITTER - CQA MANAGER																																

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 933-1354

		DECEMBER, 1993																														
DAY		W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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SECONDARY HDPE LINER																																
SECONDARY LCRS																																
PRIMARY SOIL LINER																																
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GCS ONSITE STAFF																																
SCOTT MATTHEES - CQA ENGINEER																																
NANCY EVANS - TECHNICIAN																																
DAVE MATHIS - LEAD TECHNICIAN																																
STEVE MILKA - TECHNICIAN																																
CLIFF KNITTER - CQA MANAGER																																

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

BMW LAND DISPOSAL FACILITY, NON-DRAG-OFF GCS PROJECT NO. 933-1354

JANUARY, 1994

DAY	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M							
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
CONSTRUCTION ACTIVITY																															
SDRI TEST																															
GENERAL FILL																															
SECONDARY HDPE LINER																															
SECONDARY LCRS																															
PRIMARY SOIL LINER																															
PRIMARY HDPE LINER																															
PRIMARY LCRS																															
OPERATIONS LAYER																															
ELECTRICAL / MECHANICAL																															
TOP COURSE / PAVING																															
GCS ONSITE CQA STAFF																															
SCOTT MATTHEES - CQA ENGINEER																															
DAVE MATHIS - LEAD TECHNICIAN																															
NANCY EVANS - TECHNICIAN																															
ALAN MACLEOD - SENIOR GEOLOGIST																															
CLIFF KNITTER - CQA MANAGER																															

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 933-1354

DAY		FEBRUARY, 1994																											
DATE		T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CONSTRUCTION ACTIVITY																													
SDRI TEST																													
EXCAVATION																													
GENERAL FILL																													
PRIMARY HDPE LINER																													
PRIMARY LCRRS																													
OPERATIONS LAYER																													
ELECTRICAL / MECHANICAL																													
TOP COURSE / PAVING																													
CONCRETE																													
GCS ONSITE CQA STAFF																													
SCOTT MATTHEES - CQA ENGINEER																													
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NANCY EVANS - TECHNICIAN																													
CLIFF KNITTER - CQA MANAGER																													

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 933-1354

		MARCH, 1994																														
DAY		T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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GCS ONSITE CQA STAFF																																
SCOTT MATTHEES - CQA ENGINEER																																
DAVE MATHIS - LEAD TECHNICIAN																																
NANCY EVANS - TECHNICIAN																																
CLIFF KNITTER - CQA MANAGER																																

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAW-OFF

GCS PROJECT NO. 833-1354

APRIL, 1994

DAY		F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S							
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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TANK & PIPE INSULATION																															
GCS ONSITE CQA STAFF																															
SCOTT MATTHEES - CQA ENGINEER																															
DAVE MATHIS - LEAD TECHNICIAN																															
NANCY EVANS - TECHNICIAN																															
CLIFF KNITTER - CQA MANAGER																															

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 933-1354

		MAY, 1994																														
DAY	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	
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NANCY EVANS - TECHNICIAN																																
CLIFF KNITTER - CQA MANAGER																																

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 833-1354

DAY		SEPTEMBER, 1994																													
		T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F
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GCS ONSITE CQA STAFF																															
SCOTT MATTHEES - CQA ENGINEER																															
DAVE MATHIS - LEAD TECHNICIAN																															
NANCY EVANS - TECHNICIAN																															
CLIFF KNITTER - CQA MANAGER																															

CONSTRUCTION SCHEDULE AND GCS ONSITE CQA STAFF
PROJECT W-025

RMW LAND DISPOSAL FACILITY, NON-DRAG-OFF

GCS PROJECT NO. 833-1354

		OCTOBER, 1994																																		
DAY		S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M				
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SCOTT MATTHEES - CQA ENGINEER																																				
DAVE MATHIS - LEAD TECHNICIAN																																				
NANCY EVANS - TECHNICIAN																																				
CLIFF KNITTER - CQA MANAGER																																				

APPENDIX B

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
12	Earthwork operations plan and schedule	Approved by GCS: 09-02-93
13	Trenching and Shoring Plans	Information only
14	Trenching and Backfilling (Operations Plan and Schedule) (See Submittals 10 & 12)	Approved by GCS: 03-10-94
15	Trenching and Backfilling (Trenching and Shoring) (See Submittal 13)	Approved by GCS: 03-10-94
16	Admix preparation plan (bentonite)	Approved w/ exception by GCS: 09-17-93 Resubmit w/ test pad results
16A	Admix preparation plan (Pug mill)	Approved w/ exception by GCS: 09-29-93 Resubmit
16B	Admix preparation plan (Pug mill)	Approved by GCS: 10-05-93
16.1	Admix Prep. Plan (Belt Scale Cert.)	Approved by GCS: 10-12-93
17	Soil liner placement plan	Not approved by GCS: 09-27-93 Resubmit
17A	Soil liner placement plan	Approved by GCS: 10-25-93
18	Admix Production, Placement, and Trimming (Ops. Plan and Schedule) (See Submittals 10, 16A, 16B, 17, & 17A)	Approved by GCS: 03-10-94
19	Trenching and shoring plan	Approved by GCS: 11-12-93
20	Granular Drainage Layers/Earthwork Operations Plan and Schedule	Approved by GCS: 12-05-93
21	Granular Drainage Layers/Gravel Samples	Approved by GCS: 12-05-93
22	Operations Layer/Earthwork Operations Plan and Schedule	Approved by GCS: 12-05-93
23	Operations Layer/Trenching and Shoring Plans	Approved by GCS: 12-05-93
24	Geotextile QA and QC documentation	Approved by GAI: 09-20-93
24.1	QA/QC documentation (thread for geotextile)	Approved by GCS: 10-25-93

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
25	FML QA/QC documentation (SLT's QA Manual)	Approved w/ exception by GAI: 09-21-93 Resubmit
25A	FML QA and QC documentation (Crystallinity letter)	Approved w/ exception by GAI: 10-01-93 Resubmit
25B	Friction Angle Test (admix / FML)	Approved by GCS: 11-19-93
25.1	Geomembrane QA & QC Data	Approved by GCS: 11-19-93
25.2	Extrudate Certification	Approved by GCS: 11-19-93
25.3	Geomembrane QA & QC Data	Approved w/ exception by GCS: 11-19-93 Resubmit
25.3A	Geomembrane QA & QC Documentation (Resin lot certification and Geocomposite QA & QC data for 32 rolls)	Approved by GCS: 01-18-94
25.4	Geomembrane QA & QC Data	Approved w/ exception by GCS: 11-19-93
25.4A	Same submittal as 25.3A	Approved by GCS: 01-18-94
25.4B	Geomembrane QA & QC Documentation (Environmental Stress Crack Resistance Certification)	Approved w/ exceptions by GCS: 02-09-94
25.4C	Geomembrane QA & QC Documentation (Environmental Stress Crack Resistance Certification)	Approved by GCS: 03-22-94
25.5	Geomembrane QA & QC Documentation (Certification - welding in temperatures less than 40 degrees)	Approved by GCS: 12-08-93
25.6	Geomembrane QA & QC Documentation (Cert for roll 8388)	Approved w/ exception by GCS: 01-14-94
25.6A	Geomembrane QA & QC Documentation (Direct Shear Test Report)	Approved by GAI & GCS: 02-09-94
25.7	Geomembrane QA & QC Documentation (Resin, and rolls 9604 & 9605)	Approved by GCS: 01-18-94
25.8	Geomembrane QA & QC Documentation (Resistance to Soil Burial Data)	Approved by GCS: 03-10-94
25.9	Geomembrane QA/QC Documentation (Cert. - Resistance to Soil Burial)	Approved by GCS: 03-22-94

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
26	Geonet QA and QC documentation	Approved by GAI: 09-21-93
26.1	Geonet Certification and QC Data	Approved w/ exception by GCS: 11-19-93 Resubmittal not required.
26.2	Geonet QA/QC Documentation (Letter re: density)	Approved by GCS: 11-19-93
27	Geocomposite QA and QC documentation	Not approved by GAI: 09-21-93 Resubmit
27A	Geocomposite	Approved by GCS: 10-12-93
27B	Friction Angle Tests (geocomposite/FML & geocomposite/ops. layer)	Approved w/ exception by GCS: 11-19-93 Resubmit - (Cert. for Geocomposite)
27C	Geocomposite QA & QC Documentation	Approved w/ exception by GCS: 12-15-94
28	Geosynthetics (Samples for Fingerprinting and Conformance Tests) (GCS sampled delivered rolls. Also, see Submittal 25.3)	Approved by GCS: 03-10-94
29	Geosyn. Q.A. program for installation	Approved by GCS: 09-21-93
29.1	QA program for installation (Panel Layout Dwg.)	Approved by GCS: 10-26-93
29.2	QA Program for installation (fusion and extrusion welders)	Approved by GCS: 11-16-93
29.2A	Certs. for Gauges, Calibration of Tensiometer	Approved by GCS: 11-19-93
30	FML installer & seaming personnel	Approved by GCS: 09-21-93
31	Asphalt Mix Design	Approved by GAI: 12-08-93
31.1	Asphalt Mix Design (Seal Coat)	Approved by GAI: 04-04-94
32	Methods of placement and compaction (General fill)	Approved by GCS: 10-25-93
33	Descrip. of Methods for Excav. and Finishing Drainage Ditches	Approved by GCS: 12-08-93
34	QC certification of HDPE pipe	Approved w/ exception by GCS: 09-16-93 Resubmit
34A	QC certification - HDPE pipe	Approved w/ exception by GCS: 11-07-93

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
34B	QC Certification - HDPE Pipe	Approved by GCS: 12-08-93
35	Fabrication Drwg. - (HDPE pipe)	Approved by GCS: 11-07-93
35A	Fabrication Drawings for HDPE Collection Well	Approved by GCS: 12-08-93
36	Qualifications of joining personnel	Approved by GCS: 09-16-93
37	Vertical riser pipe	Approved w/ exception by GAI: 09-27-93 Resubmit
37A	Precast concrete pipe	Approved by GAI: 11-04-93
38	Rebar and coating	Approved by GCS: 10-26-93
39	Shop drawings - rebar	Approved by GAI: 10-26-93
40	Certificate of Admixture (Air-entraining admix for concrete)	Approved by GAI: 04-04-94
41	Concrete mix design	Approved by GAI: 10-26-93
42	Anchor bolt type	Approved by GAI: 10-28-93
43	Waterstops	Approved by GAI: 10-26-93
44	Metal Fab./Shop Dwgs (Vertical riser lid and grating)	Approved by GAI: 05-11-94
46	Manufacturer's Tech. Info. (Door for Control Building)	Approved by GAI: 04-04-94
46.1	Manufacturer's Tech. Info. (Frame for Control Building Door)	Approved by GCS: 04-18-94
47	Paint Coating Systems (Coating Systems List) (See Submittals 48, 48A, and 48.1)	Approved by GCS: 03-10-94
48	Manufacturer's Specifications (Manhole coating)	Not approved by GAI: 10-26-93 Resubmit
48A	Manu's Specifications (manhole coating)	Approved by GAI: 11-16-93
48.1	Manu's Specifications (tank coating)	Approved by GAI: 11-09-93

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
49	Paint Coating Systems (Color Samples)	Approved by GCS: 03-16-94
50	Pumps, motors, materials, etc.	Approved by GAI: 09-17-93
50.1	Info. on pumps, motors, etc.	Approved w/ exception by GAI: 10-07-93 Resubmit
50.1A	Info. on pumps, motors, etc.	Approved by GAI: 11-04-93
51	Manu. Info. - Control bldg., hardware, etc.	Approved w/ exception by GAI: 10-26-93 Resubmit
51.1	Control building foundation	Approved by GAI: 11-04-93
51.2	Manu's Information (control building)	Approved by GAI: 11-17-93
52	Manu. Info. - Design load - bldg.	Approved by GAI: 11-12-93
53	Leachate tank: fabricator drawings	Approved w/ exception by GAI: 09-20-93 Resubmit
53A	Fabricator drawings	Approved w/ exception by GAI: 10-14-93 Resubmit
53B	Liquid level indicator - tank	Approved by GAI: 11-04-93
53.1	Fabrication dwgs - Vent - leachate tank	Approved by GAI: 11-04-93
53.2	Fabrication dwgs. - Elbow for leachate tank	Approved by GAI: 11-05-93
53.3	Fab. Drawings (Leachate Tank)	Approved by GAI: 12-08-93
53.4	Fabricator Drawings (letter from tank fabricator)	Approved by GAI: 12-08-93
53.5	Fab. Dwgs. (ASME Cert. for Leachate Tank)	Approved by GAI: 12-08-93
53.6	Fab. Drawings (Leachate Tank)	Approved by GAI: 12-08-93
54	Pump Controls (Detailed Drawings and Manufacturer's Information)	Approved by GAI: 04-04-94
55	Electrical System and Pump Controls	Approved w/ comments by GAI: 12-08-93

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
56	Record Drawings (electrical)	Approved w/ comments by GAI: 12-08-93
57	Shop Drawings - Discharge Pipe	Resubmit: 01-21-94
58	Fabricator drawings (Leachate tank shell)	Approved w/ exception by GCS: 08-30-93 Resubmittal covered by Nos. 53 - 53.8
59	Certification for Stainless Steel Pipe	Approved by GCS: 03-24-94
60	Tech. data for hangers, brackets, supports	Approved by GAI: 10-07-93
61	Pipe and Conduit Support Systems (Calculations)	Approved by GAI: 04-04-94
62	Pipe and Conduit Support Systems (Drawings)	Approved by GAI: 03-16-94
63	Vacuum release valves	Approved by GAI: 09-23-93
64	Solenoid drain valve and piping	Approved by GAI: 09-23-93
64.1	Solenoid Drain Valve and Piping	Approved by GAI: 03-18-94
65	Valves: Sample cocks	Approved by GAI: 09-23-93
66	Check valves	Approved by GAI: 09-23-93
67	Manu. data - auto drain valve	Approved by GAI: 11-12-93
68	Butterfly valves	Not approved by GAI: 09-23-93 Resubmit
68A	Butterfly valve	Approved by GAI: 10-05-93
69	Turbine meter	Approved by GAI: 09-23-93
70	Manufacturer's product data & tech. info.	Approved by GAI: 10-07-93
72	Elec. System Certification (Installation per Drawings provided by KEH)	Approved by GAI: 04-04-94
73	Raceways	Approved w/ exception by GAI: 09-30-93 Resubmit
73A	Materials and methods (coating and conduits)	Approved by GAI: 11-05-93

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
74	Wire and cables	Approved by GAI: 09-30-93
75	Connectors and terminations	Approved by GAI: 09-30-93
76	Motor controllers	Approved w/ exception by GAI: 10-28-93 Resubmit
76A	Motor Controllers	Approved w/ exception by GCS: 12-08-93
77	Power service equipment	Approved by GAI: 10-28-93
78	Transformers	Approved by GAI: 11-05-93
78.1	Transformers	Approved by GAI: 11-15-93
79	Panel boards	Approved w/ exception by GAI: 11-05-93 No resubmittal required.
80	Product Data (Lighting Fixtures and Ballasts)	Approved by GAI: 04-08-94
81	Wood poles	Approved by GAI: 09-30-93
82	Open fuse cutouts	Approved w/ exception by GAI: 11-07-93 No resubmittal required.
83	Surge arresters/product data	Approved w/ exception by GAI: 10-05-93 Resubmit
83A	Product data - surge arrestor	Approved by GAI: 11-08-93
84	Push button stations	Approved w/ exception by GAI: 10-28-93 Resubmit
84A	Push Button Stations	Approved w/ exception by GCS: 12-08-93
85	Pullbox	Approved by GAI: 09-30-93
86	Heat trace	Not approved by GAI: 09-30-93 Resubmit

SUMMARY OF SUBMITTAL REVIEWS BY GCS AND GAI

Project W-025, Non-Drag-Off

GCS Project No. 933-1354

SUBMITTAL NO.	DESCRIPTION	STATUS
86A	Heat trace	Approved w/ exception by GAI: 11-05-93 No resubmittal required.
87	Materials and methods (panelboard)	Approved w/ exception by GAI: 11-09-93 No resubmittal required.
88	Motor Controllers	Approved w/ exception by GAI: 10-28-93 Resubmit
88A	Motor Controllers	Approved w/ exception by GCS: 12-08-93
89	Shop drawings - transformers	Approved by GAI: 11-05-93
89.1	Dry Type Transformers/Shop Drawings	Approved by GAI: 12-08-93
90	Shop drawing (panelboard)	Approved w/ exception by GAI: 11-09-93 No resubmittal required.
91	Certified Laboratory Test Report - Lighting	Approved w/ exception by GAI: 11-05-93
91A	Certified Laboratory Test Report - Lighting	Approved by GAI: 12-22-93
92	Lighting	Approved w/ exception by GAI: 11-12-93
93	Electric Heat Trace-Catalog data	Not approved by GAI: 09-30-93 Resubmit
93A	Elec. heat trace	Approved w/ exception by GAI: 11-09-93 No resubmittal required.
94	Manufacturer's QC test results	Resubmit--cannot review until cable has been submitted: 10-19-93
94A	Manufacturer's QA/QC Tests	Approved by GAI: 12-06-93
300	Info. request: Piggy back pump	Arrangement approved by GAI: 09-09-93 Resubmit w/ additional information

APPENDIX C
SPECIFICATION CLARIFICATIONS AND ENGINEERING CHANGE NOTICES

APPENDIX C-1
PRECONSTRUCTION MEETING MINUTES

KAISER ENGINEERS HANFORD		MINUTES OF MEETING	
Type PRECONSTRUCTION MEETING		Meeting No. 5346-004	Date August 25, 1993
Project or Work Order No. and Title KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY		Distribution Attendees L. Gavin - KEH C. Maxson - KEH (E3-23) W. A. Holstein (KEH PM) E. G. Erpenbeck (CUST. PE) M. S. Collins (DOE PE) A. G. Pines - WHC Contract File	
References			
Attendees J. Morton - KEH C. Knitter - Golder Const. Svc. S. Matthees - Golder Const. Svc. B. P. Rivers - Redsal Mobile Offices J. Tadlock - JRT ELEC. A. B. Beck - KEH T. Holth - Delhur Ind. Inc. R. Hurwort - Delhur Ind. Inc. D. Martin - Geo. Pacific Lining V. G. Clements - Industrial Plastics Inc. J. Hensley - WDOE K. McLerran - KEH M. Prindiville - KEH J. Sarn - ACME M&C J. Webber - Permit Surveying B. Mast - WI J. Coskey - PPL/CETCO F. Shurl - Golder Associates Inc. L. Borneman - Pilchuck Mech.			
<p>I <u>INTRODUCTIONS</u></p> <ul style="list-style-type: none"> • Introduction of Attendees. • The "Contract Player Sheet" was distributed and establishes Jim Morton/Peyton Rackley of KEH at (509) 373-3722/372-2170 as the Field Contract Engineers, and Bill Holstein of KEH at (509) 376-5089 as the Project Manager. • All correspondence pertaining to this project should be directed to: <p style="text-align: center;">Kaiser Engineers Hanford Company P. O. Box 888 Richland, Washington 99352 Attention: Jim Morton/Peyton Rackley Field Contract Engineers S2-55</p>			
Prepared By Jim Morton/Peyton Rackley		Approved By Jim Morton/Peyton Rackley	
Title Field Contract Engineers		Title Field Contract Engineers	

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type <p style="text-align: center;">PRECONSTRUCTION MEETING</p>	Meeting No. <p style="text-align: center;">5346-004</p>	Date <p style="text-align: center;">August 25, 1993</p>
Project or Work Order No. and Title <p style="text-align: center;">KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY</p>	Page No. <p style="text-align: center;">Page 2 of 8</p>	
Minutes Continued <div style="margin-left: 40px;"> <p>II <u>SUMMARY OF WORK</u></p> <ul style="list-style-type: none"> • The Notice of Award was issued August 8, 1993, to Delhur Ind. in the total amount of \$1,663,093. • Work included: Mass Excavation, soil bentonite liner, Geosynthetics liners, piping, electrical, roads, paving, construct test fill. • Work Not Included: Installing and monitoring SDRI in test fill. Quality assurance acceptance and testing, except as noted in CQA Plan, construct closure cover for landfill. • The Notice to Proceed to be issued after approval of safety related submittals or about August 31. The contract completion date is 268 days after receipt of Notice to Proceed. • Specific milestones or work elements to be completed per Div 1, Section 1010.1.3.2. <p>III <u>ITEMS FURNISHED FOR CONSTRUCTION</u></p> <ul style="list-style-type: none"> • Gravel and sand may be obtained from mass excavation of trench and per Contract documents. . <p>IV <u>APPLICATION FOR PAYMENT</u></p> <ul style="list-style-type: none"> • Payments to the contractor are normally made on a monthly basis in accordance with Section No. 15 of the Contract General Conditions. At the end of each month KEH and contractor will meet and review progress to date. • The contractor was reminded that up-to-date certified payrolls are necessary to assure timely progress payments. • Final payment for this contract will not be made until all associated KEH subcontractor security badges (with exception to previously reported lost badges) are returned to the KEH subcontractor badging office, 1301 Building/3000 Area.- Note: Lost security badges must be reported immediately to KEH. • Schedules are per the Contract documents and some are required in the first 15 days of the contract after NTP. </div>		
Prepared By <p style="text-align: center;">Jim Morton/Peyton Rackley</p>	Approved By <p style="text-align: center;">Jim Morton/Peyton Rackley</p>	
Title <p style="text-align: center;">Field Contract Engineers</p>	Title <p style="text-align: center;">Field Contract Engineers</p>	

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type PRECONSTRUCTION MEETING	Meeting No. 5346-004	Date August 25, 1993
Project or Work Order No. and Title KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY	Page No. Page 3 of 8	
Minutes Continued <div style="margin-left: 20px;"> <p>V <u>COORDINATION</u></p> <ul style="list-style-type: none"> • Work activities should be coordinated to ensure efficient and orderly sequence of work. • Advance notice of work that will affect existing systems must be scheduled through KEH and four (4) days notice is required for tie-ins. <p>VI <u>JOBSITE ADMINISTRATION</u></p> <ul style="list-style-type: none"> • Working hours were established as 7:00 a.m. to 5:30 p.m. 5 days a week. • The Contract Worksheet is attached and lists the subcontractors. If additional subcontractors will be working on this contract, KEH should be notified so they can be added to the Contract Worksheet. If they are not listed on the worksheet, badges will not be issued for their personnel. Badges will not be issued until NTP is issued. • Contractor badges are issued at the 1301 Building, 3000 Area between the hours of 7:00 a.m. to 11:a.m. 12:30 p.m. to 2:00 p.m., Monday through Friday, except Holidays. Personnel are advised that the badging process requires approximately 45 minutes; those arriving after 2:00 p.m. may not be badged that work day. • A KEH Safeguards and Security Manual (KEH-MA-6) is available from the KEH Contract Administration Manager for your use or reference. This manual outlines your responsibilities to follow KEH Safeguards and Security procedures. • A KEH Security Representative reviewed the attached list of security requirements. • A Safety Representative reviewed the attached list of safety requirements. </div>		
Prepared By Jim Morton/Peyton Rackley	Approved By Jim Morton/Peyton Rackley	
Title Field Contract Engineers	Title Field Contract Engineers	

HPH_614.KEH 9/1/90

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type <p style="text-align: center;">PRECONSTRUCTION MEETING</p>	Meeting No. <p style="text-align: center;">5346-004</p>	Date <p style="text-align: center;">August 25, 1993</p>
Project or Work Order No. and Title <p style="text-align: center;">KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY</p>	Page No. <p style="text-align: center;">Page 4 of 8</p>	
Minutes Continued <div style="margin-left: 40px;"> <p>VII <u>SURVEY AND FIELD ENGINEERING</u></p> <ul style="list-style-type: none"> • Contract required Contractor to perform survey and field engineering and shall be the responsibility of a land surveyor registered in the state of Washington. <p>VIII <u>PERMITS</u></p> <ul style="list-style-type: none"> • Excavation Permit was issued during Pre Con Meeting. • Backfill Permit will be issued as required by KEH. • Tie-in Permit is required for water. • Hazardous Work Permit will be issued for burning/cutting as required. • Radiation Work Permit no. SW-24 REV. 1 was issued for excavation only. • Oversize Load Permits are required, KEH requires 4 days notice. <p>IX <u>SPECIAL PROJECT PROCEDURES</u></p> <ul style="list-style-type: none"> • Asbestos handling requirements: Do not anticipate any materials with asbestos to be used in the construction of trench facility. • Hazardous material requirements: Submit a proposed method for storage of hazardous materials, 5 day notice is required. <p>X <u>PROJECT MEETINGS</u></p> <ul style="list-style-type: none"> • The contractor has held an informational meeting on August 25, 1993, with representatives of any Labor Organizations. The contractor is also responsible to ensure their lower tier subcontractor are signatory to HSSA and the agreement is complied with. • Construction Progress Meetings will be held per the Contract documents and will last approximately one hour or as necessary. Contractor requested meeting be held on Tuesday at 7 a.m. • Daily meetings will be per the CQA Plan or as required by Golder Associates. </div>		
Prepared By <p style="text-align: center;">Jim Morton/Peyton Rackley</p> <hr/> Title Field Contract Engineers	Approved By <p style="text-align: center;">Jim Morton/Peyton Rackley</p> <hr/> Title Field Contract Engineers	

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type PRECONSTRUCTION MEETING	Meeting No. 5346-004	Date August 25, 1993
Project or Work Order No. and Title KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY	Page No. Page 5 of 8	
Minutes Continued		
<p>XI <u>SUBMITTALS</u></p> <ul style="list-style-type: none"> • KEH provided the contractor data transmittal forms to use to transmit submittals to KEH. Each submittal shall have a separate transmittal form completely filled out with Submittal No., Specification Section, Title and Description of submitted data. • Twelve (12) copies of all submittal are required. A fifteen (15) day turnaround is allowed for KEH to review submittals. • The contractor is required to review and approve all submittals prior to transmitting to KEH. • Upon receipt of deficient submittal data, the contractor shall make corrections noted on the transmittal and shall resubmit the data to KEH within ten (10) calendar days. • Critical submittals one through ten have been received by KEH are being distributed for review. Qualifications for liner installer and pugmill operators have been reviewed and are acceptable. <p>XII <u>PROGRESS SCHEDULES</u></p> <ul style="list-style-type: none"> • A progress schedule must be submitted. Schedules are due within 30 days after NTP or before. • The Contract Completion 268 days after NTP. • Specific milestones as specified in 1010-3.1.3.2. • Work is scheduled to start on or about September 1, 1993 or after NTP is issued. <p>XIII <u>QUALITY ASSURANCE</u></p> <ul style="list-style-type: none"> • QA/QC requirements were reviewed by Golder Associates and as specified in the Contract documents. • Reviewed Hold and Witness points. Destruct test will be by Golder. 		
Prepared By Jim Morton/Peyton Rackley	Approved By Jim Morton/Peyton Rackley	
Title Field Contract Engineers	Title Field Contract Engineers	

HFM_614.KEH 9/1/90

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type <p style="text-align: center;">PRECONSTRUCTION MEETING</p>	Meeting No. <p style="text-align: center;">5346-004</p>	Date <p style="text-align: center;">August 25, 1993</p>
Project or Work Order No. and Title <p style="text-align: center;">KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY</p>	Page No. <p style="text-align: center;">Page 6 of 8</p>	
Minutes Continued <div style="margin-left: 40px;"> <p>XIV <u>CONSTRUCTION FACILITIES & TEMPORARY CONTROLS</u></p> <ul style="list-style-type: none"> • First Aid is available at 2719 Bldg. in the 200 West Area. • Storage and laydown areas are available at job site and as directed by KEH. • The waste disposal area is located about 10 miles from job site, Central landfill. • Water is available after tie-in is completed and per Contract documents. • Drinking water is not available. • Electrical power is not available. • Telephones are not available. Use of cellular are required. • Toilets and washrooms are not available. Contractor to provide per contract. • Dust Control is required during all construction activities. • A field office is required. <p>XV <u>TRANSPORTATION AND HANDLING</u></p> <ul style="list-style-type: none"> • Railroad shipments are possible into the Hanford Site per Addendum No. 1 and Section 01610 of the Contract documents. <p>XVI <u>PRODUCT OPTION AND SUBSTITUTION</u></p> <ul style="list-style-type: none"> • The contractor must prepare a substitution approval request for any product substitutions. <p>XVII <u>PROJECT RECORD DOCUMENTS</u></p> <ul style="list-style-type: none"> • Contract documents are required to be turned over to KEH after certain activities are completed and after Completion of Construction. • One (1) copy of the Certified Payroll is required on a weekly basis. Payroll shall include employee's full name and Social Security Number. • Daily Force and Equipment Reports are required. The format for reporting is the contractor's choice. </div>		
Prepared By <p style="text-align: center;">Jim Morton/Peyton Rackley</p>	Approved By <p style="text-align: center;">Jim Morton/Peyton Rackley</p>	
Title Field Contract Engineers	Title Field Contract Engineers	

HPM_614-KEH 9/1/90

**KAISER ENGINEERS
HANFORD**

MINUTES OF MEETING - CONTINUED

Type PRECONSTRUCTION MEETING	Meeting No. 5346-004	Date August 25, 1993
Project or Work Order No. and Title KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY	Page No. Page 7 of 8	
Minutes Continued		
<ul style="list-style-type: none"> Weekly manpower reports are to be submitted to KEH and due by Friday noon, KEH to furnish the forms. Test reports are required for certain activities per the Contract documents. 		
XVIII SPECIFICATIONS		
<ul style="list-style-type: none"> Contractor received six (6) sets of drawings and specifications. 		
XIX GENERAL		
<ul style="list-style-type: none"> The contractor was advised he should not proceed with any changes to the contract without prior written direction from the Contract Administrator or the Field Contract Engineer. Contractors shall not direct shipments to "Kaiser Engineers Hanford, 801 First Street, Richland, Washington 99352", or to themselves in care of Kaiser Engineers Hanford Company. Shipments should be addressed to: CONTRACTOR <u>Delhur Industries, Inc.</u> PROJECT NO. <u>KEH 5346- W-025</u> ADDRESS <u>23rd St. and Dayton Ave, 200 West Area</u> The contractor should arrange for appropriate badging and be mobilized and able to off-load shipments with his equipment. Any deviations in this procedure must be approved by the Director of Subcontracts and Procurement or back charges will be made. Contractors responsible for their lower tier subcontractors. This responsibility includes the timely submission of all contract required documents as well as copies of Certified Payrolls. Failure to comply on any level could delay processing of payments. WHC to provide temporary power, WHC shall issue LOI requesting Contract Change. KEH will issue Change Order after receiving direction from WHC. Golder Associates requested not KEH to hold weekly progress meetings any day except Mondays. Contractor requested the meetings to be held on Tuesday at 7 a.m. that was agreeable to all parties involved. 		
Prepared By Jim Morton/Peyton Rackley	Approved By Jim Morton/Peyton Rackley	
Title Field Contract Engineers	Title Field Contract Engineers	

HPM_614-KEH 9/1/90

**KAISER ENGINEERS
HANFORD****MINUTES OF MEETING - CONTINUED**

Type PRECONSTRUCTION MEETING	Meeting No. 5346-004	Date August 25, 1993
Project or Work Order No. and Title KEH-5346 W-025 RADIOACTIVE MIXED-WASTE LAND DISPOSAL FACILITY	Page No. Page 8 of 8	
Minutes Continued <ul style="list-style-type: none">• Contractor is required by Contract to have a signed HSSA for all subcontractors.• Need JSA for specific work activities before NTP can be issued. Contractor will develop plan for the following activities: Mobilization, excavation, pugmill operations, test fill construction.• Contractor requested map of Hanford area. KEH will hard copy.• KEH requested the contractor to use RFI for all requested information. KEH to issue forms. <p>Unless the originator is advised otherwise, it is assumed that the foregoing Meeting Minutes are correct as written.</p>		
Prepared By Jim Morton/Peyton Rackley	Approved By Jim Morton/Peyton Rackley	
Title Field Contract Engineers	Title Field Contract Engineers	

HPM_614.KEH 9/1/90

APPENDIX C-2

GEOSYNTHETICS PRECONSTRUCTION MEETING MINUTES

RMW LAND DISPOSAL FACILITY, NON DRAG-OFF
PRECONSTRUCTION MEETING WITH GEOMEMBRANE INSTALLER
NOVEMBER 17, 1993
REF. NO. 933-1354

ATTENDANCE

<u>NAME</u>	<u>REPRESENTING</u>
DENNIS MARTIN	GEOPACIFIC
DAVE MATHIS	GCS
STEVE MILKA	GCS
SCOTT MATTHEES	GCS

GENERAL DISCUSSION

Subgrade acceptance certificates will be required prior to deployment.

GeoPacific will install geomembrane on the slopes, then the floor, then in the sump.

Trial seams will be required every four hours, generally at the start of the day and after lunch. If a breakdown of a welding apparatus occurs, a new trial seam will be required after that piece of equipment is repaired (before being allowed to resume welding). During each seaming period, each technician who will be welding will be required to perform a trial seam with each welding apparatus he will be using.

Overlap for extrusion welds shall be at least 3 inches, and overlap for fusion welds shall be at least 5 inches.

Destructive test samples will be obtained at a minimum frequency of every 500 feet of welded seam. If a destructive test fails, bracketing destructive tests will be required at least ten feet on either side of the failing test. At a minimum, capped seams longer than 150 feet in length will destructively tested.

For welding below 40 degrees F., GCS will require additional trial seams, and will increase the frequency of destructive tests. GeoPacific should certify that their cold weather seams will be equivalent in quality to seams produced at temperatures between 40 and 104 degrees F., and that such welding will not cause physical or chemical modifications such that the short-term or long-term performance of the liner will be adversely affected.

Resumes have been received for the crew proposed for this project. If the crew which actually works on this project is different from the proposed crew, resumes of the new people will be required.

Generators must be fueled outside of the liner area, unless GeoPacific can construct suitable catch basins to catch spilled fuel and prevent spillage of the fuel on liner, even during windy conditions.

November 17, 1993

2

933-1354

Calibration for GeoPacific's field tensiometer must be supplied to GCS.

Calibration for the vacuum gauges to be used in vacuum testing extrusion welds must be supplied to GCS.

Calibration for the pressure gauges to be used in air pressure testing the fusion seams must be supplied to GCS.

APPENDIX C-3
ENGINEERING CHANGE NOTICES

ENGINEERING CHANGE NOTICE				1. ECN <u>191281</u>		
			Page 1 of <u>12</u>	Proj. ECN <u>W025-001</u>		
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Supersede ☐ Discovery ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shurt, Golder Associates Inc. (206) 883-0777		4. Date 5-17-93			
	5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys. Fac. No. 200W / 218-W-5	7. Impact Level 3Q			
	8. Doc. No. Affected (include rev. and sheet no.) see item 12 below. & pg. 12	9. Related ECN No(s). W-025-002, -003, -004	10. Related PO No. NA			
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package Doc. No. NA	11c. Complete Installation Work NA Cog. Engineer/Signature & Date	11d. Complete Restoration (Temp. ECN only) NA Cog. Engineer Signature & Date			
12. Description of Change Changes and Clarifications to Project W-025 Design Drawings (see attached sheets): <ol style="list-style-type: none"> 1. Drawing No. H-2-131584, Details 16 and 35: Revise pavement configuration at intersection of entrance road and Dayton Ave. entrance road and truck staging area. Add paving on 50 ft radius. 2. Drawing No. H-2-131579, Detail 4: Remove gravel hatching from 4-in diameter HDPE drainage pipe at toe of slope. 3. Drawing No. H-2-131584, Section D and Detail 13: Change "Truck Staging Area" to "Truck Unloading Area". 4. Drawing No. H-2-131587, Sheet 4 of 4: <ul style="list-style-type: none"> Add pump WSP3 to panel A. Increase size of panel. Remove pump WSP3 from panel B. Elementary Diagram: Relocate pump WSP3 from Panel B to Panel A. Conduit and Wire Schedule: Add conduit CNW5016 (symbol 20). Remove wires for pump WSP3 from conduit CNW5014. 5. Drawing No. H-2-131587, Sheet 3 of 4: Editorial revisions to title block. Drawing reissued as Rev. 2; not attached to this ECN. (Continued on attached sheet 2a)						
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	13b. Justification Details <ol style="list-style-type: none"> 1. Provide easier turning for large trucks. 2. Correct drafting error. 3. Correct drafting error. 4. Larger pump motor requires 3 phase rather than single phase power. 5. Correct drafting error. 6. Potential land use conflict with existing facilities. 7. Editorial. 8. Editorial. 9. Administrative. 					
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (2) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1) </td> <td style="width: 50%; vertical-align: top;"> KEH DISTRIBUTION J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1) </td> </tr> </table>			WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (2) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1)	KEH DISTRIBUTION J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1)	RELEASE STAMP <div style="border: 1px solid black; padding: 10px; margin-top: 10px; text-align: center;"> OFFICIAL RELEASE BY WHC DATE MAY 27 1993 <i>Sta #10</i> </div>	
WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (2) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1)	KEH DISTRIBUTION J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1)					

ENGINEERING CHANGE NOTICE		Page 2 of 12	1. ECN (use no. from pg. 1) W-025-001			
15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ENGINEERING Additional ☒ \$ 0 Savings ☐ \$ _____ </div> <div style="text-align: center;"> CONSTRUCTION Additional ☒ \$ 0 Savings ☐ \$ _____ </div> </div>	17. Schedule impact (days) Improvement ☒ 0 Delay ☐ _____				
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.						
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;"> SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐ </td> <td style="width: 33%; vertical-align: top;"> Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Samp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐ </td> <td style="width: 33%; vertical-align: top;"> Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLBG Part B Permit Application ☒ </td> </tr> </table>				SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Samp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLBG Part B Permit Application ☒
SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Samp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLBG Part B Permit Application ☒				
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.						
Document Number/Revision <u>WHC-SD-W-025-PLN-001 Rev. 2</u> <u>DOE/RL-88-20, Supplement 2</u>						
20. Approvals						
Signature OPERATIONS AND ENGINEERING Cog./Project Engineer <u>[Signature]</u> Cog./Project Engr. Mgr. <u>[Signature]</u> QA <u>[Signature]</u> Safety _____ Security _____ Proj. Prog./Dept. Mgr. _____ Def. React. Div. _____ Chem. Proc. Div. _____ Def. Wst. Mgmt. Div. _____ Adv. React. Dev. Div. _____ Proj. Dept. _____ Environ. Div. _____ IRM Dept. _____ Facility Rep. (Ops) _____ Other _____	Date <u>5/25/93</u> <u>5/25/93</u> <u>5/25/93</u> _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Signature ARCHITECT-ENGINEER PE <u>[Signature]</u> QA <u>[Signature]</u> Safety <u>N/A</u> Design <u>[Signature]</u> Other <u>[Signature]</u> DEPARTMENT OF ENERGY <u>[Signature]</u> ADDITIONAL _____ _____ _____	Date <u>5-20-93</u> <u>5-24-93</u> _____ _____ <u>21 May 93</u> _____ _____ <u>26 May 93</u> _____ _____ _____			

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 2a of 12

1. ECN (use no. from pg. 1)
W-025-001

Continued from Section 12, page 1:

6. Drawing Nos. H-2-131575, H-2-131576, and H-2-131577: Remove "Excavation Stockpile Area" and "Admix Preparation Area" locations. Add note that excavation stockpile and admix preparation locations shall be approved by the Construction Manager.
7. Drawing No. H-2-131587, Sheet 4 of 4, Elementary Diagram: Change callout for watt-hour meter to refer to detail number 33.
8. Drawing Nos. H-2-131575, H-2-131576, and H-2-131577: Change CP4 Northing to 44121.29.
9. Alt: Place Golder Associates CAD file number in appropriate location in title block.

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131584

Date 10-26-92 By FSS Ckd GM

ECN No. W-025-001

Page 3 of 112 686

Description of Change: Revise pavement configuration at intersection of entrance road and Dayton Ave, entrance road and truck staging area.

GRADING PLAN OF TRUCK STAGING AND UNLOADING AREAS

16
H-2-131584

0 20 40
SCALE IN FEET

ecn00101.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131584

Date 10-26-92 By FSS Ckd GM

ECN No. W-025-001

Page 4 of 12 *6866*

Description of Change: Revise pavement configuration at intersection of entrance road and Dayton Ave, entrance road and truck staging area.

PAVED CONTOURS OF TRUCK STAGING AND UNLOADING AREAS

35
H-2-131584

0 20 40
SCALE IN FEET

ecn00102.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131579

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 5 of 12 ~~686~~

Description of Change: Remove gravel hatching from 4-in dia.
HDPE drainage pipe. No other changes.

TYPICAL TOE OF SLOPE DETAIL

4
H-2-131579

0 2 4
SCALE IN FEET

ecn00103.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131584

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 6 of 12 ~~486~~

Description of Change: Change "Truck Staging Area" to
"Truck Unloading Area".

ACCESS RAMP PROFILE D H-2-131584

0 20 40
SCALE IN FEET

ecn00104.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131584

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 7 of 12 *686*

Description of Change: Change "Truck Staging Area" to
"Truck Unloading Area".

**ACCESS RAMP/TRUCK
UNLOADING AREA DETAIL**

13
H-2-131584

0 5 10
SCALE IN FEET

ecn00105.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131587

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 8 of 12 *ELC*

Description of Change: Add pump W5P3 to Panel A.
Increase size of panel.

[illegible]

ecn00106.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131587

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 9 of 112 6846.

Description of Change: Remove pump W5P3 from Panel B.

PANEL SCHEDULE									
PANEL: <u>8</u>				LOCATION: _____		CONTROL BLDG			
SURFACE ☒ FLUSH ☐				<div style="display: flex; justify-content: space-around;"> A B C </div>		120/240 _____ VOLTS 1 PHASE 3 WIRE			
A.I.C. <u>10K</u>						30 _____ AMP MAIN BREAKER			
CIRCUIT DESCRIPTION				KVA		AMP		CIRCUIT DESCRIPTION	
PUMP - 1/2 HP				1.1		15		1 2	
WSP1						2		3 4	
PUMP - 1/2 HP				1.1		15		5 6	
WSP2						2		7 8	
SPARE						15		9 10	
↓						2		11 12	
SPARE								13 14	
↓								15 16	
CONNECTED LOAD:				6.3 KVA		26 AMP		17 18	
NOTES: _____				DEMAND LOAD:		_____ KVA		_____ AMP	

ecn00107.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131587

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 10 of 11 12 686

Description of Change: Relocate pump W5P3 from Panel B to Panel A.

ELEMENTARY DIAGRAM

N.T.S.

ecn00108.dwg

ENGINEERING CHANGE NOTICE

Modifies Dwg. No. H-2-131587

Date 10-27-92 By FSS Ckd GM

ECN No. W-025-001

Page 11 of 112 686

Description of Change: Add conduit CNW5016 (symbol 20).

Remove wires for pump W5P3 from conduit CNW5014.

CONDUIT AND WIRE SCHEDULE						
SYMBOL	CONDUIT SIZE	WIRE	CIRCUIT NO.	DESCRIPTION	NOTES	CONDUIT NO.
1	3/4"	2#12 & 1#12 G.	A-2	TRANSFORMER		CNW5010
2	3/4"	3#10 & 1#12 G.	-	PANEL 'B'		CNW5011
3	3/4"	2#12 & 1#12 G.	B-4	RECEPTACLE		CNW5012
4	3/4"	2#12 & 1#12 G.	B-6	LIGHT, SWITCH		CNW5013
5	3/4"	3#12 & 1#12 G.	B-1 (5)	TO MS1 (MS2)	TO EACH	CNW5014 (15)
6	3/4"	4 #14	-	TO CONTROL PANEL FROM MS1 (MS2,MS3)	TO EACH	CNW5017 (18,19)
7	3/4"	2#12 & 1#12 G.	A-6	TO PHOTOCELL, J-BOX	3 #12 TO PHOTOCELL	CNW5020
8	3/4"	2#10 & 1#10 G.	A-6	TO OUTDOOR LIGHTS	BELOW GRADE	CNW5021
9	3/4"	3#12 & 1#12 G.	A-1	TO MS4	BELOW GRADE	CNW5007
10	3/4"	4#14 & 1#14 G.	-	TO FS1 & FS2	BELOW GRADE	CNW5001
11	3/4"	3#12 & 1#12 G.	-	TO PUMP W5P3	BELOW GRADE	CNW5002
12	3/4"	6#12 & 1#12 G.	-	TO PUMPS W5P1 & W5P2	BELOW GRADE	CNW5003
13	3/4"	AS REQUIRED	-	TO LEVEL SENSORS	BELOW GRADE	CNW5004
14	3/4"	2#12 & 1#12 G.	-	TO SOLENOID VALVE W54	BELOW GRADE	CNW5005
15	3/4"	2#12 & 1#12 G.	-	TO FS3	BELOW GRADE	CNW5006
16	3/4"	2#12 & 1#12 G.	-	TO ALARM BEACON		CNW5009
17	3/4"	2#8 & 1#10 G.	B-8	TO HEAT CABLE	BELOW GRADE	CNW5008
18	3/4"	2#12 & 1#12 G.	B-2	TO CONTROL PANEL		CNW5022
19	1 1/2"	4#2	-	SERVICE		CNW5023
20	3/4"	3#12 & 1#12 G.	A-7	TO MS3		CNW5016

ecn00109.dwg

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 12 of 12

1. ECN

W-025-001

GENERAL REVISION TO THE FOLLOWING DRAWINGS & SPECIFICATIONS:

H-2-131573, "COVER SHEET," REV 1, SHEET 1 OF 1
H-2-131574, "SITE PLAN AND EXPLORATIONS," REV 1, SHEET 1 OF 1
H-2-131575, "GRADING PLAN," REV 1, SHEET 1 OF 1
H-2-131576, "SECONDARY ADMIX CONTOURS," REV 1, SHEET 1 OF 1
H-2-131577, "OPERATIONS LAYER CONTOURS," REV 1, SHEET 1 OF 1
H-2-131578, "CROSS-SECTIONS," REV 1, SHEET 1 OF 1
H-2-131579, "LINER SYSTEM DETAILS," REV 1, SHEET 1 OF 1
H-2-131580, "SUMP LAYOUT," REV 1, SHEET 1 OF 1
H-2-131581, "SUMP CROSS-SECTIONS," REV 1, SHEET 1 OF 1
H-2-131582, "SUMP LEACHATE COLLECTION PIPES," REV 1, SHEET 1 OF 1
H-2-131583, "SIDE SLOPE AND VERTICAL RISER PIPES," REV 1, SHEET 1 OF 1
H-2-131584, "TRUCK STAGING AREA AND ACCESS RAMP," REV 1, SHEET 1 OF 1
H-2-131585, "LEACHATE COLLECTION TANK AND PIPING," REV 1, SHEET 1 OF 1
H-2-131586, "SUMP PUMP DETAILS," REV 1, SHEET 1 OF 1
H-2-131587, "ELECTRICAL," REV 1, SHEET 1 OF 4
H-2-131588, "CONCEPTUAL FILL PLAN," REV 1, SHEET 1 OF 1
H-2-131589, "SUBGRADE GRID POINTS," REV 1, SHEET 1 OF 1
H-2-131590, "SECONDARY ADMIX GRID POINTS," REV 1, SHEET 1 OF 1
H-2-131591, "SECONDARY DRAINAGE GRAVEL GRID POINTS," REV 1, SHEET 1 OF 1
H-2-131592, "PRIMARY DRAINAGE GRAVEL GRID POINTS," REV 1, SHEET 1 OF 1
H-2-131593, "OPERATIONS LAYER GRID POINTS," REV 1, SHEET 1 OF 1
H-2-131594, "PRIMARY ADMIX GRID POINTS," REV. 0, SHEET 1 OF 1

ENGINEERING CHANGE NOTICE			1. ECN <u>NA-6846</u>	
Page 1 of 3			Proj. ECN W-025-002	
ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Supersede ☐ Discovery ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shurt, Golder Associates Inc. (206) 883-0777		4. Date 5-19-93	
	5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys. Fac. No. 200W / 218-W-5	7. Impact Level 30	
	8. Doc. No. Affected (include rev. and sheet no.) WHC-S-045 Rev. 1	9. Related ECN No(s). W-025-001, -003, -004	10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Blk. 11b), ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package Doc. No. NA	11c. Complete Installation Work NA	11d. Complete Restoration (Temp. ECN only) NA	
		Cog. Engineer/Signature & Date	Cog. Engineer Signature & Date	
12. Description of Change Changes and Clarifications to Project W-025 Specifications: 1. Section 02224, Part 3-1 A. 1.: Delete "ASR 280E". Delete "Production capability of 300 tons per hour." 2. Section 02224, Part 3-1 A. 2.: Add "Alternatively, belt scales on finished product belt only, and scale(s) for accurately weighing soil and bentonite in small batches to the satisfaction of the Construction Manager and the COA Engineer prior to mixing." 3. Section 02224, Part 3-1 A.5.: Change to "Variable speed hydraulic supply water pumps capable of producing 300 tons per hour of admixture." 4. Section 02224, Part 3-1 F.: Add to end of paragraph "The Contractor shall provide a means of testing for the percentage of bentonite by the methylene blue method. A minimum of three tests shall be performed on each sample. At least two test results shall be within the specified limits of bentonite content, and the third result shall be within 0.5% of the specified limits."				
(Continued on attached sheet)				
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐	13b. Justification Details 1. Unnecessarily restrictive requirement. 2. Potentially lower cost option. 3. Necessary requirement based on experience. 4. Necessary requirement based on experience. 5. Potentially not applicable and therefore misleading. 6. Clarification. 7. Clarification. 8. Additional requirement to facilitate QA. 9. Additional requirements to improve material and work quality. 10. Additional requirement to improve work quality. 11. Clarification. 12. Additional requirements to improve material and work quality. 13. Already in design, therefore not required of Contractor. 14. Already in design, therefore not required of Contractor. 15. Verify installation quality. 16. Verify that material meets specifications. 17. Verify material quality. 18. More accurate value. 19. Clarification. 20. Changes in industry standards.			
14. Distribution (include name, MSIN, and no. of copies) <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) Dorian B2-16 (1) J. Evans H4-57 (1) J.M. Nielsen T3-29 (1) </div> <div style="width: 45%;"> KEH DISTRIBUTION J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1) </div> </div>			RELEASE STAMP <div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 150px;"> OFFICIAL RELEASE BY WHC DATE MAY 27 1993 <i>Sta # 10</i> </div>	

ENGINEERING CHANGE NOTICE

Page 2 of 3

1. ECN (use no. from pg. 1)
W-025-002

15. Design Verification Required

☐ Yes
☒ No

16. Cost Impact

ENGINEERING

Additional Savings ☒ \$ 0
☐ \$

CONSTRUCTION

Additional Savings ☒ \$ 0
☐ \$

17. Schedule impact (days)

Improvement ☒ 0

Delay ☐

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Construction Quality Assurance Plan	☒
Environmental Report	☐	Inspection Plan	☐	LLBG Part B Permit Application	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
WHC-SD-W-025-PLN-001 Rev. 2		
DOE/RL-88-20, Supplement 2		

20. Approvals

Signature
OPERATIONS AND ENGINEERING

Cog./Project Engineer [Signature] 5/25/93

Cog./Project Engr. Mgr. [Signature] 5/25/93

QA [Signature] 5/25/93

Safety _____

Security _____

Proj. Prog./Dept. Mgr. _____

Def. React. Div. _____

Chem. Proc. Div. _____

Def. Wst. Mgmt. Div. _____

Adv. React. Dev. Div. _____

Proj. Dept. _____

Environ. Div. _____

IRM Dept. _____

Facility Rep. (Ops) _____

Other _____

Signature
ARCHITECT-ENGINEER

PE [Signature] 5-20-93

CA [Signature] 5-24-93

Safety NA _____

Design [Signature] _____

Other [Signature] 21 May 93

DEPARTMENT OF ENERGY

[Signature] 26 May 93

ADDITIONAL

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 3

1. ECN (use no. from pg. 1)
W-025-002

Continued from Section 12, page 1:

7. Section 02224, Part 3-5 H.: Remove "or 825C".

8. Section 02226, Part 3-1 F.: Revise last sentence to read "Grading equipment shall operate on no less than 1 foot of drainage layer material over any geosynthetic layer."

9. Section 02228, Part 3-1 A.3.: Revise last sentence to read "Grading equipment shall operate on a minimum of 2 feet of operations layer material."

10. Section 02275, Part 2-1, C.2.: Revise first bullet to read "roll numbers and identification, resin lot and batch numbers; and".

11. Section 02511: Add new part

"1-5 SUBMITTALS

A. Submit asphalt concrete mix design for approval prior to ordering materials.

B. Prior to construction, submit for approval the proposed methods for placing and compacting top course and asphalt layers, and for applying all primers and coatings.

C. Submit in accordance with Section 01300."

12. Section 02725, Part 1-3: Add new paragraph "D. Submit qualifications of proposed joining personnel."

13. Section 02725, Part 3-4, C.: Add "Hold test pressure for 1 hour."

14. Section 03310, Part 1-2: Add new paragraphs

"C. Submit concrete mix design for approval prior to ordering materials.

D. Submit manufacturer's technical data on waterstops and proposed installation methods prior to ordering materials.

E. Submit manufacturer's technical data on anchor bolts and proposed installation methods prior to ordering materials."

Section 13340, Part 2-3: Delete "conforming to the requirements of Hanford Site Standards".

15. Section 16010, Part 1-4, B: Delete "All applicable Hanford Plant Standards".

16. Section 02275, Part 3-1, E: Add new subsection:

"13. Containment Basin Liner Testing

The lining of the containment basin under the leachate storage tank shall be tested to demonstrate that it is free from leaks. To perform the test, the basin shall be filled with clean water. The water level shall be measured to the nearest 0.01 inch over a minimum time of 48 hours. If the water level decreases, the basin shall be drained and the leak repaired in accordance with the procedures described in the previous section of these Specifications. The testing and repair activities shall be repeated until a passing result is achieved. During the test, measures shall be taken as necessary to prevent precipitation from entering the basin. If the testing is performed during hot weather, it may be necessary to cover the water surface to prevent evaporation."

17. Section 02226, Part 2-1: Add to end of first paragraph: "The CQA Engineer will perform a slake durability test on the gravel samples submitted by the Contractor. A loss in weight of less than 1% will be considered acceptable."

18. Section 02224, Part 2-2: Add after first sentence: "The bentonite shall have a free swell of 25 ml per 2 gm or greater."

19. Section 02275, Part 2-1, B.2: Change specific gravity requirement from "> 0.94" to "> 0.935".

20. Section 02275, Part 2-1, B.5: Add "textured" before "geomembrane".

21. Section 02275, Part 2-1, table of Required Geomembrane Properties:

- Change puncture resistance of Type II geomembrane to 80 lbs.
- Change puncture resistance of Type III geomembrane to 105 lbs.
- Change resistance to soil burial of Types II and III geomembrane to 90%.
- Change environmental stress crack of Types II and III geomembrane to 2000 hrs.

ENGINEERING CHANGE NOTICE				Page 1 of 2
1. ECN 686			Proj. ECN W-025-003	
2. ECN Category (mark one) ☐ Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Supersede ☐ Discovery ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 5-19-93	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys. Fac. No. 200W / 218-W-5		7. Impact Level 3Q
8. Doc. No. Affected (include rev. and sheet no.) WHC-SD-W025-ATP-001 Rev. 0		9. Related ECN No(s). W-025-001, -002, -004		10. Related PO No. NA
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)		11b. Work Package Doc. No. NA		11c. Complete Installation Work NA
11d. Complete Restoration (Temp. ECN only) NA		Cog. Engineer/Signature & Date		Cog. Engineer Signature & Date
12. Description of Change Changes and Clarifications to Project W-025 Acceptance Test Procedure, Instrumentation/Electrical: 1. Paragraph 7.1.4: Change end of sentence to read "... in accordance with technical specifications WHC-S-045, latest revision." 2. Paragraph 3.6: Revise last sentence to read "Performance of test activities shall always include safety and health aspects as delineated in the most current version of the Federal Occupational Safety and Health Administration / Washington Industrial Safety and Health Act (OSHA/WISHA) safety health codes and standards."				
13a. Justification (mark one) ☐ Criteria Change ☐ Design improvement ☐ Environmental ☐ As-Found ☒ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission		13b. Justification Details 1. Clarification. 2. Original document superseded.		
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RELEASE STAMP				
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ENGINEERING CHANGE NOTICE		Page 2 of 2	1. ECN (use no. from pg. 1) W-025-003																																																																
15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ENGINEERING Additional ☒ \$ 0 Savings ☐ \$ _____ </div> <div style="text-align: center;"> CONSTRUCTION Additional ☒ \$ 0 Savings ☐ \$ _____ </div> </div>	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐ _____																																																																	
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ENGINEERING CHANGE NOTICE				1. ECN
Page 1 of 3				Proj. ECN W-025-004
ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Supersede ☐ Discovery ☐ Cancel/void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shurt, Golder Associates Inc. (206) 883-0777		4. Date 5-19-93	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys. Fac. No. 200W / 218-W-5	7. Impact Level 3Q	
8. Doc. No. Affected (include rev. and sheet no.) WHC-SD-W025-PLN-001 Rev. 2		9. Related ECN No(s). W-025-001, -002, -003	10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package Doc. No. NA	11c. Complete Installation Work NA	11d. Complete Restoration (Temp. ECN only) NA	
Cog. Engineer/Signature & Date		Cog. Engineer Signature & Date		
12. Description of Change Changes and Clarifications to Project W-025 Construction Quality Assurance Plan: 1. Appendix A, CQA Summary Requirements, Specification Section 02224, page 1: Change acceptance criteria for Bentonite Content to read "11% to 14% dry weight as determined by #200 sieve". 2. Appendix A, CQA Summary Requirements, Specification Section 02511, page 1: For first entry "Contractor submittal ...", change Specification Section & Paragraph to "02511 1-5". 3. Appendix A, CQA Summary Requirements, Specification Section 09900, page 1: Change all entries in CQA Ref. column to "4.7". 4. Section 4.4.2.3: Add new subsection: <u>"Containment Basin Under Testing"</u> The lining of the containment basin under the leachate storage tank shall be tested to demonstrate that it is free from leaks. To perform the test, the basin shall be filled with clean water. The water level shall be measured to the nearest 0.01 inch over a minimum time of 48 hours. If the water level decreases, the basin shall be drained and the leak repaired in accordance with the procedures described in the Specifications. The testing and repair activities shall be repeated until a passing result is achieved. The installer shall be responsible for supplying all equipment and performing the test. The results shall be submitted to the CQA Engineer for review prior to approving the liner installation. During the test, measures shall be taken as necessary to prevent precipitation from entering the basin. If the testing is performed during hot weather, it may be necessary to cover the water surface to prevent evaporation. All such measures shall be the installer's responsibility."				
(Continued on attached sheet)				
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facility Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐	13b. Justification Details <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> 1. Revise to be consistent with Specifications. 2. Revise to be consistent with Specifications. 3. Editorial 4. Verify installation quality. 5. Verify installation quality. 6. Verify that material meets specifications. 7. Verify that material meets specifications. </div> <div style="width: 45%;"> 8. Verify material quality. 9. Verify material quality. 10. Verify assumed conditions. </div> </div>			
14. Distribution (include name, MSIN, and no. of copies) <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <u>WHC DISTRIBUTION</u> Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) J. Briggs G6-47 (1) J. Johnson H2-58 (1) J.J. Dorlan B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1) </div> <div style="width: 45%;"> <u>KEH DISTRIBUTION</u> J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) <u>DOE DISTRIBUTION</u> M.S. Collins A5-18 (1) </div> </div>		RELEASE STAMP <div style="border: 1px solid black; padding: 10px; text-align: center;"> OFFICIAL RELEASE 23 BY WHC DATE MAY 27 1993 SA #10 </div>		

ENGINEERING CHANGE NOTICE				Page 2 of 3	1. ECN (use no. from pg. 1) W-025-004
15. Design Verification Required ☐ Yes ☒ No		16. Cost Impact <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ENGINEERING Additional Savings ☐ \$ <u>0</u> </div> <div style="text-align: center;"> CONSTRUCTION Additional Savings ☐ \$ <u>0</u> </div> </div>		17. Schedule Impact (days) Improvement ☒ <u>0</u> Delay ☐ _____	
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.					
☐ SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit		☐ Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Samp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request		☐ Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☒ LLBG Part B Permit Application ☐ _____ ☐ _____	
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.					
Document Number/Revision		Document Number/Revision		Document Number/Revision	
<u>DOE/RL-88-20, Supplement 2</u>		_____		_____	
_____		_____		_____	
_____		_____		_____	
20. Approvals					
Signature		Date		Signature	
OPERATIONS AND ENGINEERING				ARCHITECT-ENGINEER	
Cog./Project Engineer <u>[Signature]</u>		<u>5/25/93</u>		PE <u>Frank S. Shiri</u>	
Cog./Project Engr. Mgr. <u>[Signature]</u>		<u>5/25/93</u>		OA <u>[Signature]</u>	
CA <u>[Signature]</u>		<u>5/26/93</u>		Safety _____	
Safety _____		_____		Design <u>[Signature]</u>	
Security _____		_____		Other <u>[Signature]</u>	
Proj. Prog./Dept. Mgr. _____		_____		_____	
Def. React. Div. _____		_____		_____	
Chem. Proc. Div. _____		_____		_____	
Def. Wst. Mgmt. Div. _____		_____		DEPARTMENT OF ENERGY	
Adv. React. Dev. Div. _____		_____		<u>[Signature]</u>	
Proj. Dept. _____		_____		_____	
Environ. Div. _____		_____		ADDITIONAL	
IRM Dept. _____		_____		_____	
Facility Rep. (Ops) _____		_____		_____	
Other _____		_____		_____	

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 3

1. ECN (use no. from pg. 1)
W-025-004

Continued from Section 12, page 1:

Appendix A, CQA Summary Requirements, Specification Section 02275, page 4: Add requirement for containment basin liner testing.

6. Section 4.3.3: Add requirement for preconstruction slake durability testing.

7. Appendix A, CQA Summary Requirements, Specification Section 02226, page 2: Add requirement for slake durability testing.

8. Section 4.3.2: Add requirement for free swell testing.

9. Appendix A, CQA Summary Requirements, Specification Section 02224, page 1: Add requirement for free swell testing.

10. Section 4.3.1: To second bullet, add requirement for recording data on geologic map during construction, and notifying COTR if unexpected or changed geologic conditions are encountered.

ENGINEERING CHANGE NOTICE				Page 1 of <u>4</u>	ECN <u>106572</u> Proj. ECN <u>W-025-005</u>
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☒ Supersedeure ☐ Discovery ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. Eric G. Erpenbeck, SWP, G6-47, 6-8032			4. Date March 3, 1993	
5. Project Title/No./Work Order No. CF21A RMWDISPOSAL FACILITY/W-025			6. Bldg./Sys./Fac. No. 200W/CWC		7. Impact Level 3 S
8. Document Number Affected (include rev. and sheet no.) H-Z-80895, Sheet 3, Rev 1			9. Related ECN No(s). N/A		10. Related PO No. N/A
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package Doc. No. N/A	11c. Complete Installation Work N/A Cog. Engineer Signature & Date		11d. Complete Restoration (Temp. ECN only) N/A Cog. Engineer Signature & Date	
12. Description of Change TEMPORARY WATER LINE FOR W-025 <p style="margin: 10px 0;">This ECN outlines details for tie in to an existing 12" Sanitary Water line in the 200 West area Low Level Burial Grounds/Central Waste Complex (21B-W-5).</p> <p style="margin: 10px 0;"><u>NOTE:</u> When as-Building the drawing, only show the 6" UL/FM Saddle tap & Gate Valve & 6" Blind flange. The rest of the system is only temporary.</p>					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐		13b. Justification Details <p style="margin: 10px 0;">TO ENSURE WHC UTILITIES REVIEWS & APPROVES TEMPORARY TIE-IN FOR PROJECT W-025 TEMPORARY WATER FOR CONSTRUCTION.</p>			
14. Distribution (include name, MSIN, and no. of copies) * Adv. Copy E. G. Erpenbeck (2 COPIES) W.A. Holstein E6-40 D.A. Rohl S2-66 L.R. TOLLBOM R3-46 S.R. Briggs G6-47 K.D. JOHNSON H5-33 J. R. McGee G6-47 J. M. Neben T4-04 KEH E. M. MEGAHED T4-03 J. R. Morton S2-55				RELEASE STAMP <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> OFFICIAL RELEASE (20) BY WHC DATE JUL 08 1993 <i>Eta. 21</i> </div>	

* STA-3 S2-05 STA-6 T2-03

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ENGINEERING CHANGE NOTICE		Page 2 of <u>4</u>	1. ECN (use no. from pg. 1) W-025-005																																																									
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SEE DETAIL NOTES ON SHEET 4 OF 4

SPECIFICATIONS FOR TEMPORARY WATER LINE ON W-025

NO WORK TO COMMENCE PRIOR TO WHC APPROVED TIE-IN PERMIT SEE SECTION 01065

1. Hand dig to locate existing 12 inch Poly Vinyl Chloride (PVC) line. No digging shall be initiated without the excavation permit. Permit to be provided by Westinghouse Hanford Company (WHC).
2. Bury 6 inch PVC line to match existing 12 inch Sanitary Water line at tie-in.
3. Install all thrust blocks and restraints per National Fire Protection Association (NFPA) and Kaiser Engineers Hanford (KEH) approval.
4. The saddle tap and 6 inch gate valves shall be flange connections all other can be mechanical joint.
5. Provide and install valve box and cover at tie-in. Minimum 40 inch soil cover.
6. After completion of construction remove all pipe and appurtenance to the saddle tap and 6" Underwriters Laboratory Factory Mutual (UL/FM) gate valve. Install a 6 inch blind flange.
7. Saddle tap and gate valve shall be designed for hot tap.
8. Install Per NFPA 24
9. Pipe shall conform to American Water Works Association (AWWA) C900, 6 inch.
10. Submit manufacturers procedure for hot tap and installation, submit to WHC purveyor and KEH for approval.
11. The following equipment shall be required for the temporary construction water, above grade connections:
 - 6 inch slow opening gate valve, rising stem and a 6 inch flow meter.
 - Reduced pressure backflow preventer, similar to Beeco-aergap. KEH/WHC approval.
 - Locking device on 6 inch gate valve to control Gallons Per Minute (GPM) flow not to exceed 400 GPM.
12. Disinfection of components shall be in accordance with the Hanford Plant Standard, HPS-112-M, or AWWA C-650 and/or C-651. Water purveyor will release water line for use after receipt of results of bacteriological Analysis from Hanford Environmental Health Foundation (HEHF).
13. The Reduced Pressure (RP) backflow prevention device shall be on the current Washington State Department of Health approved list. It shall be tested per WHC procedure S-CC-0044 or WHC water purveyor approved equal. System will not be place into service prior to WHC water purveyors review and acceptance of device test data sheet. The RP backflow prevention device shall be skid or stand mounted, and anchored to prevent movement. The device shall be mounted horizontally on framework suitable for supporting the weight of the device and the shutoff valves (#1 and # 2) supplied with the device as required by the Washington State Department of Health.
14. Installation of the backflow prevention device shall be in accordance with the AWWA, Pacific Northwest Section, Accepted Procedure and Practice in Cross-Connection Control Manual, latest edition.
15. When energizing the cross country line, the contractor and/or employees shall not open the 6 inch valve more than four (4) revolutions per minute on the valve hand wheel. KEH shall be notified 4 hours in advance of contractor opening valve and witnessed by KEH to ensure the above procedure is followed. This procedure must be followed for all operations of the valve on and off.
16. All backfill shall be compacted to achieve a density of 95% of Modified Proctor Density (ASTM D1557).
17. Contractor shall sanitize and flush (allow 3 days for testing) temporary water supply line from 12" tap to the above ground connections.
18. Contractor shall provide, install and maintain until completion of the Project, 1200± linear feet of 6 inch Aluminum line with all new gaskets and joint clamps. Cross country line shall be leak free while in operation or repaired per WHC/KEH direction.

ENGINEERING CHANGE NOTICE				1. ECN <u>154076</u> Proj. W-025-006 ECN																						
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 7-7-93																						
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																						
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-S-045 Rev. 2		9. Related ECN No(s). NA		10. Related PO No. NA																						
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date																							
12. Description of Change Changes to Project W-025 Specifications: 1. Section 02275-2, Part 1-7 "Submittals": Add new paragraph: <div style="margin-left: 40px;"> <p>"E. Submit evidence of qualifications of organization that will serve as Geosynthetics Installer. At a minimum, the Geosynthetics Installer shall have successfully completed at least 10 projects consisting of installation of at least 10,000,000 square feet (total) of HDPE liner. Projects shall include RCRA landfills and surface impoundments.</p> <p>Submit qualifications of key personnel including superintendent, foreman, and lead welder. Key personnel shall be full time employees of the Geosynthetics Installer."</p> </div> <p>2. Section 16460 "Dry Type Transformers": Include attached Section in its entirety (2 pages).</p> <p>3. Section 16400, Part 2-8 "Pole Mounted Transformers": Change "75 KV BIL" to "95 KV BIL".</p> <p>4. Section 16400, Part 2-4 "Open Fuse Cutouts - Pole Mounted": Add the following: "Cutouts shall be extra heavy duty, 100 Amp continuous, 5600 Amp interrupting duty or better. Cutouts shall be fused with 2T fuses."</p> <p>5. Section 16450, Part 3-1 "Grounding, General": Add the following: "Grounding shall be performed in accordance with the requirements of the National Electrical Safety Code rules 96 and 97."</p>																										
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A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE				DET 7/9/93 Page 2 of 24	1. ECN (use no. from pg. 1) W-025-006																																																
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SECTION 16460
DRY TYPE TRANSFORMERS

PART 1: GENERAL

1-1 DESCRIPTION

Provide dry type transformers complete and fully operational. Transformers shall be U.L. listed and comply with NEMA Standard ST-20. Deliver transformers to site for testing 2 weeks prior to installation.

1-2 SUBMITTALS

- A. Prepare and submit shop drawings for review prior to manufacture. Include dimensioned front plan and section views, wiring and connection diagrams, and bolting template.
- B. Submit in accordance with Section 01300.

PART 2: PRODUCTS

2-1 MANUFACTURER

Tierney, Sorgel, Westinghouse, General Electric.

2-2 ENCLOSURE

- A. Steel panel enclosure over core, coil, and terminal chamber with louvered openings for convection cooling.
- B. Enclosure required for environment in which located.

2-3 WINDINGS

Separate primary and secondary. Windings shall have Class H insulation and shall be rated for continuous operation at rated KVA with temperature rise of not over 150 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C. Windings and core and coil assembly shall be treated and built to resist the effects of dirt and moisture.

2-4 PRIMARY TAPS

Minimum of two 2-1/2 percent below normal (rated) primary voltage.

2-5 CAPACITY

WHC NON-DRAG-OFF
933-1278

16460-1
May 26, 1993

Continuous rating not less than size noted.

PART 3: INSTALLATION

3-1 MOUNTING

Mount on vertical mounting wall as noted or as required. Remove all shipping blocks prior to installation.

3-2 CONNECTIONS

- A. 120/240 volt single phase secondary transformers shall be considered "grounded neutral separately derived systems" and neutral shall be grounded per code accordingly.
- B. Transformer raceway connections shall be flexible metal conduit as specified in Section 16110.
- C. Voltage Tap Connections: Connect all transformers at "normal" tap. After facility is completely energized, measure secondary voltages at all transformers and reconnect taps as subsequently directed.

3-3 FIELD QUALITY CONTROL

Verify that transformer installation is in accordance with manufacturer's instructions and Drawings and Specifications. Verify correct wire identification and type of transformer.

- END -

1.5

ENGINEERING CHANGE NOTICE				Page 1 of 2	
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ N/A Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐				1. ECN <u>164074</u> Proj. W-025-007 ECN	
3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shurt, Golder Associates Inc. (206) 883-0777				4. Date 6-17-93	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q	
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-SD-W025-ATP-001 Rev. 1		9. Related ECN No(s). NA		10. Related PO No. NA	
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11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date					
12. Description of Change Changes to Project W-025 Acceptance Test Procedure, Instrumentation/Electrical: 1. Paragraph 9.1.1: The circuit breaker for power to pump WSP1 is located on panel A. 2. Paragraph 9.1.4: Change "WPS1" to "WSP1", both locations. 3. Section 10.0: For pumps WSP1, WSP2, WSP3, and WSP4, measure the phase currents prior to beginning the pumping tests. Record this information on the bottom of Test Data Forms 10-2, 10-3, 10-4, and 11-1, respectively. Verify that motor overload devices are sized correctly.					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details 1. Make ATP consistent with current design. 2. Editorial. 3. Standard testing procedure.					
14. Distribution (include name, MSIN, and no. of copies) WHC DISTRIBUTION R. TOLLBom R3-46 Project Files R1-28 (1) G6-47 J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1)				KEH DISTRIBUTION J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Holstein E2-50 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1)	
				RELEASE STAMP OFFICIAL RELEASE BY WHC (23) DATE JUL - 9 1993 <i>Sta #10</i>	

A-7900-013-2 (06/92) GEF095

A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE				Page 2 of 2	1. ECN (use no. from pg. 1) W-025-007																																																				
15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">ENGINEERING</td> <td style="width: 50%; text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☐ \$0</td> <td>Additional ☐ \$0</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>			ENGINEERING	CONSTRUCTION	Additional ☐ \$0	Additional ☐ \$0	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ 0 Delay ☐																																															
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18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.																																																									
SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Semp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☐ LLBG Part B Permit Application ☐																																																							
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.																																																									
Document Number/Revision WHC-SD-W-025-PLN-001 Rev. 3 DOE/RL-88-20, Supplement 2		Document Number/Revision	Document Number Revision																																																						
20. Approvals																																																									
<table style="width: 100%; border: none;"> <tr> <th style="text-align: left;">Signature</th> <th style="text-align: left;">Date</th> </tr> <tr> <td>OPERATIONS AND ENGINEERING</td> <td></td> </tr> <tr> <td>Cog Engineer <i>[Signature]</i></td> <td>7/8/93</td> </tr> <tr> <td>Cog. Mgt. <i>[Signature]</i></td> <td>7/8/93</td> </tr> <tr> <td>QA <i>[Signature]</i></td> <td>7/8/93</td> </tr> <tr> <td>Safety</td> <td></td> </tr> <tr> <td>Security</td> <td></td> </tr> <tr> <td>Environ.</td> <td></td> </tr> <tr> <td>Projects/Programs</td> <td></td> </tr> <tr> <td>Tank Waste Remediation System</td> <td></td> </tr> <tr> <td>Facilities Operations</td> <td></td> </tr> <tr> <td>Restoration & Remediation</td> <td></td> </tr> <tr> <td>Operations & Support Services</td> <td></td> </tr> <tr> <td>IRM</td> <td></td> </tr> <tr> <td>Other</td> <td></td> </tr> </table>		Signature	Date	OPERATIONS AND ENGINEERING		Cog Engineer <i>[Signature]</i>	7/8/93	Cog. Mgt. <i>[Signature]</i>	7/8/93	QA <i>[Signature]</i>	7/8/93	Safety		Security		Environ.		Projects/Programs		Tank Waste Remediation System		Facilities Operations		Restoration & Remediation		Operations & Support Services		IRM		Other		<table style="width: 100%; border: none;"> <tr> <th style="text-align: left;">Signature</th> <th style="text-align: left;">Date</th> </tr> <tr> <td>ARCHITECT-ENGINEER</td> <td></td> </tr> <tr> <td>PE <i>[Signature]</i></td> <td>6-17-93</td> </tr> <tr> <td>QA <i>[Signature]</i></td> <td>6-17-93</td> </tr> <tr> <td>Safety</td> <td></td> </tr> <tr> <td>Design</td> <td></td> </tr> <tr> <td>Environ.</td> <td></td> </tr> <tr> <td>Other <i>[Signature]</i></td> <td>7/8/93</td> </tr> <tr> <td colspan="2" style="text-align: center;">DEPARTMENT OF ENERGY</td> </tr> <tr> <td colspan="2" style="text-align: center;">Signature or Letter No.</td> </tr> <tr> <td colspan="2" style="text-align: center;">- ADDITIONAL</td> </tr> </table>				Signature	Date	ARCHITECT-ENGINEER		PE <i>[Signature]</i>	6-17-93	QA <i>[Signature]</i>	6-17-93	Safety		Design		Environ.		Other <i>[Signature]</i>	7/8/93	DEPARTMENT OF ENERGY		Signature or Letter No.		- ADDITIONAL	
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Date Received: 7/9/93	INFORMATION RELEASE REQUEST	Reference: WHC-CH-3-4
Complete for all Types of Release		
Purpose ☐ Speech or Presentation ☐ Full Paper (Check only one suffix) ☐ Summary ☐ Abstract ☐ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape		ID Number (include revision, volume, etc.) Previously released WHC-SD-W025-ATP-001, Rev. 1 List attachments. ECN W-025-007 Date Release Required 7-8-93
☐ Reference ☒ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☐ Other		

Title W-025 RMW Land Disposal Facility		Unclassified Category UC-	Impact Level 3Q
New or novel (patentable) subject matter? ☒ No ☐ Yes If "Yes", has disclosure been submitted by WHC or other company? ☐ No ☐ Yes Disclosure No(s).		Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? ☒ No ☐ Yes (Identify)	
Copyrights? ☒ No ☐ Yes If "Yes", has written permission been granted? ☐ No ☐ Yes (Attach Permission)		Trademarks? ☒ No ☐ Yes (Identify)	
Complete for Speech or Presentation			
Title of Conference or Meeting		Group or Society Sponsoring	
Date(s) of Conference or Meeting	City/State	Will proceedings be published? ☐ Yes ☐ No Will material be handed out? ☐ Yes ☐ No	
Title of Journal			

CHECKLIST FOR SIGNATORIES			
Review Required per WHC-CH-3-4	Yes	No	Reviewer - Signature Indicates Approval Name (printed) Signature Date
Classification/Uncontrolled Nuclear Information	☐	☒	Approval per OGC
Patent - General Counsel	☒	☐	
Legal - General Counsel	☒	☐	
Applied Technology/Export Controlled Information or International Program	☐	☒	
WHC Program/Project	☐	☒	
Communications	☐	☒	
RL Program/Project	☐	☒	
Publication Services	☐	☒	
Other Program/Project	☐	☒	
Information conforms to all applicable requirements. The above information is certified to be correct.			

References Available to Intended Audience ☒ Yes ☐ No Transmit to DOE-HQ/Office of Scientific and Technical Information ☐ Yes ☒ No Author/Requestor (Printed/Signature) E. G. Erpenbeck <i>E. G. Erpenbeck</i> 7/9/93 Intended Audience ☐ Internal ☐ Sponsor ☒ External Responsible Manager (Printed/Signature) S. R. Briggs <i>SR Briggs</i> 7/9/93	INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP Stamp is required before release. Release is contingent upon resolution of mandatory comments. Date Cancelled Date Disapproved
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<div style="display: flex; justify-content: space-between;"> 1.5 ENGINEERING CHANGE NOTICE </div> <div style="text-align: right;"> Page 1 of <u>3</u> </div>		1. ECN 164075 Proj. W-025-008 ECN																																													
2. ECN Category (mark one) ☒ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 7-7-93																																												
☒ <i>date</i>	5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys./Fac. No. 200W / 218-W-5	7. Impact Level 3Q																																												
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) see item 12 below - <i>PAGE 3</i>	9. Related ECN No(s). NA	10. Related PO No. NA																																												
	11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)																																														
11b. Work Package No. NA		11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date																																													
11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date																																															
12. Description of Change Changes to Project W-025 Design Drawings: 1. Drawing No. H-2-131587, Sheet 4 of 4, Detail 33: Change number 4 under meter to number 3, referring to bushing. 2. Drawing No. H-2-131587, Sheet 4 of 4, Conduit and Wire Schedule: Change symbol 19 wire entry to read "4#2 & 1#6 G". 3. Drawing No. H-2-131587, Sheet 4 of 4, Elementary Diagram: Change wire symbol between dry type transformer and Panel B from "3" to "2". 4. Drawing Nos. H-2-131590 through H-2-131592, H-2-131594: Add "U.S. Department of Energy" and "Richland Operations Office" to title block per other drawings. (Continued on Sheet 3)																																															
13a. Justification (mark one) <table style="width: 100%;"> <tr> <td>Criteria Change ☐</td> <td>Design Improvement ☐</td> <td>Environmental ☐</td> </tr> <tr> <td>As-Found ☐</td> <td>Facilitate Const. ☒</td> <td>Const. Error/Omission ☐</td> </tr> <tr> <td></td> <td></td> <td>Design Error/Omission ☐</td> </tr> </table>				Criteria Change ☐	Design Improvement ☐	Environmental ☐	As-Found ☐	Facilitate Const. ☒	Const. Error/Omission ☐			Design Error/Omission ☐																																			
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13b. Justification Details 1. Editorial. 2. Make consistent with detail 33. 3. Editorial. 4. Editorial. 5. Make compatible with WHC drawing number system. 6. Clarify requirement.																																															
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%;"> <tr> <th colspan="2" style="text-align: left;"><u>WHC DISTRIBUTION</u></th> <th colspan="2" style="text-align: left;"><u>KEH DISTRIBUTION</u></th> </tr> <tr> <td>Project Files</td> <td>R1-28 (1)</td> <td>J.R. Morton</td> <td>E2-30 (3)</td> </tr> <tr> <td>J.R. McGee</td> <td>G6-47 (1)</td> <td>P.G. Beaudet</td> <td>E2-30 (1)</td> </tr> <tr> <td>Station 10</td> <td>A3-87 (1)</td> <td>W.A. Holstein</td> <td>E2-50 (1)</td> </tr> <tr> <td>D.A. Rohl</td> <td>S4-01 (1)</td> <td></td> <td></td> </tr> <tr> <td>E.G. Erpenbeck</td> <td>G6-47 (3)</td> <th colspan="2" style="text-align: left;"><u>DOE DISTRIBUTION</u></th> </tr> <tr> <td>S.R. Briggs</td> <td>G6-47 (1)</td> <td>M.S. Collins</td> <td>A5-18 (1)</td> </tr> <tr> <td>K.D. Johnson</td> <td>H2-58 (1)</td> <td></td> <td></td> </tr> <tr> <td>J.J. Dorian</td> <td>B2-16 (1)</td> <td></td> <td></td> </tr> <tr> <td>G.C. Evans</td> <td>H4-57 (1)</td> <td></td> <td></td> </tr> <tr> <td>J.M. Nielsen</td> <td>T3-29 (1)</td> <td></td> <td></td> </tr> </table>			<u>WHC DISTRIBUTION</u>		<u>KEH DISTRIBUTION</u>		Project Files	R1-28 (1)	J.R. Morton	E2-30 (3)	J.R. McGee	G6-47 (1)	P.G. Beaudet	E2-30 (1)	Station 10	A3-87 (1)	W.A. Holstein	E2-50 (1)	D.A. Rohl	S4-01 (1)			E.G. Erpenbeck	G6-47 (3)	<u>DOE DISTRIBUTION</u>		S.R. Briggs	G6-47 (1)	M.S. Collins	A5-18 (1)	K.D. Johnson	H2-58 (1)			J.J. Dorian	B2-16 (1)			G.C. Evans	H4-57 (1)			J.M. Nielsen	T3-29 (1)			RELEASE STAMP <div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE 23 BY WHC DATE JUL - 9 1993 <i>Sta #10</i> </div>
<u>WHC DISTRIBUTION</u>		<u>KEH DISTRIBUTION</u>																																													
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ENGINEERING CHANGE NOTICE

Page 2 of 3

1. ECN (use no. from pg. 1)
W-025-008

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
☐ Yes ☐ No	Additional Savings	☐ \$0 ☐ \$	Additional Savings	☐ \$0 ☐ \$	Improvement Delay	☐ 0 ☐
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.						
SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐	
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐	
Operating Specification	☐	Interface Control Drawing	☐	Spent Multiple Unit Listing	☐	
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐	
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐	
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐	
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐	
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐	
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐	
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐	
FSA/SAI	☐	IEPD Drawing	☐	Process Control Manual/Plan	☐	
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐	
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐	
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Construction Quality Assurance Plan	☐	
Environmental Report	☐	Inspection Plan	☐	LLSQ Part B Permit Application	☐	
Environmental Permit	☐	Inventory Adjustment Request	☐		☐	
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.						
Document Number/Revision		Document Number/Revision		Document Number/Revision		
WHC-SD-W-025-PLN-001 Rev. 3						
DOE/RL-88-20, Supplement 2						
20. Approvals						
Signature		Date		Signature		Date
OPERATIONS AND ENGINEERING						
Cog Engineer <i>John H. Gopenchuk</i>		7/9/93		ARCHITECT-ENGINEER		
Cog. Mgr. <i>LR Day</i>		7/9/93		PE <i>Frank S. Shari</i>		7-8-93
QA <i>Jack Kusch</i>		7/9/93		QA <i>W. J. Gorman</i>		7-8-93
Safety				Safety		
Security				Design		
Environ.				Environ.		
Projects/Programs				Other <i>Michael L. Brown</i>		7-7-93
Tank Waste Remediation System						
Facilities Operations				DEPARTMENT OF ENERGY		
Restoration & Remediation				Signature or Letter No.		
Operations & Support Services						
IRM				ADDITIONAL		
Other						

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ENGINEERING CHANGE NOTICE CONTINUATION SHEET

1. ECN (use no. from pg. 1)
W-025-008

Page 3 of 3

Continued from Section 12, page 1:

5. General: In title blocks of drawings, change CAD FILE designations as follows:

Drawing: H-2-131573 Sh. 1	Rev. 1	New CAD FILE: B131573A
H-2-131574 Sh. 1	Rev. 2	B131574A
H-2-131575 Sh. 1	Rev. 2	B131575A
H-2-131576 Sh. 1	Rev. 2	B131576A
H-2-131577 Sh. 1	Rev. 2	B131577A
H-2-131578 Sh. 1	Rev. 2	B131578A
H-2-131579 Sh. 1	Rev. 2	B131579A
H-2-131580 Sh. 1	Rev. 2	B131580A
H-2-131581 Sh. 1	Rev. 2	B131581A
H-2-131582 Sh. 1	Rev. 2	B131582A
H-2-131583 Sh. 1	Rev. 2	B131583A
H-2-131584 Sh. 1	Rev. 2	B131584A
H-2-131585 Sh. 1	Rev. 2	B131585A
H-2-131586 Sh. 1	Rev. 2	B131586A
H-2-131587 Sheet 1 - Sh. 1	Rev. 2	B131587A
H-2-131587 Sheet 2	Rev. 2	B131587B
H-2-131587 Sheet 3	Rev. 2	B131587C
H-2-131587 Sheet 4	Rev. 2	B131587D
H-2-131588 Sh. 1	Rev. 2	B131588A
H-2-131589 Sh. 1	Rev. 2	B131589A
H-2-131590 Sh. 1	Rev. 2	B131590A
H-2-131591 Sh. 1	Rev. 2	B131591A
H-2-131592 Sh. 1	Rev. 2	B131592A
H-2-131593 Sh. 1	Rev. 2	B131593A
H-2-131594 Sh. 1	Rev. 1	B131594A

6. Drawing No. H-2-131587, Sheet 4, Detail 30: Add note "Ground transformer case."

7. Drawing No. H-2-131587, Sheet 4: Elementary Diagram: add new conduit/wire symbol 21 to line between weatherhead and watt-hour meter. In the Conduit and Wire Schedule, add a new line with the following information:

Symbol:	21
Conduit Size:	1-1/2"
Wire:	4#2
Circuit No.:	-
Description:	Service
Notes:	[blank]
Conduit No.:	CNW5024

ENGINEERING CHANGE NOTICE	Page 1 of <u>3</u>	1. ECN 164077 Proj. W-025-009 ECN
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2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 7-7-93																						
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys./Fac. No. 200W / 218-W-5	7. Impact Level 3Q																							
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-W025-PLN-001, Rev. 3	9. Related ECN No(s). NA	10. Related PO No. NA																						
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date																						
12. Description of Change Changes to Project W-025 Construction Quality Assurance Plan, Appendix A Tables. 1. Table 02220, Page 1: Entry "Backfill ASTM D422": add "GC, SC" to acceptance criteria. Entry "Backfill ASTM D4318": add "GC, SC" to acceptance criteria. 2. Table 02222, Page 1: Entry "Sump drainage gravel compaction": change acceptance criterion to "Track walked". 3. Table 02226, Page 2: Entry "ASTM D2434": In frequency, change "ever" to "every". 4. Table 02275, Page 2: Entry "Collect Subgrade Acceptance Certificate": Change CQA reference to "4.4.1.4". 5. Table 02275, Page 4: Entry "Locate, sample, and perform destructive tests": In frequency, change "50" to "500". 6. Table 02275, Page 5: First 3 entries, conformance testing: Add " or 1 per production lot" to all frequencies. (Continued on Sheet 3)																									
13a. Justification (mark one) As-Found ☐	Criteria Change ☐	Design Improvement ☐	Environmental ☐																						
Facilitate Const. ☒	Const. Error/Omission ☐	Design Error/Omission ☐																							
13b. Justification Details All: Editorial to make CQA Plan consistent with Specifications (WHC-S-045 Rev.2)																									
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A-7900-013-2 (06/92) GEF095

A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE	Page 2 of 3	1. ECN (use no. from pg. 1) W-025-009
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <td style="text-align: center;">ENGINEERING</td> <td style="text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☒ \$0 Savings ☐ \$</td> <td>Additional ☒ \$0 Savings ☐ \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☒ \$0 Savings ☐ \$	Additional ☒ \$0 Savings ☐ \$	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐
ENGINEERING	CONSTRUCTION					
Additional ☒ \$0 Savings ☐ \$	Additional ☒ \$0 Savings ☐ \$					

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/VSAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Semp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ LLBG Part B Permit Application ☒ ☐
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19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
DOE/RL-88-20, Supplement 2		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING			
Cog Engineer <i>[Signature]</i>	7/9/93	ARCHITECT-ENGINEER	
Cog. Mgr. <i>[Signature]</i>	7/9/93	PE <i>Frank S. Shuri</i>	7-6-93
QA <i>[Signature]</i>	7/6/93	QA <i>[Signature]</i>	7-8-93
Safety		Safety	
Security		Design	
Environ.		Environ.	
Projects/Programs		Other <i>Michael L. Brown</i>	7-7-93
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation			
Operations & Support Services			
IRM			
Other			

A-7900-013-2 (05/92) GEF096

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 3

1. ECN (use no. from pg. 1)
W-025-009

Continued from Section 12, page 1:

7. Table 02275, Page 5: Entry "Confirm that all geonet is covered": change CQA reference to "4.5.2.3" and change specification section and paragraph to "02275 3-2". Entry "Visually examine geotextile": change CQA reference to "4.5.2.3" and change specification section and paragraph to "02275 3-2".

8. Table 02511, Page 1: Entry "Contractor submittal": change frequency to "Prior to ordering (materials) and prior to construction (methods)".

9. Table 02511, Page 1: Entry "Extraction/gradation": change specification section and paragraph to "02511 2-1".

10. Table 02511, Page 1: Entry "Top course ASTM D1557": change specification section and paragraph to "02511 3-1".

11. Table 02511, Page 1: Entry "Top course ASTM D2922": change specifications section and paragraph to "02511 3-1".

12. Table 02511, Page 1: Entry "Asphalt concrete construction tolerances": change specification section and paragraph to "02511 3-5".

13. Table 02511, Page 1: Entry "Compaction of asphalt": change specification section and paragraph to "02511 3-3B".

14. Table 02720, Page 1: Entry "Ditch dimensions": change specification section and paragraph to "02720 3".

15. Table 02727, Page 1: Entry "Riser pipe tolerance": change specification section and paragraph to "02727-3B".

16. Table 15060 to 15250, Page 1: Entry "Contractor submittal": in specification section and paragraph, change "15100 1-2" to "15100 1-3". Entry "Receiving inspection": in specification section and paragraph, change "15100 1-2" to "15100 1-3".

17. Table 16010 to 16859, Page 1: Entry "Contractor's as-built drawings": in specification section and paragraph, change "13340 1-5B" to "13340 1-6C".

Date Received: 7/9/93	INFORMATION RELEASE REQUEST		Reference: WHC-CM-3-4
Complete for all Types of Release			
Purpose ☐ Speech or Presentation ☐ Full Paper (Check only one suffix) ☐ Summary ☐ Abstract ☒ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape		☒ Reference ☐ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☐ Other	ID Number (include revision, volume, etc.) Previously released WHC-SD-W025-PLN-001, Rev. 3 List attachments. ECN W-025-009 Date Release Required 7-8-93

Title CONSTRUCTION QUALITY ASSURANCE PLAN		Unclassified Category UC-	Impact Level 3Q
New or novel (patentable) subject matter? ☒ No ☐ Yes If "Yes", has disclosure been submitted by WHC or other company? ☐ No ☐ Yes Disclosure No(s).		Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? ☒ No ☐ Yes (Identify)	
Copyrights? ☒ No ☐ Yes If "Yes", has written permission been granted? ☐ No ☐ Yes (Attach Permission)		Trademarks? ☒ No ☐ Yes (Identify)	
Complete for Speech or Presentation			
Title of Conference or Meeting		Group or Society Sponsoring	
Date(s) of Conference or Meeting	City/State	Will proceedings be published?	☐ Yes ☐ No
		Will material be handed out?	☐ Yes ☐ No
Title of Journal			

CHECKLIST FOR SIGNATORIES			
Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature Indicates Approval
			Name (printed) Signature Date
Classification/Unclassified Controlled Nuclear Information	☐	☒	<i>Disapproval per MGC memo</i>
Patent - General Counsel	☒	☐	
Legal - General Counsel	☒	☐	
Applied Technology/Export Controlled Information or International Program	☐	☒	
WHC Program/Project	☐	☒	
Communications	☐	☒	
RL Program/Project	☐	☒	
Publication Services	☐	☒	
Other Program/Project	☐	☒	

Information conforms to all applicable requirements. The above information is certified to be correct.	
References Available to Intended Audience ☒ Yes ☐ No Transmit to DOE-HQ/Office of Scientific and Technical Information ☐ Yes ☒ No Author/Requestor (Printed/Signature) ☐ Date E. G. Erpenbeck <i>E. G. Erpenbeck 7/9/93</i> Intended Audience ☐ Internal ☐ Sponsor ☒ External Responsible Manager (Printed/Signature) ☐ Date S. R. Briggs <i>S. R. Briggs 7/9/93</i>	INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP Stamp is required before release. Release is contingent upon resolution of mandatory comments. Date Cancelled Date Disapproved

ENGINEERING CHANGE NOTICE				Page 1 of 2	
1. ECN 164000				Proj. W-025-010 ECN	
2. ECN Category (mark one)		3. Originator's Name, Organization, MSIN, and Telephone No.		4. Date	
☐ Supplemental ☒ Direct Revision <i>Elle</i> ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void		F.S. Shurt, Golder Associates Inc. (206) 883-0777		9-22-93	
		5. Project Title/No./Work Order No.		6. Bldg./Sys./Fac. No.	
		W-025 RMW Land Disposal Facility		200W / 218-W-5	
		8. Document Numbers Changed by this ECN (includes sheet no. and rev.)		9. Related ECN No(s).	
		WHC-S-045 Rev. 2		NA	
				10. Related PO No.	
				NA	
11a. Modification Work		11b. Work Package No.		11c. Modification Work Complete	
☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)		NA		NA	
				11d. Restored to Original Condition (Temp. or Standby ECN only)	
				NA	
		Cog. Engineer Signature & Date		Cog. Engineer Signature & Date	
12. Description of Change					
Changes to Project W-025 Specifications:					
1. Section 02275, Part 2-1 C. 4. "Conformance Testing"; Modify first sentence to read "... in the greater number of tests, except that only two (2) friction angle tests will be performed."					
2. Section 02275, Part 2-2 C. "Conformance Testing"; Modify first sentence to read "... in the greater number of tests, except that only two (2) friction angle tests on each interface will be performed."					
13a. Justification (mark one)					
Criteria Change ☐		Design Improvement ☐		Environmental ☐	
As-Found ☐		Facilitate Const. ☒		Const. Error/Omission ☐	
				Design Error/Omission ☐	
13b. Justification Details					
1. Eliminate unnecessary testing.					
2. Eliminate unnecessary testing.					
14. Distribution (include name, MSIN, and no. of copies)					
WHC DISTRIBUTION				KEH DISTRIBUTION	
Project Files R1-28 (1)		L.R. Tollborn R3-46 (1)		J.R. Morton E2-30 (3)	
J.R. McGee G6-47 (1)		D.A. Pratt T4-03 (1)		P.G. Beaudet E2-30 (1)	
Station 10 A3-87 (1)		STA 4 R1-29		W.A. Holstein E2-50 (1)	
D.A. Rohl S4-01 (1)				P.L. Rackley S2-55 (1)	
E.G. Erpenbeck G6-47 (3)					
S.R. Briggs G6-47 (1)		ECOLOGY DISTRIBUTION		DOE DISTRIBUTION	
K.D. Johnson H2-58 (1)		J. Hensley S6-75 (1)		M.S. Collins A5-18 (1)	
J.J. Dorlan B2-16 (1)					
G.C. Evans H4-57 (1)					
J.M. Nielsen T3-29 (1)					
				RELEASE STAMP	
				OFFICIAL RELEASE BY WHC	
				DATE SEP 27 1993	
				Sta 4	

A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE				Page 2 of 2	1. ECN (use no. from pg. 1) W-025-010																																																
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	<i>Jerry Hensley</i>																																																				

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN ~~154002~~Proj. W-025-011
ECN

2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777 224950		4. Date 9-22-93	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q	
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-W025-PLN-001, Rev. 3		9. Related ECN No(s). NA		10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)		11b. Work Package No. NA		11c. Modification Work Complete NA Cog. Engineer Signature & Date	
				11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date	
12. Description of Change Changes to Project W-025 Construction Quality Assurance Plan: 1. Section 4.4.1.2 "Receiving Inspection and Conformance Testing": In first paragraph following bulleted list, modify second-to-last sentence to read "... whichever results in the greater number of tests, except that only two (2) friction angle tests will be performed." 2. Section 4.5.2.3 "Geotextile, Geocomposite, and Geonet": In first paragraph under the subheading "Conformance Testing", modify the second sentence to read "... whichever results in the greater number of tests, except that only two (2) friction angle tests on each interface will be performed."					
13a. Justification (mark one) As-Found ☐ Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details 1. Eliminate unnecessary testing. 2. Eliminate unnecessary testing.					
14. Distribution (include name, MSIN, and no. of copies)					
WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G5-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1)			KEH DISTRIBUTION L.R. Tollborn R3-46 (1) D.A. Pratt T4-03 (1) J.R. Morton E2-30 (3) P.G. Beaudet E2-30 (1) W.A. Houtain E2-50 (1) P.L. Rackley S2-55 (1)		
ECOLOGY DISTRIBUTION J. Hensley 56-75 (1)			DOE DISTRIBUTION M.S. Collins AS-18 (1)		
RELEASE STAMP OFFICIAL RELEASE BY WHC DATE SEP 29 1993 <i>Station 10</i>					

A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) W-025-011
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">ENGINEERING</td> <td style="text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☒ \$0</td> <td>Additional ☒ \$0</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>		ENGINEERING	CONSTRUCTION	Additional ☒ \$0	Additional ☒ \$0	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐																																																					
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* ADDITIONAL Department of Ecology <i>[Signature]</i> <u>9/27/93</u>																																																														

A-7500-013-2 (06/92) GEF095

SEP 29 1993

INFORMATION RELEASE REQUEST

Reference:
WHC-CM-3-4

Complete for all Types of Release	Purpose		New ID Number ECN-W025-011	
	☐ Speech or Presentation ☐ Full Paper ☐ Summary ☐ Abstract ☐ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape	☐ Reference ☐ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☒ Other <u>ECN</u>	Existing ID Number (include revision, volume, etc.) WHC-SD-W025-PLN-001, REV 3	
	(Check only one suffix)		if previously cleared, list ID number. Same	
			Date Release Required 9/27/92	
Complete for Speech or Presentation	Title ECN TO W-025 CQA Plan		Unclassified Category UC-	
	Title of Journal		Group or Society Sponsoring	
	Date(s) of Conference or Meeting	City/State	Will proceedings be published? ☐ Yes ☐ No Will material be handed out? ☐ Yes ☐ No	
	Title of Conference or Meeting		Impact Level 4	

CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer Name (printed)	Signature	Date
Classification/Unclassified Controlled Nuclear Information	☐	☒			
Patent - General Counsel	☐	☒			
Legal - General Counsel	☐	☒			
Applied Technology/Export Controlled Information or International Program	☐	☒			
WHC Program	☐	☒			
Communications	☐	☒			
DOE-RL Program	☐	☒			
Publications Services	☐	☒			
Other Program	☐	☒			
References Available to Intended Audience	N/A ☐	☒			
Transmit to DOE-HQ/Office of Scientific and Technical Information	☐	☒			

Information conforms to all applicable requirements. The above information is certified to be correct.

Author/Requestor (Printed/Signature)

ERIC G. ERPENBEK / *Eric G. Erpenbek*
9/27/93

Responsible Manager (Printed/Signature)

S.R. BRIGGS / *S.R. Briggs*
9/28/93

Intended Audience

☐ Internal
 ☐ Sponsor
 ☒ External

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments.

Date Received 9/28/93

*Only mandatory comments are to be documented. All other comments should be made on a copy of the information submitted for review and returned to the author.

	<u>Affix</u>		<u>Remove</u>	
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
Applied Technology	☐	☐	☐	☐
Business-Sensitive Information	☐	☐	☐	☐
Computer Software Notice	☐	☐	☐	☐
Copyright License Notice	☐	☐	☐	☐
Export Controlled Information	☐	☐	☐	☐
Legal Disclaimer	☐	☐	☐	☐
Limited Disclosure	☐	☐	☐	☐
Patent Status	☐	☐	☐	☐
Predecisional Information	☐	☐	☐	☐

	<u>Affix</u>		<u>Remove</u>	
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
Programmatic Notice	☐	☐	☐	☐
Proprietary Information	☐	☐	☐	☐
Purpose and Use	☐	☐	☐	☐
Thesis/Dissertation	☐	☐	☐	☐
Trademark Disclaimer	☐	☐	☐	☐
Unclassified Controlled Nuclear Information/Official Use Only	☐	☐	☐	☐

Responsible Manager (Printed Signature)

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN ~~164079~~Proj. W-025-012
ECN

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ <i>SEE</i> Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 9-22-93	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q	
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) see item 12 below		9. Related ECN No(s). NA		10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)		11b. Work Package No. NA		11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	
				11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date	
12. Description of Change Changes to Project W-025 Design Drawings: 1. Drawing No. H-2-131584, Rev. 2, Details 16 and 35: Relocate access road between Dayton Ave. and the Truck Staging Area. Move entire road directly north to avoid existing power pole. Provide 10-foot separation between power pole and edge of asphalt pavement. Provide 50-foot radius transition at southwest corner of access road where it joins the Truck Staging Area. Provide road with uniform slope between Truck Staging Area and Dayton Avenue. Transition between access road and Truck Staging Area shall be smooth and even. Do not place top course until location and prepared subgrade have been approved by the Construction Manager. Record actual location of road on as-built drawings. This modification also applies to all other Project W-025 Design Drawings that show the access road.					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details 1. Actual location of power pole interferes with road. Location originally provided to Designer was not correct. Moving road is anticipated to be less expensive and disruptive than relocating power pole.					
14. Distribution (include name, MSIN, and no. of copies)					
WHC DISTRIBUTION Project Files R1-28 (1) J.R. McGee G5-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorlan B2-16 (1) G.C. Evans H4-57 (1) J.M. Nielsen T3-29 (1)			KEH DISTRIBUTION L.R. Tollborn R3-46 (1) D.A. Pratt T4-03 (1) STA-4 R1-29 ECOLOGY DISTRIBUTION J. Hensley S6-75 (1)		
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A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE

Page 2 of 2

1. ECN (use no. from pg. 1)

W-025-012

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact		17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION	
	Additional \$0	Additional \$0	Improvement 0	
	Savings \$	Savings \$	Delay	

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
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Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
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Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Semp. Schedule	☐	LLBG Part B Permit Application	☒
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
DOE/RL-88-20, Supplement 2		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer <i>[Signature]</i>	9/24/93	PE Frank J. Shuri	9-22-93
Cog. Mgr. <i>[Signature]</i>	9/24/93	QA <i>[Signature]</i>	9-23-93
QA <i>[Signature]</i>	9/24/93	Safety	
Safety		Design	
Security		Environ.	
Environ.		Other <i>Michael L. Brown</i>	9/22/93
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation		DEPARTMENT OF ENERGY	
Operations & Support Services		Signature or Letter No.	
IRM			
Other		ADDITIONAL	
		<i>ecology Jerry Henry</i>	9/27/93

A-7900-013-2 (06/92) GEF096

ENGINEERING CHANGE NOTICE				1. ECN W-025-013																																												
<div style="text-align: right; font-size: small;">Page 1 of 4</div> <div style="text-align: center; font-family: cursive;">EG Erpenbeck W24950 66-47 376-8033</div>				Proj. W-025-013 ECN																																												
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shurt, Golder Associates Inc. (206) 883-0777		4. Date 10-6-93																																													
5. Project Title/No./Work Order No. CF2 BS W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																																												
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-S-045 Rev. 2		9. Related ECN No(s). NA		10. Related PO No. NA																																												
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12. Description of Change Changes to Project W-025 Specifications: <ol style="list-style-type: none"> 1. Section 02275, Part 2-2 B. 1. Table "Required Geonet Properties": Nominal Transmissivity of 0.001 m²/sec (4.8 gals/min/ft) or higher at 10,000 psf normal load will be acceptable. Mass per unit area of 22 oz/yd² or higher Minimum Average Roll Value will be acceptable. 2. Section 02275, Part 2-2 B. 2. Table "Required Geotextile Properties": Mass/Unit Area of 7.0 oz/yd² or higher will be acceptable for Type A geotextile. Permittivity of 1.2 sec⁻¹ or higher will be acceptable for Type A geotextile. Permittivity of 0.45 sec⁻¹ or higher will be acceptable for Type B geotextile. 3. Section 02725, Part 2-4 "Schedule": For 1.5-inch-diameter submersible pump discharge piping, SDR 11 will also be acceptable. 																																																
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A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE				Page 2 of 4	1. ECN (use no. from pg. 1) W-025-013																																																
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19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.																																																					
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W-025-13 Sheet 3 of 4

**Golder
Associates**

SUBJECT *Submitted 26 - Georet*

Job No. 933-1360

Made by *FES*

Date 9-20-93

Ref. W-025

Checked

Sheet 1 of 1

Reviewed

Mufham

① Transmissivity

Specified Value:

$$\frac{7.2 \text{ gal}}{\text{min} \cdot \text{ft}} \times \frac{1 \text{ ft}^3}{7.48 \text{ gal}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ m}^2}{3.28^2 \text{ ft}^2} = 1.49 \times 10^{-3} \frac{\text{m}^2}{\text{sec}} @ 2090 \text{ psf}$$

Proposed Value: $1.0 \times 10^{-3} @ 10,000 \text{ psf}$

Required Value: See Section 3, Page 7 of Vol II of Design Report.

 $Q_{\text{max}} = \text{Flow at toe of slope} = 0.62 \text{ gpm/ft}$

$$= \frac{0.62 \text{ gal}}{\text{min} \cdot \text{ft}} \times \frac{1 \text{ ft}^3}{7.48 \text{ gal}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ m}^2}{(3.28)^2 \text{ ft}^2}$$

$$= 1.3 \times 10^{-4} \text{ m}^2/\text{sec}/\text{m} \checkmark$$

$$= 1.3 \times 10^{-4} \text{ m}^2/\text{sec} \checkmark$$

Sideslope = 33% $\therefore$ gradient = 0.33

$$T = 1.0 \times 10^{-3} \text{ m}^2/\text{sec} \times 0.33 = 3.3 \times 10^{-4} \text{ m}^2/\text{sec}$$

$$Still > 1.3 \times 10^{-4} \text{ m}^2/\text{sec} \text{ so OK} \checkmark \checkmark$$

② Mass Per Unit Area

Specified Value: 25 oz/yd²Proposed Value: 260 lb/roll $\times$ 16 oz/lb

$$= 22.4 \text{ oz/yd}^2$$

$$16.75 \text{ ft}^2/\text{roll} \times \frac{1 \text{ yd}^2}{9 \text{ ft}^2}$$

Required Value: None, this is an index parameter, not a design value.

Because other parameters are within spec, particularly transmissivity, and because the mass per unit area is an MARV, proposed material is acceptable.

W-025-13 Sheet 4 of 4

**Golder
Associates**

SUBJECT <u>Submittal 24 - Geotextiles</u>		
Job No. <u>933-1360</u>	Made by <u>FSS</u>	Date <u>9-20-93</u>
Ref. <u>W-025</u>	Checked	Sheet <u>1</u> of <u>1</u>
	Reviewed <u>KW/Hum</u>	

Deviations from specified materials:

① Type A: ^{weight} Specified: 7.10 oz/yd^2 Proposed: 7.00 oz/yd^2 (MARV)

Resolution: OK because Specs did not state average or minimum average roll value, and.

All strength values exceed requirements (i.e., no impact of reduced thickness)

② Type A: Permittivity: Specified: $1.5/\text{sec}$ Proposed: $1.2/\text{sec}$ (MARV)

Resolution: OK because required permeability is only 10^{-3} cm/sec , proposed is 0.38 cm/sec ✓

(see Section 25, page 3 of Vol. III of Design Report)

Note that $P = \frac{K}{t}$ where P = permittivity, K = permeability, t = thickness

∴ for comparably thick geotextiles, if permeability is OK, permittivity will be also.

③ Type B: Permittivity: Specified: $0.5/\text{sec}$ Proposed: $0.45/\text{sec}$

Resolution: OK because required permeability is only $9.8 \times 10^{-2} \text{ cm/sec}$

proposed is 0.20 cm/sec . (see Section 25, page 11 of Vol. III of Design Report)

Same argument as for ②

ENGINEERING CHANGE NOTICE				Page 1 of 4	1. ECN <u>164084</u> Proj. <u>W-025-014</u> ECN																																											
2. ECN Category (mark one) ☒ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 10-19-93																																													
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																																												
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-S-045 Rev. 2		9. Related ECN No(s). NA		10. Related PO No. NA																																												
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date																																													
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ENGINEERING CHANGE NOTICE

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1. ECN (USW NO. FROM PG. 1)

W-025-014

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table border="1"> <tr> <th colspan="2">ENGINEERING</th> <th colspan="2">CONSTRUCTION</th> </tr> <tr> <td>Additional \$0</td> <td>☐ \$</td> <td>Additional \$0</td> <td>☐ \$</td> </tr> <tr> <td>Savings</td> <td>☐ \$</td> <td>Savings</td> <td>☐ \$</td> </tr> </table>	ENGINEERING		CONSTRUCTION		Additional \$0	☐ \$	Additional \$0	☐ \$	Savings	☐ \$	Savings	☐ \$	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐
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18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Slide 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.														
SDO/DD	☐	Schedule/Status Analysis	☐	Tank Calibration Manual	☐									
Functional Design Criteria	☐	Success/Design Report	☐	Health Physics Procedure	☐									
Operating Specification	☐	Interface Control Drawing	☐	Spent Multiple Unit Listing	☐									
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐									
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐									
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐									
Genet. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐									
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐									
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐									
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐									
FEAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐									
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐									
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐									
Environmental Impact Statement	☐	Fac. Proc. Sump. Schedule	☐	Construction Quality Assurance Plan	☒									
Environmental Report	☐	Inspection Plan	☐	LLSQ Part B Permit Application	☒									
Environmental Permit	☐	Inventory Adjustment Request	☐		☐									
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.														
Document Number/Revision		Document Number/Revision		Document Number/Revision										
WHC-SD-W-025-PLN-001 Rev. 3														
DOE/RL-88-20, Supplement 2														
20. Approvals														
Signature		Date		Signature										
OPERATIONS AND ENGINEERING				ARCHITECT-ENGINEER										
Cog Engineer <i>[Signature]</i>		10/20/93		PE <i>[Signature]</i>										
Cog. Mgr. <i>[Signature]</i>		10/22/93		QA <i>[Signature]</i>										
QA <i>[Signature]</i>		10/25/93		Safety										
Safety				Design										
Security				Environ.										
Environ.				Other <i>[Signature]</i>										
Projects/Programs				10-19-93										
Tank Waste Remediation System														
Facilities Operations														
Restoration & Remediation				DEPARTMENT OF ENERGY										
Operations & Support Services				Signature or Letter No.										
IRM														
Other				ADDITIONAL										
ECOLGY (WA STATE)		10/25/93												

MEMORANDUM

TO: Project File

October 19, 1993

FR: Frank Shuri, GAI Redmond *FS*

RE: W-025 GEOTEXTILE CONFORMANCE TESTING RESULTS, Job No. 933-1360

Conformance test results on several geotextile samples indicated property values that are slightly lower than the project specifications for the material. Specifically,

- Geotextile Type B: specified thickness: 185 mils, measured thickness: 175 and 176 mils
- Geotextile Type B: specified trapezoidal tear strength: 150 lb, measured trapezoidal tear strength: 146 and 147 lb
- Geotextile Type B: specified permittivity: 0.45 sec^{-1} , measured permittivity: 0.44 sec^{-1}

The impact of slightly low property values on geotextile performance was evaluated. With respect to Type B geotextile, thickness is not a primary consideration if the other material properties are within specification. Some compression of the geotextile may occur as it is wrapped into a roll. Thickness may affect the ability of a geotextile to provide cushioning, but for the W-025 Landfill, this is no longer a significant design concern. Originally, one of the purposes of the Type B geotextile was to cushion the primary geomembrane from the underlying secondary drainage gravel. However, the liner system has been redesigned so that a primary admix layer is now present between the geomembrane and the gravel. Therefore, cushioning the geomembrane is no longer required.

With respect to slightly low trapezoidal tear strength, the W-025 Design Report (WHC-SD-W025-FDR-001), Calculation C.25 "Geotextile Selection" was reviewed to evaluate required design strengths. The required strength parameters (including factors of safety) and those measured on the Type B geotextile are as follows:

-	Burst Strength:	Required:	51 psi
		Available:	850 to 918 psi
-	Grab Strength:	Required:	216 lb
		Available:	507 to 745 lbs
-	Puncture Strength:	Required:	2 lb
		Available:	288 to 312 lb

Trapezoidal tear strength is not a specifically required parameter that models a physically realistic failure mode, hence there is no required design value. The above conformance test results indicate that the available strength of the Type B geotextile far exceeds the design requirements. Therefore, the slightly low trapezoidal tear strength is not a concern.

WHC-SD-W025-RPT-001, Rev. 0

With respect to the slightly low permittivity value for the Type B geotextile, the measured value is still more than twice the value required for design purposes. The supporting calculations are presented in ECN W-025-13.

In summary, the conformance test results discussed above probably reflect normal variability in geotextile materials and will not adversely affect the performance of these materials as part of the W-025 liner system. This conclusion applies only to the test data evaluated in this memo and should not be applied to other conformance test results.

geotextw51

ENGINEERING CHANGE NOTICE				Page 1 of <u>2</u>	1. ECN <u>164085</u> Proj. <u>W-025-015</u> ECN																																											
2. ECN Category (mark one) ☐ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☒ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 10-26-93																																													
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																																												
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) 0045 WHC-S-045 Rev. 2		9. Related ECN No(s). NA		10. Related PO No. NA																																												
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bks. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date																																													
12. Description of Change Changes to Project W-025 Specifications: 1. Section 02224, Part 3-5. A.: The first lift of admix material may be placed in a 12-inch loose lift thickness. The maximum loose thickness for subsequent lifts remains at 10 inches.																																																
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13b. Justification Details 1. Increased thickness necessary to prevent mixing of subgrade into first lift of admix by contractor's compactor. Such mixing can decrease permeability to unacceptable levels.																																																
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%; border: none;"> <tr> <td colspan="2"><u>WHC DISTRIBUTION</u></td> <td colspan="2"><u>KEH DISTRIBUTION</u></td> <td rowspan="8" style="text-align: center; vertical-align: middle; padding: 10px;"> RELEASE STAMP <div style="border: 1px solid black; padding: 5px; display: inline-block;"> OFFICIAL RELEASE (23) BY WHC DATE OCT 28 1993 <i>Sta #10</i> </div> </td> </tr> <tr> <td>Project Files R1-28 (1)</td> <td>L.R. Tollbom R3-46 (1)</td> <td>J.R. Morton E2-30 (3)</td> <td></td> </tr> <tr> <td>J.R. McGee G6-47 (1)</td> <td>D.A. Pratt T4-03 (1)</td> <td>P.G. Beaudet E2-30 (1)</td> <td></td> </tr> <tr> <td>Station 10 A3-87 (1)</td> <td>H.R. BENZEL T4-03 (1)</td> <td>W.A. Holstein E2-50 (1)</td> <td></td> </tr> <tr> <td>D.A. Rohl S4-01 (1)</td> <td></td> <td>P.L. Rackley S2-55 (1)</td> <td></td> </tr> <tr> <td>E.G. Erpenbeck G6-47 (3)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>S.R. Briggs G6-47 (1)</td> <td><u>ECOLOGY DISTRIBUTION</u></td> <td><u>DOE DISTRIBUTION</u></td> <td></td> </tr> <tr> <td>K.D. Johnson H2-58 (1)</td> <td>J. Hensley (1)</td> <td>M.S. Collins AS-18 (1)</td> <td></td> </tr> <tr> <td>J.J. Dorian B2-16 (1)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>G.C. Evans H4-57 (1)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>J.M. Nielsen T3-29 (1)</td> <td></td> <td></td> <td></td> </tr> </table>				<u>WHC DISTRIBUTION</u>		<u>KEH DISTRIBUTION</u>		RELEASE STAMP <div style="border: 1px solid black; padding: 5px; display: inline-block;"> OFFICIAL RELEASE (23) BY WHC DATE OCT 28 1993 <i>Sta #10</i> </div>	Project Files R1-28 (1)	L.R. Tollbom R3-46 (1)	J.R. Morton E2-30 (3)		J.R. McGee G6-47 (1)	D.A. Pratt T4-03 (1)	P.G. Beaudet E2-30 (1)		Station 10 A3-87 (1)	H.R. BENZEL T4-03 (1)	W.A. Holstein E2-50 (1)		D.A. Rohl S4-01 (1)		P.L. Rackley S2-55 (1)		E.G. Erpenbeck G6-47 (3)				S.R. Briggs G6-47 (1)	<u>ECOLOGY DISTRIBUTION</u>	<u>DOE DISTRIBUTION</u>		K.D. Johnson H2-58 (1)	J. Hensley (1)	M.S. Collins AS-18 (1)		J.J. Dorian B2-16 (1)				G.C. Evans H4-57 (1)				J.M. Nielsen T3-29 (1)			
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12. Description of Change Changes to Project W-025 Specifications: 1. Section 02275, Part 2-1, B.2.: Change specific gravity requirement to read "> 0.930". 2. Section 02275, Part 2-2, B.4.: Add to end of paragraph: "Other combinations of shear strength parameters which can be shown by standard analytical techniques to provide static and dynamic factors of safety against slope failure that are equivalent or greater than those of the specified material may be acceptable if approved by the COTR."																																																											
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A-7900-013-2 (05/92) GEF095

ENGINEERING CHANGE NOTICE

Page 2 of 8

1. ECN (use no. from pg. 1)

W-025-016

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table border="0"> <tr> <td colspan="2">ENGINEERING</td> <td colspan="2">CONSTRUCTION</td> </tr> <tr> <td>Additional</td> <td>☒ \$0</td> <td>Additional</td> <td>☒ \$0</td> </tr> <tr> <td>Savings</td> <td>☐ \$</td> <td>Savings</td> <td>☐ \$</td> </tr> </table>	ENGINEERING		CONSTRUCTION		Additional	☒ \$0	Additional	☒ \$0	Savings	☐ \$	Savings	☐ \$	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐																																									
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~~ECN W-025-16~~~~Sheet 3 of 8~~

MEMORANDUM

TO: W-025 Landfill Project File, 933-1360

November 17, 1993

FR: Frank S. Shuri *FSS*

RE: CHANGES TO GEOMEMBRANE SPECIFICATIONS

1. Crystallinity. Specification Section 02275, Part 2-1, B.4. requires a crystallinity of 50 to 60 percent, or as approved by the COTR. Crystallinity of the geomembrane proposed by the Contractor appears to be in the range of 40 to 50 percent. It is recommended that the COTR approve this material with respect to crystallinity for the following reasons:

- (a) Per the attached letter from SLT North America, Inc., lower crystallinity provides an increase in elongation, resistance to stress cracking, and chemical resistance. Such changes will enhance the long-term performance of the liner and are therefore desirable.
- (b) Because there are only minimal tensile loads on the liner, the slight decrease in tensile strength noted in the SLT letter is not a concern for this project.
- (c) Measurement of crystallinity appears to be a relatively inexact process.
- (d) Crystallinity is not a primary design parameter; it is included for "fingerprinting" purposes. As long as other physical properties conform to specifications, geomembrane performance is expected to be satisfactory.

2. Interface Shear Strength. Specification Section 02275, Part 2-2, B.4. requires a friction angle between the geocomposite and textured geomembrane of at least 27.5° under a normal load of 400 psf and a displacement of at least 2 inches. Test results indicate a friction angle of 18° with an apparent cohesion of 0.6 psi (86 psf). Slope stability analyses using the specified strength parameters (friction angle = 27.5°, cohesion = 0) show a static factor of safety of 1.6 and a dynamic factor of safety of 1.1 (see attached sheet). The same stability analysis using the actual strength parameters (friction angle = 18°, cohesion = 86 psf) shows a static factor of safety of 1.8 and a dynamic factor of safety of 1.3. For design purposes, factors of safety of 1.5 and 1.1 have been considered acceptable for static and dynamic loading conditions, respectively.

The factors of safety exhibited by the actual liner materials are well above both the minimum acceptable values and the values provided by a material with the specified strength parameters. Therefore, the Specifications should be expanded to allow any combination of parameters which can be shown by standard analysis to provide adequate factors of safety under expected loading conditions.

3. Resin Density. Specification Section 02275, Part 2-1, B.2. requires a resin specific gravity greater than 0.935. Actual measurements range from 0.932 to 0.934. However, the finished geomembrane density ranges from 0.942 to 0.945, which is greater than the minimum required value of 0.94. Because the finished geomembrane density is greater

than required and because other physical properties satisfy the specification requirements, the slightly low resin density is not considered significant with respect to geomembrane performance. The Specifications should be revised to allow lower values for resin density.

ecn16mmo.w51

INFINITE SLOPE STABILITY

Date: 10-Mar-92

Made by: *FS*
Checked by: *RDJ*
Reviewed by: _____

Reference: Stability Analysis of Earth Slopes, Huang, Y.H., 1983

Infinite slope equation: $FS = ((c/Gd)\sec a + ((1-ru)\cos a - Cs \cdot \sin a)\tan P)/(\sin a + Cs \cdot \cos a)$

Where: c = effective cohesion
 G = unit weight of sliding mass
 d = vertical thickness of sliding mass
 a = slope angle
 Cs = horizontal acceleration
 P = effective friction angle
 ru = pore pressure factor

$G =$	120 pcf
$d =$	3 ft
$a =$	18.43 degrees
$Cs =$	0.12 g
$c =$	0 psf
$P =$	27.5 degrees
$ru =$	0

Static Analysis: FS = 1.56 ✓

Dynamic Analysis: FS = 1.10 ✓

INFINITE SLOPE STABILITY

Date: 17-Nov-93

Made by: FSS

Checked by: *[Signature]*Reviewed by: *[Signature]*

Reference: Stability Analysis of Earth Slopes, Huang, Y.H., 1983

Infinite slope equation: $FS = ((c/Gd)\sec a + ((1-ru)\cos a - Cs \cdot \sin a)\tan P)/(\sin a + Cs \cdot \cos a)$

Where: c = effective cohesion
 G = unit weight of sliding mass
 d = vertical thickness of sliding mass
 a = slope angle
 Cs = horizontal acceleration
 P = effective friction angle
 ru = pore pressure factor
 $= (\text{Volume of mass submerged} \cdot 62.4 \text{ pcf}) /$
 $(\text{Total volume of mass} \cdot \text{unit weight of soil in pcf})$

$G =$	120 pcf
$d =$	3 ft
$a =$	18.43 degrees
$Cs =$	0.12 g
$c =$	86 psf
$P =$	18 degrees
$ru =$	0

Static Analysis: FS = 1.77 ✓

Dynamic Analysis: FS = 1.27 ✓

ENGINEERING CHANGE NOTICE				4. ECN <u>154033</u>																																																																							
Page 1 of 9				Proj. W-025-017 ECN																																																																							
2. ECN Category (mark one) ☐ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 1-20-94																																																																								
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																																																																							
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-S-045 Rev. 2		9. Related ECN No(s). W-025-18		10. Related PO No. NA																																																																							
11a. Modification Work ☐ Yes (fill out B&C 11b) ☒ No (NA B&C, 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date																																																																								
12. Description of Change Changes to Project W-025 Specifications: 1. Section 02275, Part 3-1, E5.: Under "Weather Conditions for Seaming", change paragraph immediately after fourth bullet to read: "If the Installer wishes to use methods which may allow seaming at ambient temperatures below 40°F or above 104°F, the Installer shall certify in writing that the quality of the seams welded at these temperatures is the same as the quality of seams welded at temperatures between 40°F and 104°F. At the CQA Engineer's discretion, the Installer shall provide sample coupons cut from each end of the seam. These coupons shall be tested in the field by the CQA Engineer. Other testing normally required by these Specifications or the CQA Plan shall also be performed." 2. Section 02725, Part 2-4: Change wall thickness of leachate collection well to "SDR 13.5 or 15.5". (Continued on Sheet 3)																																																																											
13a. Justification (mark one) As-Found ☐	Criteria Change ☐ Design Improvement ☒ Const. Error/Omission	☐ Environmental ☐ Design Error/Omission	13b. Justification Details 1. Establishes verification tests. 2. Improved availability of pipe. Strength is adequate (see attached). (Continued on Sheet 3)																																																																								
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="border-bottom: 1px solid black;"><u>WHC DISTRIBUTION</u></td> <td colspan="2" style="border-bottom: 1px solid black;"><u>KEH DISTRIBUTION</u></td> <td rowspan="6" style="text-align: center; vertical-align: middle; padding: 10px;"> RELEASE STAMP OFFICIAL RELEASE BY WHC DATE JAN 24 1994 </td> </tr> <tr> <td>Project File</td> <td>R1-28 (1)</td> <td>L.R. Tollborn</td> <td>R3-48 (1)</td> <td>J.R. Morton</td> <td>E2-30 (3)</td> </tr> <tr> <td>J.R. McGee</td> <td>G6-47 (1)</td> <td>D.A. Pratt</td> <td>T4-03 (1)</td> <td>P.G. Beaudet</td> <td>E2-30 (1)</td> </tr> <tr> <td>Station 10</td> <td>A3-87 (1)</td> <td>R.J. Groir</td> <td>T4-05 (1)</td> <td>W.A. Holstein</td> <td>E2-50 (1)</td> </tr> <tr> <td>D.A. Rohl</td> <td>S4-01 (1)</td> <td></td> <td></td> <td>P.L. Rackley</td> <td>S2-55 (1)</td> </tr> <tr> <td>E.G. Erpenbeck</td> <td>G6-47 (3)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2" style="border-bottom: 1px solid black;"><u>ECOLOGY DISTRIBUTION</u></td> <td colspan="2" style="border-bottom: 1px solid black;"><u>DOE DISTRIBUTION</u></td> <td></td> </tr> <tr> <td>S.R. Briggs</td> <td>G6-47 (1)</td> <td>J. Hensley</td> <td>S6-15 (1)</td> <td>M.S. Collins</td> <td>A5-18 (1)</td> </tr> <tr> <td>K.D. Johnson</td> <td>H2-58 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>J.L. Dorian</td> <td>B2-18 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>G.C. Evans</td> <td>H6-23 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>H.R. Benzel</td> <td>T4-03 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>				<u>WHC DISTRIBUTION</u>		<u>KEH DISTRIBUTION</u>		RELEASE STAMP OFFICIAL RELEASE BY WHC DATE JAN 24 1994	Project File	R1-28 (1)	L.R. Tollborn	R3-48 (1)	J.R. Morton	E2-30 (3)	J.R. McGee	G6-47 (1)	D.A. Pratt	T4-03 (1)	P.G. Beaudet	E2-30 (1)	Station 10	A3-87 (1)	R.J. Groir	T4-05 (1)	W.A. Holstein	E2-50 (1)	D.A. Rohl	S4-01 (1)			P.L. Rackley	S2-55 (1)	E.G. Erpenbeck	G6-47 (3)					<u>ECOLOGY DISTRIBUTION</u>		<u>DOE DISTRIBUTION</u>			S.R. Briggs	G6-47 (1)	J. Hensley	S6-15 (1)	M.S. Collins	A5-18 (1)	K.D. Johnson	H2-58 (1)					J.L. Dorian	B2-18 (1)					G.C. Evans	H6-23 (1)					H.R. Benzel	T4-03 (1)					(Continued on Sheet 3)	
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ENGINEERING CHANGE NOTICE

Page 2 of 9

1. ECN (use no. from pg. 1)

W-025-017

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table border="0"> <tr> <td colspan="2">ENGINEERING</td><td colspan="2">CONSTRUCTION</td></tr> <tr> <td>Additional</td><td>☒ \$0</td><td>Additional</td><td>☒ \$0</td></tr> <tr> <td>Savings</td><td>☐ \$</td><td>Savings</td><td>☐ \$</td></tr> </table>	ENGINEERING		CONSTRUCTION		Additional	☒ \$0	Additional	☒ \$0	Savings	☐ \$	Savings	☐ \$	17. Schedule Impact (days) Improvement ☒ 0 Delay ☐																																									
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SDO/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPO Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Some. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spare Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICPS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLSG Part B Permit Application ☒																																																					
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.																																																							
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ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 9

1. ECN (use no. from pg. 1)
W-025-017

Continued from Section 12, page 1:

3. Section 02725, Part 2-5: Change title of Part 2-5 to "Couplings and End Caps". Add paragraph:

- "C. Provide molded polyethylene end caps for ends of all cleanout access pipes. Caps shall prevent entry of soil or debris into the cleanout pipe and shall be removable. Composition of polyethylene shall be compatible with cleanout pipes per manufacturer's recommendations and shall withstand outdoor conditions."

4. Section 15100: Replace in entirety with attached version. Major changes include (1) addition of specifications for hose bib, (2) addition of specifications for ball valves, and (3) addition of valves W51 through W56 to valve schedule.

5. Section 15104, Part 1-1: Revise paragraph to read

"Furnishing and installing three manually-operated butterfly valves (W57, W61, and W62) including epoxy coating, appurtenances, operators, and accessories, for use as the transfer pump isolation and leachate recirculation valves. All valves shall be the same model from the same manufacturer."

6. Section 15150, Part 1-1: Revise paragraph to read

"Furnishing and installing two turbine meters for monitoring the accumulated leachate discharged to the leachate temporary storage tank. One meter (3") shall be located on the combined leachate discharge line, the other (2") shall be on the secondary pump discharge line, as shown on the Drawings. Both meters shall be of the same design and from the same manufacturer."

7. Section 13340, Part 2: Add Part 2-11:

"2-11 LIMIT SWITCH

Mount a limit switch on the liquid level indicating gage for the leachate temporary storage tank. Mount so that limit switch shall be tripped when the liquid level reaches the high level point (exact level as directed by COTR). The limit switch shall be weatherproof, rated NEMA 4X, with contacts rated for 10-amperes continuous at 120 volts AC. Contact shall be SPDT, set at normally open (closed when the liquid level reaches the high level point). Rated for 20 million switching operations minimum. Switch shall be Omron No. D4A-N (with side rotary plunger or similar device) or approved equal."

Continued from Section 13b, page 1:

3. Protect cleanout pipe and facilitate operations.

4. Additional valves are required to implement operational requests including leachate recirculation system and valved inter-66 between primary and secondary sumps.

5. Additional butterfly valves are required to implement leachate recirculation system.

6. Allows discharge from each sump to be measured independently.

7. Provide redundancy with high level float switch.

ECN W-025-17 Sheet 4 of 9

**Golder
Associates**

SUBJECT Leachate Collection Well Earth Loading		
Job No. 933-1360	Made by FSS	Date 10-13-93
Ref. W-025	Checked	Sheet 1 of 3
	Reviewed M. Johnson	

Per calculation C-24 in Volume 2 of W-025 Design Report,

$$\Delta x = \frac{D I^3 K w / 2}{2E + 0.061 E} \cdot 3(SDR)^3$$

where Δx = deflection in inch

K = deflection lag factor = 1.5 from pipe manufacturer's design manual (see calc C-24)

K = bedding constant = 0.1 derived as was DI

E = modulus of polyethylene; psi = 30,000 psi derived as was DI

SDR = standard dimension ratio

E_s = modulus of soil = 700 psi - see calc C-24

Swamp Ground will be clean, hard, well graded

3/8" to 1" material. Truck walked. $\therefore$ higher modulus appropriate

w = earth pressure on pipe = 3685 lbs/ft (see calc C-24)

Deflection of SDR 13.5 = 3.0%

" " " 15.5 = 3.1%

Both < 5%, so OK

Ag Factor =	1.5	
Bedding Constant =	0.1	
HDPE Modulus =	30,000	psi
Soil Modulus =	700	psi
Earth Pressure =	3,625	lb/ft
SDR =	13.5	
OD =	30	Inches
Deflection =	0.89	Inches 3.0 %

Lag Factor =	1.5	
Bedding Constant =	0.1	
HDPE Modulus =	30,000 psi	
Soil Modulus =	700 psi	
Earth Pressure =	3,625 lb/ft	
SDR =	15.5	
OD =	30 inches	
Deflection =	0.94 inches	3.1 %

WHC-S-045 Rev. 2

SECTION 15100 VALVES

PART 1: GENERAL

1-1 SECTION INCLUDES

All valves used for control of water and air; manual, electric, hydraulic, and pneumatic operators; epoxy coating; control units; and appurtenant work. Butterfly valves are covered separately under Section 15104.

1-2 RELATED SECTIONS

- A. Section 15104 - Butterfly Valves

1-3 SUBMITTALS

- A. Submit detailed manufacturer's information on all valves proposed for use.
- B. Submit in accordance with Section 01300.

PART 2: PRODUCTS

2-1 VACUUM RELEASE VALVES

Provide vacuum release valves on discharge line of submersible pumps and the transfer pump discharge line at locations shown on the Drawings. Connect to HDPE piping using service saddles. Connect to stainless steel pipe by direct tapping or other method approved by the COTR. Valves shall be constructed of corrosion resistant wetted parts.

2-2 SOLENOID DRAIN VALVE AND PIPING

Furnish and install an electric solenoid-operated valve for back-draining of leachate to prevent freezing. Enclosure shall be NEMA-4. Wetted parts shall be stainless or thermoplastic. Orifice size 3/8" minimum, 115 VAC coil; use ASCO solenoid valve or approved equal. Tap HDPE pipe using type 101S saddle, available from Industrial Plastics, Inc., Washougal, WA or approved equal. All connecting piping shall be HDPE or type 316 stainless steel; all fittings shall be type 316 stainless steel. Drain piping shall be insulated but not heat traced.

2-3 SAMPLE COCKS

Furnish and install 1/4" NPT sample cocks, fabricated of type 316 stainless steel, on tank discharge piping at the location(s) shown on the Drawings. Sample cocks shall be heat traced.

2-4 HOSE BIB

Furnish and install hose bib and 0.5" hose connection, fabricated of type 316 stainless steel, on tank discharge piping at the location shown on the drawings. Hose bib shall be heat traced.

2-5 CHECK VALVES

Furnish and install five check valves, one on each of the leachate sump pump discharge pipes and two on the leachate tank recirculation system, as shown on the Drawings. Wetted parts shall be type 316 stainless steel, rubber, thermoplastic, or other approved corrosion-resistant material.

2-6 DRAIN DOWN VALVES AND PIPING

Provide stainless steel or thermoplastic spring-actuated valve which will close against pump pressure, and open against gravity pressure allowing the piping to drain back into the sump. Connecting pipe and fittings shall be stainless steel. Valve pipe size shall be 1/4" minimum.

2-7 BALL VALVES

Furnish and install two ball valves, one 1.5" on the primary side slope discharge line (valve W66) and one 3" on the leachate line to the temporary storage tank (valve W65), as shown on the Drawings. Valves shall be manually operated. Wetted parts shall be type 316 stainless steel or other approved corrosion resistant material. Valves shall be similar in quality to Watts Regulator Industrial Products Division series S-8XXX, Velan EE-1000, or approved equal.

2-8 VALVE SCHEDULE

<u>Valve No.</u>	<u>Description</u>
W51	1 1/2" primary check valve
W52	1 1/2" secondary check valve
W53	3" primary check valve
W54	solenoid drain down valve
W55	spring release, drain down valve, 1/4" min.

WHC NON-DRAG-OFF
933-1360

15100-2
January 20, 1994

~~ECN W-025-17 Sheet 9 of 9~~

WHC-S-045 Rev. 2

W56	spring release, drain down valve, 1/4" min.
W57	Transfer pump isolation valve, 4" manually operated BF valve, lever actuator (see Section 15104)
W58	Vacuum release valve, primary leachate discharge line
W59	Vacuum release valve, secondary leachate discharge line
W60	Vacuum release valve, transfer pump discharge line
W61	Leachate tank recirculation system, 4" manually operated BF valve, lever actuator (see section 15104)
W62	Leachate tank recirculation system, 4" manually operated BF valve, lever actuator (see section 15104)
W63	4" check valve for leachate tank recirculation system
W64	4" check valve for leachate tank recirculation system
W65	Leachate piping valved-intertie, 3" manually operated ball valve
W66	Leachate piping valved-intertie, 1.5" manually operated ball valve

2-9 VALVE MARKING

Valves shall have stainless steel (SS) indented marker plates marked with the valve number, Panduit Corporation, Catalog No. MMP350-C or approved equal, held in place with SS ties, Panduit Corporation, Catalog No. MLT4S-CP or approved equal. Characters shall be 3/16" in height minimum, indented with indenter marker press, Panduit Corporation, Catalog No. IMP187, or approved equal.

PART 3: EXECUTION

3-1 GENERAL

All valves shall be installed in accordance with AWWA Standards and manufacturer's recommendations.

3-2 SOLENOID DRAIN VALVE AND PIPING

Install solenoid drain valve and piping around 3" diameter check valve such that low spots are minimized. Locate solenoid and piping taps at an elevation about 1/2" above invert of 3" piping.

- END -

ENGINEERING CHANGE NOTICE				1. ECN <u>164083</u>
Page 1 of <u>7</u>				Proj. ECN <u>W-025-018</u>
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 1-20-94	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) Project W-025 Design Drawings		9. Related ECN No(s). W-025-17		10. Related PO No. NA
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date	
12. Description of Change				
1. Drawing No. H-2-131585, Rev. 2, Section N: Revised per attached Figure R-1. Major changes are (1) addition of valved inter-tie between primary and secondary submersible pump discharge lines and (2) addition of turbine flow meter to measure secondary submersible pump discharge.				
2. Drawing No. H-2-131585, Rev. 2, Leachate Temporary Storage Tank and Piping Plan: Revised per attached Figure R-2. Major changes are (1) addition of valved inter-tie between primary and secondary submersible pump discharge lines and (2) addition of turbine flow meter to measure secondary submersible pump discharge.				
3. Drawing No. H-2-131585, Rev. 2, Section J: Revised per attached Figure R-3. Major changes are (1) addition of leachate recirculation system, (2) addition of limit switch at end of level indicator assembly, and (3) addition of hose bib to piping.				
4. Drawing No. H-2-131585, Rev. 2, Leachate Temporary Storage Tank and Piping Plan: Revised per attached Figure R-4. Major changes are (1) addition of leachate recirculation system and (2) addition of hose bib to piping.				
5. Drawing No. H-2-131587 Rev. 2, Sheet 1 of 4: Revised per attached Figure R-5. Major changes are (1) moving wires 14, 18, and 22 to avoid bypassing high tank relay CR7 and (2) including the limit switch in parallel with high level float switch.				
13a. Justification (mark one)				
Criteria Change ☐	Design Improvement ☐	Environmental ☐		
As-Found ☐	Facilitate Const. ☒	Const. Error/Omission ☐	Design Error/Omission ☐	
13b. Justification Details				
1 and 2. Allows primary sump to be used as emergency storage for secondary sump leachate. Allows discharge from each sump to be measured independently.				
3 and 4. Allows leachate to be recirculated to provide representative sampling. Hose bib for draining recirculation pipes. Limit switch to provide redundancy with high level float switch.				
5. Pumps cannot be started in manual mode if leachate tank is full. Limit switch to provide redundancy with high level float switch.				
14. Distribution (include name, MSIN, and no. of copies)				RELEASE STAMP
WHC DISTRIBUTION		KEH DISTRIBUTION		OFFICIAL RELEASE BY WHC DATE JAN 24 1994 <i>dia. 4</i>
Project Files R1-28 (1)	L.R. Tollbom R3-46 (1)	J.R. Morton E2-30 (3)	P.G. Beaudet E2-30 (1)	
J.R. McGee G6-47 (1)	D.A. Pratt T4-03 (1)	W.A. Holstein E2-50 (1)	P.L. Rackley S2-55 (1)	
Station 10 A3-87 (1)	R.J. Giroir T4-05 (1)			
D.A. Rohl S4-01 (1)				
ECOLOGY DISTRIBUTION		DOE DISTRIBUTION		
E.G. Erpenbeck G6-47 (3)	J. Hensley S6-75 (1)	M.S. Collins AS-18 (1)		
S.R. Briggs G6-47 (1)				
K.D. Johnson H2-58 (1)				
J.J. Dorian B2-16 (1)				
G.C. Evans H6-23 (1)				
H.R. Benzal T4-03 (1)				

A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE

Page 2 of 7

1. ECN (use no. from pg. 1)

W-025-018

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table border="0"> <tr> <td>ENGINEERING</td> <td>CONSTRUCTION</td> </tr> <tr> <td>Additional ☒ \$0</td> <td>Additional ☒ \$6500</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☒ \$0	Additional ☒ \$6500	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 10																																																						
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18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.																																																														
SDD/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IED Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Pos. Proc. Comp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Special Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLSQ Part B Permit Application ☒ Project W-025 Specifications ☒																																																												
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below. <table border="0"> <tr> <td>Document Number/Revision</td> <td>Document Number/Revision</td> <td>Document Number/Revision</td> </tr> <tr> <td>WHC-SD-W-025-PLN-001 Rev. 3</td> <td></td> <td></td> </tr> <tr> <td>DOE/RL-88-20, Supplement 2</td> <td></td> <td></td> </tr> <tr> <td>WHC-S-045 Rev. 2</td> <td></td> <td></td> </tr> </table>			Document Number/Revision	Document Number/Revision	Document Number/Revision	WHC-SD-W-025-PLN-001 Rev. 3			DOE/RL-88-20, Supplement 2			WHC-S-045 Rev. 2																																																		
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20. Approvals <table border="0"> <tr> <th>Signature</th> <th>Date</th> <th>Signature</th> <th>Date</th> </tr> <tr> <td>OPERATIONS AND ENGINEERING</td> <td></td> <td>ARCHITECT-ENGINEER</td> <td></td> </tr> <tr> <td>Cog Engineer <i>[Signature]</i></td> <td>1/24/94</td> <td>PE <i>Frank S. Shari</i></td> <td>1-21-94</td> </tr> <tr> <td>Cog. Mgr. <i>[Signature]</i></td> <td>1/24/94</td> <td>QA <i>W. J. [Signature]</i></td> <td>1-21-94</td> </tr> <tr> <td>QA <i>[Signature]</i></td> <td>1/24/94</td> <td>Safety</td> <td></td> </tr> <tr> <td>Safety</td> <td></td> <td>Design</td> <td></td> </tr> <tr> <td>Security</td> <td></td> <td>Environ.</td> <td></td> </tr> <tr> <td>Environ.</td> <td></td> <td>Other <i>Michael L. Brown</i></td> <td>1-21-94</td> </tr> <tr> <td>Projects/Programs</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tank Waste Remediation System</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Facilities Operations</td> <td></td> <td>DEPARTMENT OF ENERGY</td> <td></td> </tr> <tr> <td>Restoration & Remediation</td> <td></td> <td>Signature or Letter No.</td> <td></td> </tr> <tr> <td>Operations & Support Services</td> <td></td> <td></td> <td></td> </tr> <tr> <td>IRM</td> <td></td> <td>ADDITIONAL</td> <td></td> </tr> <tr> <td>Other <i>H. Q. Benzyl</i></td> <td>1/24/94</td> <td><i>W DOE Jerry Herby</i></td> <td>1/24/94</td> </tr> </table>			Signature	Date	Signature	Date	OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER		Cog Engineer <i>[Signature]</i>	1/24/94	PE <i>Frank S. Shari</i>	1-21-94	Cog. Mgr. <i>[Signature]</i>	1/24/94	QA <i>W. J. [Signature]</i>	1-21-94	QA <i>[Signature]</i>	1/24/94	Safety		Safety		Design		Security		Environ.		Environ.		Other <i>Michael L. Brown</i>	1-21-94	Projects/Programs				Tank Waste Remediation System				Facilities Operations		DEPARTMENT OF ENERGY		Restoration & Remediation		Signature or Letter No.		Operations & Support Services				IRM		ADDITIONAL		Other <i>H. Q. Benzyl</i>	1/24/94	<i>W DOE Jerry Herby</i>	1/24/94
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Page 3 of 7

NOTES

1. SOME LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED TO IMPROVE CLARITY OF CHANGES. PLEASE REFER TO DRAWING H-2-1315AS REV. 2 FOR COMPLETE DESIGN NOTES AND LABELS.
2. DESIGN CHANGES CONTAINED IN CLOUDED AREA.
3. INSTALL ALL PPRG SLOPED TO DRAIN.

N
H-2-1315AS

SECTION

NOT TO SCALE
SLOPE EXAGGERATED FOR CLARITY

FIGURE R-1
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: VALVED INTER-TIE SECTION

Golder Associates

DRAWN RDL

DATE

DWG ID: \9331360\ 42770

W025-018

Page 4 of 7

W025-012
Page 8 of 7

Golder Associates

DRAWN RDL

DATE

DWG ID: \9.43\360\42767

W025-012
Page 6 of 7

LEACHATE TEMPORARY STORAGE TANK & PIPING PLAN

0 5 10
SCALE IN FEET

NOTES

1. SOME LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED TO IMPROVE CLARITY OF CHANGES. PLEASE REFER TO DRAWING M-2-131585 REV. 2 FOR COMPLETE DESIGN NOTES AND LABELS.
2. DESIGN CHANGES CONTAINED IN CLOUDED AREA.

FIGURE **R-4**
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: LEACHATE TANK RECIRCULATION SYSTEM PLAN VIEW

W-025-RPT-001
Page 7 of 7

- NOTES:
1. DESIGN CHANGES SHOWN IN CLOUDED AREAS.
2. PLEASE REFER TO DRAWING H-2-131507 REV. 2, SHEET 1 OF 4.

FIGURE R-5
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: CONTROL SYSTEM

Golder Associates

DWG ID: \9331360\4277
DATE: 7-19-94 14:58
DRAWN RDL

ENGINEERING CHANGE NOTICE				1. ECN W-025-018
Page 1 of <u>6</u>				Proj. W-025-019 ECN
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/VOID ☐	3. Originator's Name, Organization, MSIN, and Telephone No. <u>W 24950</u> F.S. Shurt, Golder Associates Inc. (206) 883-0777		4. Date 2-10-94	
5. Project Title/No./Work Order No. <u>C F 2 1 2</u> W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-W025-ATP-001 Rev. 1		9. Related ECN No(s). W-025-018, 020		10. Related PO No. NA
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date	
12. Description of Change Changes to Project W-025 Acceptance Test Procedure: 1. Section 10.1 Initial Conditions for Pump Tests: Prior to testing pumps, verify that relay CR7 (high tank) is de-energized (closed). 2. Section 11.2 High Level Float Switch: Prior to testing the high level float switch, verify that the high level limit switch (L1 - see ECN W-025-18) is de-energized. After testing the high level float switch, verify that it is de-energized. Repeat the test procedure described in Section 11.2 for the high level limit switch. Record all data on a separate Test Data Form 11-2. 3. Section 10.0 Pump Tests: Test spare pumps at the ground surface to verify that they function. Test submersible pumps in a "barrel" that allows complete immersion. Install a valve on the discharge line to simulate head. Install a pressure gage between the valve and pump to measure the head. To test, energize the pump and allow it to achieve steady state conditions at a pressure of approximately 90% of the maximum efficiency discharge head as shown on the manufacturer's pump performance curves. Measure the volume of water pumped for at least 30 seconds. Repeat the test with the pressure set at about 110% of the maximum efficiency discharge head. Repeat test with the discharge valve closed to determine the "shutoff" pressure. Record all data on Test Data Form 10-6, attached to this ECN. Compare results to manufacturer's performance curves. (Continued on Sheet 3)				
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐				
13b. Justification Details 1. Consistency with changes implemented in ECN W-025-018. 2. Consistency with changes implemented in ECN W-025-018. 3. Verify that spare pumps are functional prior to acceptance. (Continued on Sheet 3)				
14. Distribution (include name, MSIN, and no. of copies) <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> WHC DISTRIBUTION Project Files <u>G6-46</u> J.R. McGee <u>G6-47</u> (1) Johnston <u>G6-47</u> (1) D.A. Rohl <u>S4-01</u> (1) E.G. Erpenbeck <u>G6-47</u> (3) S.R. Briggs <u>G6-47</u> (1) K.D. Johnson <u>H2-58</u> (1) J.J. Dorlan <u>B2-16</u> (1) G.C. Evans <u>H6-23</u> (1) H.R. Benzel <u>T4-03</u> (1) </div> <div style="width: 45%;"> KEY DISTRIBUTION L.R. Tollborn <u>R3-46</u> (1) D.A. Pratt <u>T4-03</u> (1) R.J. Giroir <u>T4-05</u> (1) Central Files <u>LS-04</u> (1) </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> ECOLOGY DISTRIBUTION J. Hensley <u>S6-75</u> (1) </div> <div style="width: 45%;"> DOE DISTRIBUTION J.R. Morton <u>S2-55</u> E2-06 (3) P.G. Beaudet <u>S2-55</u> E2-06 (1) W.A. Holstein <u>E6-41</u> E6-68 (1) P.L. Rackley <u>S2-55</u> (1) </div> </div>				RELEASE STAMP <div style="border: 1px solid black; padding: 10px; text-align: center;"> OFFICIAL RELEASE BY WHC DATE <u>FEB 17 1994</u> <u>Sta. 21</u> </div>

A-7900-013-2 (06/92) GEP095

ENGINEERING CHANGE NOTICE				Page 2 of 6		1. ECN (use no. from pg. 1) W-025-019	
15. Design Verification Required ☐ Yes ☒ No		16. Cost Impact ENGINEERING Additional ☐ \$0 Savings ☐ \$ CONSTRUCTION Additional ☐ \$3,000 Savings ☐ \$		17. Schedule Impact (days) Improvement ☐ Delay ☒ 3			
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.							
SOD/DO		☐		Solismic/Struct Analysis		☐	
Functional Design Criteria		☐		Stress/Design Report		☐	
Operating Specifications		☐		Interface Control Drawing		☐	
Criticality Specifications		☐		Calibration Procedure		☐	
Conceptual Design Report		☐		Installation Procedure		☐	
Equipment Spec.		☐		Maintenance Procedure		☐	
Control Spec.		☐		Engineering Procedure		☐	
Procurement Spec.		☐		Operating Instruction		☐	
Vendor Information		☐		Operating Procedure		☐	
OM Manual		☐		Operational Safety Requirement		☐	
FSAR/ISAR		☐		IOP Drawing		☐	
Safety Equipment List		☐		Cell Arrangement Drawing		☐	
Radiation Work Permit		☐		Essential Material Specifications		☐	
Environmental Impact Statement		☐		Fee, Fee, Sump, Schedule		☐	
Environmental Report		☐		Inspection Plan		☐	
Environmental Permit		☐		Inventory Adjustment Request		☐	
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.							
Document Number/Revision		Document Number/Revision		Document Number Revision			
WHC-SD-W-025-PLN-001 Rev. 3							
DOE/RL-88-20, Supplement 2							
20. Approvals							
Signature		Date		Signature		Date	
OPERATIONS AND ENGINEERING				ARCHITECT-ENGINEER			
Cog Engineer <i>Frank S. Shuri</i>		<i>2/14/94</i>		PE <i>Frank S. Shuri</i>		<i>2-10-94</i>	
Cog. Mgr. <i>J.R. Brown</i>		<i>2/14/94</i>		QA <i>John L. Brown</i>		<i>2-11-94</i>	
QA <i>John L. Brown</i>		<i>2/14/94</i>		Safety			
Safety				Design			
Security				Environ.			
Environ.				Other <i>Michael L. Brown</i>		<i>2-11-94</i>	
Projects/Programs							
Tank Waste Remediation System							
Facilities Operations							
Restoration & Remediation							
Operations & Support Services							
IRM							
Other							
				DEPARTMENT OF ENERGY			
				Signature or Letter No.			
				ADDITIONAL <i>John L. Brown</i>			
				<i>cc: 6/97</i>			
				<i>2-14-94</i>			

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

1. ECN (use no. from pg. 1)
W-025-019

Page 3 of 6

Continued from Section 12, page 1:

4. Section 10.0 Pump Tests: Add Section 10.5 to describe testing and calibration of flowmeters:

*10.5 FLOWMETERS

Record all data on Test Data Form 10-5 (see Appendix A).

- 10.5.1 Disconnect the 3-inch-diameter discharge line at a convenient location between the 3-inch flowmeter and the leachate temporary storage tank.
- 10.5.2 Position the water barrel (empty) so that it will collect all discharge through the 3-inch flowmeter.
- 10.5.3 Verify that ball valve W65 is open and ball valve W66 is closed.
- 10.5.4 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.5 Verify that there are at least 200 gallons of pumpable water in the secondary sump.
- 10.5.6 Energize the secondary submersible pump until at least 50 gallons have been pumped into the barrel. De-energize the pump.
- 10.5.7 Measure the depth of water in the barrel and record on Test Data Sheet 10-5. Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.8 Empty the barrel and reposition to receive the discharge through the 3-inch flowmeter.
- 10.5.9 Energize the secondary submersible pump until a constant discharge is achieved (determine by visual observation). Immediately de-energize the pump. Wait 60 seconds. Repeat this cycle 9 more times (total of 10 cycles). In each cycle energizing the pump for the time determined in cycle 1. However, do not allow the barrel to overflow; repeat the cycle fewer than 9 times if necessary. Record the number of cycles and the cycle time on Test Data Sheet 10-5.
- 10.5.10 Measure the depth of water in the barrel and record on Test Data Sheet 10-5. Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.11 Empty the barrel, empty the secondary sump, and reconnect the 3-inch-diameter discharge line between the 3-inch flowmeter and the leachate temporary storage tank.

5. Section 12 Building Power and Lighting: Add Section 12.4 to verify that control panel heaters are functioning correctly:

*12.4 Control Panel Heaters

Record all data on Test Data Form 12-4 (see Appendix A).

- 12.4.1 Turn thermostat on heater in Control Panel A off. Verify that heater is at ambient temperature. Wait for heater to cool if necessary.
- 12.4.2 Turn thermostat until it energizes. Verify that heater becomes warm.
- 12.4.3 Repeat procedure for Control Panels B and C.

Continued from Section 13b, page 1:

- 4. Provide calibration of flowmeters.
- 5. Verify that heaters in control panels are functional.

~~WHC-SD-W025-ATP-001 Rev. 1~~TEST DATA FORM 10-5

W-025-019

PS 4/6

PUMP TESTS - FLOWMETER CALIBRATION

Barrel Diameter (units) _____

Step No.	Activity	Verify	Reading	Date	By
10.5.1	Disconnect discharge line		NA		
10.5.2	Position water barrel		NA		
10.5.3	Ball valve W65 open		NA		
	Ball valve W66 closed		NA		
10.5.4	2-inch flowmeter reading	NA			
	3-inch flowmeter reading	NA			
10.5.5	200 gallons in secondary sump		NA		
10.5.6	Pump 50 gallons into barrel		NA		
10.5.7	Depth of water in barrel	NA			
	2-inch flowmeter reading	NA			
	3-inch flowmeter reading	NA			
10.5.8	Empty barrel and reposition		NA		
10.5.9	First cycle time	NA			
	Total number of cycles (including 1st)	NA			
10.5.10	Depth of water in barrel	NA			
	2-inch flowmeter reading	NA			
	3-inch flowmeter reading	NA			
10.5.11	Empty barrel		NA		
	Empty secondary sump		NA		
	Reconnect discharge line		NA		

~~WHC-SD-W025-ATP-001 Rev. 1~~

TEST DATA FORM 10-6

~~W025-019~~

~~Pg. 5/6~~

PUMP TESTS - SPARE PUMPS

Pressure Gage Model and S/N _____

Pump Type and Serial No.	Volume Pumped (units)	Time	Pressure Head (units)	Date	By

~~WHC-SD-W025-ATP-001 Rev. 1~~~~W-025-019~~~~12-6/6~~TEST DATA FORM 12-4

BUILDING POWER AND LIGHTING - CONTROL PANEL HEATERS

Step No.	Activity	Verify	Reading	Date	By
12.4.1	Heater at ambient - Control Panel A		NA		
12.4.2	Heater becomes warm - Control Panel A		NA		
12.4.3	Heater at ambient - Control Panel B		NA		
	Heater becomes warm - Control Panel B		NA		
	Heater at ambient - Control Panel C		NA		
	Heater becomes warm - Control Panel C		NA		

ENGINEERING CHANGE NOTICE				1. ECN W-025-020																		
Page 1 of <u>2</u>			Proj. W-025-020 ECN																			
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. <u>W24950</u> <u>F.S. Shuri, Golder Associates Inc. (206) 883-0777</u>		4. Date <u>2-10-94</u>																			
5. Project Title/No./Work Order No. <u>CF212</u> <u>W-025 RMW Land Disposal Facility</u>		6. Bldg./Sys./Fac. No. <u>200W / 218-W-5</u>		7. Impact Level <u>3Q</u>																		
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) <u>WHC-S-045 Rev. 2</u>		9. Related ECN No(s). <u>W-025-19</u>		10. Related PO No. <u>NA</u>																		
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. <u>NA</u>	11c. Modification Work Complete <u>NA</u> Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) <u>NA</u> Cog. Engineer Signature & Date																			
12. Description of Change Changes to Project W-025 Specifications: 1. Section 16859, Part 2-1, B.: Heat trace cable may be either 120-volts or 240-volts. If 240-volts is used for the power source, a 30-ampere, 2-pole circuit breaker shall be used in circuit number 8, Panel B. 2. Section 16471, Part 2: Add new section: <div style="margin-left: 40px;"> "2-7 CONTROL PANEL HEATERS Provide a heater with thermostat inside each control panel enclosure. Connect to 120-volt supply for panel. Heater shall be 100 watts, 120-volts AC, Hoffman catalog number D-AH1001A or approved equal. Install heater in accordance with manufacturer's recommended clearances." </div>																						
13a. Justification (mark one) <table style="width: 100%; border: none;"> <tr> <td style="width: 20%;">Criteria Change</td> <td style="width: 20%;">☐</td> <td style="width: 20%;">Design Improvement</td> <td style="width: 20%;">☐</td> <td style="width: 20%;">Environmental</td> <td style="width: 20%;">☐</td> </tr> <tr> <td>As-Found</td> <td>☐</td> <td>Faciliate Const.</td> <td>☒</td> <td>Const. Error/Omission</td> <td>☐</td> </tr> <tr> <td></td> <td></td> <td></td> <td>☐</td> <td>Design Error/Omission</td> <td>☐</td> </tr> </table>					Criteria Change	☐	Design Improvement	☐	Environmental	☐	As-Found	☐	Faciliate Const.	☒	Const. Error/Omission	☐				☐	Design Error/Omission	☐
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As-Found	☐	Faciliate Const.	☒	Const. Error/Omission	☐																	
			☐	Design Error/Omission	☐																	
13b. Justification Details 1. Thermostat with specified current rating could not be obtained. 2. Ensure that control panel remains within operating temperature range during extreme cold weather.																						
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> WHC DISTRIBUTION Project Files <u>G6-46</u> J.R. McGee <u>G6-47 (1)</u> Station 40 <u>A2-87 (4)</u> D.A. Rohl <u>S4-01 (1)</u> E.G. Erpenbeck <u>G6-47 (3)</u> S.R. Briggs <u>G6-47 (1)</u> K.D. Johnson <u>H2-58 (1)</u> J.J. Dorlan <u>B2-16 (1)</u> G.C. Evans <u>H6-23 (1)</u> H.R. Benzel <u>T4-03 (1)</u> </td> <td style="width: 50%; vertical-align: top;"> KEH DISTRIBUTION L.R. Tollbom <u>R3-46 (1)</u> D.A. Pratt <u>T4-03 (1)</u> R.J. Grolr <u>T4-05 (1)</u> L. Garza <u>L6-76 (1)</u> ECOLOGY DISTRIBUTION J. Hensley <u>Sp-75 (1)</u> </td> </tr> <tr> <td style="width: 50%; vertical-align: top;"> DOE DISTRIBUTION J.R. Morton <u>S2-55</u> P.G. Beaudet <u>E2-30 (1)</u> W.A. Holstein <u>E2-50 (1)</u> P.L. Rackley <u>S2-55 (1)</u> <u>E6-41</u> M.S. Collins <u>A5-18 (1)</u> </td> <td style="width: 50%; vertical-align: top;"> RELEASE STAMP <div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE BY WHC <u>20</u> DATE <u>FEB 16 1994</u> <u>Sta. 21</u> </div> </td> </tr> </table>				WHC DISTRIBUTION Project Files <u>G6-46</u> J.R. McGee <u>G6-47 (1)</u> Station 40 <u>A2-87 (4)</u> D.A. Rohl <u>S4-01 (1)</u> E.G. Erpenbeck <u>G6-47 (3)</u> S.R. Briggs <u>G6-47 (1)</u> K.D. Johnson <u>H2-58 (1)</u> J.J. Dorlan <u>B2-16 (1)</u> G.C. Evans <u>H6-23 (1)</u> H.R. Benzel <u>T4-03 (1)</u>	KEH DISTRIBUTION L.R. Tollbom <u>R3-46 (1)</u> D.A. Pratt <u>T4-03 (1)</u> R.J. Grolr <u>T4-05 (1)</u> L. Garza <u>L6-76 (1)</u> ECOLOGY DISTRIBUTION J. Hensley <u>Sp-75 (1)</u>	DOE DISTRIBUTION J.R. Morton <u>S2-55</u> P.G. Beaudet <u>E2-30 (1)</u> W.A. Holstein <u>E2-50 (1)</u> P.L. Rackley <u>S2-55 (1)</u> <u>E6-41</u> M.S. Collins <u>A5-18 (1)</u>	RELEASE STAMP <div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE BY WHC <u>20</u> DATE <u>FEB 16 1994</u> <u>Sta. 21</u> </div>															
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A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) W-025-020
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <th style="text-align: left;">ENGINEERING</th> <th style="text-align: left;">CONSTRUCTION</th> </tr> <tr> <td>Additional \$0</td> <td>Additional \$1,500</td> </tr> <tr> <td>Savings \$</td> <td>Savings \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional \$0	Additional \$1,500	Savings \$	Savings \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 1
ENGINEERING	CONSTRUCTION							
Additional \$0	Additional \$1,500							
Savings \$	Savings \$							

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SOD/DOO ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Control Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ FEAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Safety/Stress Analysis ☐ Stress/Design Report ☐ Intercom Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Coil Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Temp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Space Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLSD Part B Permit Application ☒
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19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
WHC-SD-W-025-PLN-001 Rev. 3		
DOE/RL-88-23, Supplement 2		

20. Approvals	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer <i>[Signature]</i>	2-14-94	PE <i>Frank S. Shuri</i>	2-10-94
Cog. Mgr. <i>[Signature]</i>	2-14-94	QA <i>[Signature]</i>	2-11-94
QA <i>[Signature]</i>	2-14-94	Safety	
Safety		Design	
Security		Environ.	
Environ.		Other <i>Michael L. Brown</i>	2-11-94
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation			
Operations & Support Services			
IRM			
Other			

DEPARTMENT OF ENERGY
Signature or Letter No.

ADDITIONAL
Ecclery *[Signature]* 2-14-94

ENGINEERING CHANGE NOTICE				1. ECN <u>16406</u>																														
Page 1 of <u>2</u>				Proj. W-025-021 ECN																														
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 2-18-94																															
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q																														
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-S-045 Rev. 2, also Dwgs		9. Related ECN No(s). W-025-012		10. Related PO No. NA																														
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date																															
12. Description of Change Changes to Project W-025 Specifications: 1. Section 02511: Change title of section to "Paving". Change Part 1-1 A. to read "Asphalt concrete paving and surface sealer in the truck unloading area, truck staging area, and access road." 2. Appendix A: Subtract 0.33 feet from the elevations of the following grid points in the truck staging area subgrade: 802, 808, 809, 815, 816, 822, 823, 826, 830, 831, 833, 834, 835, 836, 837, 838, 839, 840, 841, 852, 853, 855, 856, 857, 858, 859, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000. Changes to Project W-025 Drawings: 3. Drawing H-2-131584 Rev. 2: Change note 3 to read: "Truck Unloading Area to be lined and paved as shown in Section 1. Truck Staging A and entrance road to be paved with 8 inches of top course and 4 inches of asphalt concrete only." 4. Drawing H-2-131584 Rev. 2: On Detail 16, subtract 0.33 feet from the elevations of the following grid points in the truck staging area subgrade: 802, 808, 809, 815, 816, 822, 823, 826, 830, 831, 833, 834, 835, 836, 837, 838, 839, 840, 841, 852, 853, 855, 856, 857, 858, 859, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.																																		
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13b. Justification Details 1 and 3. Design criteria change. 2 and 4. Allowance for thickness of asphalt paving.																																		
14. Distribution (include name, MSIN, and no. of copies) WHC DISTRIBUTION <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Project Files 66-47</td> <td style="width: 33%;">L.R. Tollbom R3-46 (1)</td> <td style="width: 33%;">J.R. Morton 32-55</td> </tr> <tr> <td>J.R. McGee G6-47 (1)</td> <td>D.A. Pratt T4-03 (1)</td> <td>P.G. Beaudet 66-47 (1)</td> </tr> <tr> <td>Station 10 A3-87 (1)</td> <td>R.J. Girard T4-05 (1)</td> <td>W.A. Holstein 66-47 (1)</td> </tr> <tr> <td>D.A. Rohl S4-01 (1)</td> <td></td> <td>P.L. Rackley S2-55 (1)</td> </tr> <tr> <td>E.G. Erpenbeck G6-47 (3)</td> <td></td> <td></td> </tr> <tr> <td>S.R. Briggs G6-47 (1)</td> <td></td> <td></td> </tr> <tr> <td>K.D. Johnson H2-58 (1)</td> <td></td> <td></td> </tr> <tr> <td>J.J. Dorlan B2-16 (1)</td> <td></td> <td></td> </tr> <tr> <td>G.C. Evans H6-23 (1)</td> <td></td> <td></td> </tr> <tr> <td>H.R. Benzal T4-03 (1)</td> <td></td> <td></td> </tr> </table>				Project Files 66-47	L.R. Tollbom R3-46 (1)	J.R. Morton 32-55	J.R. McGee G6-47 (1)	D.A. Pratt T4-03 (1)	P.G. Beaudet 66-47 (1)	Station 10 A3-87 (1)	R.J. Girard T4-05 (1)	W.A. Holstein 66-47 (1)	D.A. Rohl S4-01 (1)		P.L. Rackley S2-55 (1)	E.G. Erpenbeck G6-47 (3)			S.R. Briggs G6-47 (1)			K.D. Johnson H2-58 (1)			J.J. Dorlan B2-16 (1)			G.C. Evans H6-23 (1)			H.R. Benzal T4-03 (1)			KEH DISTRIBUTION J.R. Morton 32-55 (3) P.G. Beaudet 66-47 (1) W.A. Holstein 66-47 (1) P.L. Rackley S2-55 (1)
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ECOLOGY DISTRIBUTION J. Hensley 56-75 (1)				DOE DISTRIBUTION M.S. Collins AS-18 (1)																														
RELEASE STAMP OFFICIAL RELEASE BY WHC DATE FEB 24 1994 23 <i>Sta # 10</i>																																		

A-7900-013-2 (06/92) GEF095

ENGINEERING CHANGE NOTICE				Page 2 of 2	1. ECN (use no. from pg. 1) W-025-021																																																																											
15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;">ENGINEERING</td> <td style="text-align: center; width: 50%;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☐ \$0</td> <td>Additional ☐ \$600</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>			ENGINEERING	CONSTRUCTION	Additional ☐ \$0	Additional ☐ \$600	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 0.5																																																																						
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<i>[Signature]</i>	2-23-94

Golder Associates

REVIEW COMMENT FORM (RCF)

Project Name W-025 Engineering During Construction

Document Title ECN W-025-021

Author(s) F. Shui

Project No. 933-1360

Review Date 2-18-94

SWI No. W025 S-1 Rev. 0

Page 1 of 1

Comment No.	Page, Line, Para, Section No.	Mandatory	Non-Mandatory	Review Comment	Comment Resolution	Resolution Accepted
1				No comments.	NA	

Author(s) F. S. Shui

Reviewer Richard L. Brown

Calculation checks verified NA

APPROVAL

M. J. Johnson Quality Assurance

NA Project Manager

Date 2-18-94

ENGINEERING CHANGE NOTICE				Page 1 of 5	
<i>W7ED 50</i>				1. ECN 164097	
2. ECN Category (mark one)				Proj. W-025-022 ECN	
☒ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void				3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777	
4. Date 4-20-94				5. Project Title/No./Work Order No. CFAB 4	
6. Bldg./Sys./Fac. No. 200W / 218-W-5				7. Impact Level 8%	
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-S-045 Rev. 2, Design Drawings				9. Related ECN No(s). NA	
10. Related PO No. NA				11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	
11b. Work Package No. NA				11c. Modification Work Complete NA Cog. Engineer Signature & Date	
11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date				12. Description of Change Changes to Project W-025 Specifications: 1. Section 11210, Part 1-1: Add new paragraph: "E. The self-priming centrifugal pump and wet/dry vacuum used to remove liquid from the secondary containment basin under the leachate temporary storage tank." 2. Section 11210, Part 2: Add new Part: "2-6 LIQUID REMOVAL PUMPS Provide electric pump to remove liquid from secondary containment basin under temporary leachate storage tank. Pump will discharge liquid into temporary leachate storage tank through quick connect fitting attached to discharge line from bottom of tank. Pump shall be electric self-priming centrifugal pump with stainless steel internal components, minimum discharge of 10 gpm against 40 ft head, Price Pump Co. Model SP150SS, W.W. Grainger, Inc. stock no. 2P121, or equivalent. Pump shall be close coupled to a capacitor start 115 Volt electric motor." (Continued on Sheet 3)	
13a. Justification (mark one)				13b. Justification Details	
☒ Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission				1 through 5, 10. Change requested by operations personnel. Allow removal of liquid from secondary containment system under leachate temporary storage tank. (Continued on Sheet 3)	
14. Distribution (include name, MSIN, and no. of copies)				RELEASE STAMP	
WHC DISTRIBUTION Project Files G6-47 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorlan B2-16 (1) G.C. Evans H6-23 (1) H.R. Benzel T4-03 (1)				KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E6-41 (1) P.L. Rackley S2-55 (1) ECOLOGICAL DISTRIBUTION J. Hensley S6-75 (1)	
DOE DISTRIBUTION M.S. Collins A5-18 (1)				OFFICIAL RELEASE BY WHC DATE APR 27 1994 <i>Sta. 21</i>	

A-7900-013-2 (06/92) GEF095

A-7900-013-1 (1)

ENGINEERING CHANGE NOTICE		Page 2 of 5	1. ECN (use no. from pg. 1) W-025-022
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <td style="text-align: center;">ENGINEERING</td> <td style="text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☒ \$0</td> <td>Additional ☒ \$6600</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☒ \$0	Additional ☒ \$6600	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 14
ENGINEERING	CONSTRUCTION							
Additional ☒ \$0	Additional ☒ \$6600							
Savings ☐ \$	Savings ☐ \$							

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDG/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ O&M Manual ☐ PSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Comp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spares Multiple Unit Listing ☐ Test Procedures/Specifications ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICAS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLSO Part B Permit Application ☒
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19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
WHC-SD-W-025-PLN-001 Rev. 3		
DOE/RL-88-20, Supplement 2		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer <i>[Signature]</i>	4/25/94	PE <i>[Signature]</i>	4-21-94
Cog. Mgr. <i>[Signature]</i>	4/25/94	QA <i>[Signature]</i>	4-27-94
QA <i>[Signature]</i>	4/25/94	Safety	
Safety		Design	
Security		Environ.	
Environ.		Other <i>[Signature]</i>	4/22/94
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation			
Operations & Support Services <i>H.R. BENTLEY per email 4/25/94</i>	4/25/94		
IRM			
Other			

DEPARTMENT OF ENERGY
Signature or Letter No. _____
ADDITIONAL _____

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

Page 3 of 5

1. ECN (use no. from pg. 1)
W-025-022

Continued from Section 12, page 1:

*Provide the following accessories for the electric self priming pump:

- 35-ft-long (minimum) suction hose, reinforced, 100 psi minimum working pressure, with fittings, diameter to match pump inlet port, heavy duty, rubber or equivalent.
- 6-ft-long (minimum) discharge hose, reinforced, 100 psi minimum working pressure, with fittings, diameter to match pump discharge port, heavy duty, rubber or equivalent.
- Electrical extension cord for pump, minimum 50-feet long, rated for outdoor use, U.L. listed, OSHA approved, heavy duty, all temperature, 3-conductor. Conductor gage shall be appropriate for pump motor in accordance with electrical codes.

Provide fully removable wet/dry vacuum head to mount on standard 55 gallon drum. Vacuum will remove any liquid that cannot be removed by self-priming electrical pump. (Self-priming electrical pump will be used to pump liquid from drum into leachate storage tank as above.) Vacuum motor shall be two-stage, bypass, 120 Volt, 50/60 Hz, 11 Amp, 3.5 HP. Vacuum shall provide minimum flow of 100 CFM through a 2.5-inch-diameter hose at a static pressure of at least 105 inches. Vacuum shall be W.W. Grainger, Inc. stock no. 6Z096 or equivalent.

Provide the following accessories for the wet/dry vacuum head:

- 55 gallon drum, coated on inside to resist organic liquids.
- 20-ft-long (minimum) suction hose, diameter and material compatible with vacuum head, with squeegee attachment.
- Electrical extension cord for vacuum head, minimum 50-feet long, rated for outdoor use, U.L. listed, OSHA approved, heavy duty, all temperature, 3-conductor. Conductor gage shall be appropriate for vacuum head in accordance with electrical codes.

3. Section 15100: Add new paragraph:

*2-10 QUICK CONNECTS

Quick connects for leachate containment basin pump discharge line shall be the same diameter as the line, stainless steel construction, with metal dust caps and chains. Hansen Series X-HK or equivalent.

4. New ball valves shown on Drawing R-4A (attached to this ECN) shall be manually operated, 0.5 inch opening through ball, wetted parts type 316 stainless steel or equivalent, Watts Regulator Industrial Products Division Series S-8XXX or equivalent.

5. Check valve shown on Drawing R-4A (attached to this ECN) shall conform to the requirements of Section 15100 of the Specifications.

6. Section 05500, Paragraph 1-1: Add "stairs to provide access into containment basin under leachate temporary storage tank" to list of included items.

7. Section 05500, Part 2: Add new paragraph:

*2-5 STEEL PIPE

Steel pipe shall conform to ASTM A53.

8. Section 05500, Paragraph 2-2: Add to end of existing paragraph: "Steel components of stairways, railings, mounting hardware, and associated structures shall be galvanized in accordance with ASTM A123."

9. Section 05500, Paragraph 3-1: Add to end of existing paragraph: "Stairways shall be fabricated and installed in conformance with the requirements of OSHA 1910.23 and 1910.24 (29 CFR Ch. XVII)." Note that Contractor shall provide submittal for approval prior to fabrication.

Changes to Project W-025 Design Drawings:

10. Drawing H-2-131585 Rev. 2: Add connection for discharge line from pump used to drain containment basin, as shown on Figure R-4A, attached to this ECN.

11. Drawing H-2-131585 Rev. 2: Add stairway and railing for access in to containment basin under leachate temporary storage tank, as shown on Figure R-6, attached to this ECN. Stairway frame and railings shall be steel. Grating shall be non-slip conforming to requirements of Specifications and this ECN.

Continued from Section 13b, page 1:

6 through 9, 11. Provide access to containment basin under leachate temporary storage tank, because final ground elevation is lower than on original topography used for design.

ECN W-025-022 Page 4 of 5

LEACHATE TEMPORARY STORAGE TANK & PIPING PLAN

NOTES

1. SOME LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED TO IMPROVE CLARITY OF CHANGES. PLEASE REFER TO DRAWING W-2-131585 REV. 2 FOR COMPLETE DESIGN NOTES AND LABELS.

2. DESIGN CHANGES CONTAINED IN CLOUDED AREA.

3. INSULATE EXTENSION PIPES, CHECK VALVE, BALL VALVES, AND QUICK CONNECT.

FIGURE **R-4A**

PROJECT W-025 RMW LANDFILL

DESIGN CHANGES: CONTAINMENT BASIN PUMP DISCHARGE CONNECTION PLAN VIEW

SECTION A-A

SECTION B-B

CONTAINMENT BASIN ACCESS STAIR PLAN

NOTES

1. LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED TO IMPROVE CLARITY OF CHANGES. PLEASE REFER TO DRAWING H-2-131585 REV. 2 FOR COMPLETE DESIGN NOTES AND LABELS.

R-6

PROJECT W-025 RMW LANDFILL

DESIGN CHANGES: STAIRS TO ALLOW ACCESS TO CONTAINMENT BASIN

Golder Associates

\TEMP\42787

DATE 4-26-94 11:33 DRAWN

**Golder
Associates**

SUBJECT Cost Estimate - ECN W-025-022

Job No. 933-1360
Ref.

Made by FSS
Checked [Signature]
Reviewed

Date 4-21-94
Sheet 1 of 1

Cost Estimate for electrical Self Priming Pump:	\$1000
(includes accessories)	
Vacuum head:	\$750
Includes accessories	
Ball Valves: 2 @ \$250	\$500
check valve:	\$150
Quick Connect:	\$200
Misc Piping, Insulation:	\$100
Labor: 4 hrs @ \$56/hr	\$224
Total	\$3724
1 Day schedule impact	
Cost Estimate for stairway	
0.40 yd ³ concrete say	\$300
Labor for rebar, forming 2 hrs @ \$35	\$70
Misc materials, rebar	\$100
Stairway Mats:	\$500
Fabrication: 16 hrs @ \$50	\$800
Installation 8 hrs x 2 labor @ \$35	\$560
	\$2540 ✓
Schedule: 2 weeks delay	
Total: \$3724 + \$2540 = \$6264 + 5% markup = \$6577 say \$6600 ✓	

ENGINEERING CHANGE NOTICE				Page 1 of <u>6</u>	1. ECN 464094 Proj. ECN W-025-023					
2. ECN Category (mark one) ☐ Supplemental ☐ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 3-23-94							
☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys./Fac. No. 200W / 218-W-5	7. Impact Level 3Q ^{SE}							
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) Project W-025 Design Drawings	9. Related ECN No(s). W-025-018		10. Related PO No. NA							
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date							
12. Description of Change Changes to Project W-025 Design Drawings: 5K.1 1. Drawing No. H-2-131585, Rev. 2, Leachate Temporary Storage Tank & Piping Plan: Add heat trace and insulation to all piping, valves, flowmeters, and other piping system components between leachate temporary storage tank and check valves nearest crest wall, as designated by hatched area on Figure R-2A, attached to this ECN. Heat trace and insulation shall conform to existing requirements in Specifications WHC-S-045 Rev. 2. 2. Drawing No. H-2-131585, Rev. 2, Leachate Temporary Storage Tank & Piping Section J: Add heat trace and insulation to all piping, valves, and other piping system components associated with leachate temporary storage tank, designated by hatched area on Figure R-3A, attached to this ECN. Heat trace and insulation shall conform to existing requirements in Specifications WHC-S-045 Rev. 2. 3. Drawing No. H-2-131585, Rev. 2, Leachate Temporary Storage Tank & Piping Section J: Add vacuum release valve W67 12 inches upstream from check valve at discharge pipe entrance to leachate temporary storage tank, as shown on Figure R-3B, attached to this ECN. Vacuum release valve shall conform to existing requirements in Specifications WHC-S-045 Rev. 2.										
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐										
13b. Justification Details 1 and 2. Prevent freezing of water in piping system. 3. Allow piping system to drain so that self-priming pump will start as intended.										
14. Distribution (include name, MSIN, and no. of copies) <table style="width: 100%; border: none;"> <tr> <td colspan="2" style="vertical-align: top;"> WHC DISTRIBUTION Project Files G6-47 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H6-23 (1) H.R. Benzel T4-03 (1) </td> <td colspan="2" style="vertical-align: top;"> L.R. Tolbom R3-46 (1) D.A. Pratt T4-03 (1) R.J. Girair T4-05 (1) L. Fly T4-03 (1) STA. 4 R1-29 ECOLOGY DISTRIBUTION J. Hensley S6-75 (1) </td> <td colspan="2" style="vertical-align: top;"> KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E6-41 (1) P.L. Rackley S2-55 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1) </td> </tr> </table>				WHC DISTRIBUTION Project Files G6-47 (1) J.R. McGee G6-47 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) S.R. Briggs G6-47 (1) K.D. Johnson H2-58 (1) J.J. Dorian B2-16 (1) G.C. Evans H6-23 (1) H.R. Benzel T4-03 (1)		L.R. Tolbom R3-46 (1) D.A. Pratt T4-03 (1) R.J. Girair T4-05 (1) L. Fly T4-03 (1) STA. 4 R1-29 ECOLOGY DISTRIBUTION J. Hensley S6-75 (1)		KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E6-41 (1) P.L. Rackley S2-55 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1)		RELEASE STAMP <div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE BY WHC DATE MAR 31 1994 <i>10 #10</i> </div>
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A-7900-013-2 (06/92) GEF095

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ENGINEERING CHANGE NOTICE				Page 2 of 6	1. ECN (use no. from pg. 1) W-025-023																																																
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IRM				ADDITIONAL																																																	
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ENGINEERING CHANGE NOTICE CONTINUATION SHEET Page 3 of 6	1. ECN (use no. from pg. 1) W-025-023
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Continued from Section 12, page 1:

4. Drawing No. H-2-131586, Rev. 2, Detail 24: Add "(See Note 3)" to label indicating signal cable. Add Note 3 to notes list on drawing:

"3. Signal cables from transducers shall be terminated in junction box. Identical wires shall continue from terminal strip through conduit to control building."
5. Drawing No. H-2-131587, Rev. 2, Sheet 1: Relay CR7 shall be a time-delay relay (time delay after energizing). RTE Timer Relay, time delay adjustable over range of at least 1 to 60 minutes, or equivalent. Other requirements conforming to existing requirements in Specifications WHC-S-045 Rev. 2 as appropriate.
6. Drawing No. H-2-131587, Rev. 2, Sheet 2 and Sheet 4: Photocell on exterior of control building may be deleted if individual photocells are provided with each light fixture.

Continued from Section 13b, page 1:

4. Allow transducers to be removed for calibration or replacement without removing signal cable from conduit and control panel.
5. Prevent pumps from cycling if liquid level in leachate tank sloshes.
6. Equivalent alternative to facilitate construction.

FIGURE R-3A

PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: LEACHATE TANK RECIRCULATION SYSTEM SECTION

Goldier Associates

DRAWN RDL

DATE

DWG ID: \9331360\42767

LEACHATE TEMPORARY STORAGE TANK & PIPING

SECTION J
H-2-131583

NOTES

1. SOME LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED TO IMPROVE CLARITY OF CHANGES. REFER TO DRAWING H-2-131583 REV. 2 FOR COMPLETE DESIGN NOTES AND LABELS.
2. DESIGN CHANGES CONTAINED IN CLOUDED AREA.

FIGURE R-3B

PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: LEACHATE TANK RECIRCULATION SYSTEM SECTION

Goldier Associates

DRAWN RDL

DATE

101 \9331354\42757

**Golder
Associates**

SUBJECT Cost Estimate - EGN W-025-023

Job No. 933-1360
Ref.

Made by FSS
Checked
Reviewed

Date 3-23-94
Sheet 1 of 1

Item	Materials	Labor
1. Heat Trace + Insulation - Upstream Pipes	Heat Trace: 40 ft @ \$1/ft = \$40 Insulation: 40 ft @ \$2/ft = \$80	8 hrs @ \$56/hr = \$448
2. Heat Trace + Insulation - Recirculation Pipes	Heat Trace: 40 ft @ \$1/ft = \$40 Insulation: 40 ft @ \$2/ft = \$80	8 hrs @ \$56/hr = \$448
3. Vacuum Release Valve	Valve: \$150	4 hrs @ \$56/hr = \$224
4. Terminations	Terminal Strip: \$150 New T Box: \$200	4 hrs @ \$36/hr = \$144
5. Time Delay Relay	Relay: \$150	1 hr @ \$30/hr = \$30
6. Photocell	NA	NA
Subtotal	\$690	\$1300
Subtotal Mtl's + Labor		\$1990
Subcontractor Markup @ 20.5%		\$522
Subtotal		\$2512
Prime Contractor Markup @ 5%		\$124
Grand Total:		\$2643
Schedule Impact: 3 days		Say \$2700

ENGINEERING CHANGE NOTICE				1. ECN 1540
Page 1 of 2				Proj. W-025-02- ECN
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 3-28-94	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level SQ
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-SD-W025-ATP-001 Rev. 1		9. Related ECN No(s). W-025-018		10. Related PC No. NA
11a. Modification Work ☐ Yes (Fill out Bk. 11b) ☒ No. (NA Bk.s. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA _____ Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA _____ Cog. Engineer Signature & Date	
12. Description of Change Project W-025 Landfill Acceptance Test Procedure (Instrumentation/Electrical) has been revised in its entirety. See Rev. 2 attached.				
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐				
13b. Justification Details ATP now incorporates design changes made throughout construction.				
14. Distribution (Include name, MSIN, and no. of copies)				RELEASE STAMP
WHC DISTRIBUTION Project Files G6-47 (1) L.R. Tolbom R3-46 (1) J.R. Merton S2-55 (3) J.R. McGee G6-47 (1) D.A. Pratt T4-03 (1) P.G. Beaudet S2-55 (1) Station 10 A3-57 (1) R.L. Groir T4-05 (1) W.A. Holstein E5-41 (1) D.A. Rohl S4-01 (1) E.G. Erpenbeck G6-47 (3) P.L. Rackley S2-55 (1) S.R. Briggs G6-47 (1) ECOLOGY DISTRIBUTION DOE DISTRIBUTION K.D. Johnson H2-58 (1) J. Hensley S6-75 (1) M.S. Collins A5-18 (1) J.L. Dorian B2-18 (1) G.C. Evans H6-23 (1) H.R. Benzal T4-03 (1)				OFFICIAL RELEASE BY WHC DATE APR 01 1994

A-7900-013-2 (06/92) GEP095

A-7900-013-1 (1)

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) W-025-024
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <th style="text-align: center;">ENGINEERING</th> <th style="text-align: center;">CONSTRUCTION</th> </tr> <tr> <td> Additional ☐ \$0 Savings ☐ \$ </td> <td> Additional ☐ \$0 Savings ☐ \$ </td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☐ \$0 Savings ☐ \$	Additional ☐ \$0 Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 0
ENGINEERING	CONSTRUCTION					
Additional ☐ \$0 Savings ☐ \$	Additional ☐ \$0 Savings ☐ \$					

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

200/00 ☐ Functional Design Criteria ☐ Operating Specifications ☐ Emergency Specifications ☐ Construction Design Report ☐ Equipment Specs. ☐ Control Specs. ☐ Production Specs. ☐ Vendor Information ☐ O&M Manual ☐ P&ID/PSD ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Source/Stream Analysis ☐ Stress/Design Report ☐ Installation Control Drawing ☐ Calibration Procedures ☐ Installation Procedures ☐ Maintenance Procedures ☐ Engineering Procedures ☐ Operating Instructions ☐ Operating Procedures ☐ Operational Safety Requirements ☐ IOP Drawing ☐ Cell Arrangement Drawing ☐ Second Material Specification ☐ Fed. Proc. Serv. Schedule ☐ Installation Plan ☐ Inventory Adjustment Request ☐	Test Calibration Manual ☐ Health Physics Procedure ☐ Safety Manual Unit Listing ☐ Test Procedures/Specifications ☐ Component List ☐ ASME Codes Item ☐ Human Factor Consideration ☐ Computer Software ☐ Engine Grant Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Request ☐ Construction Quality Assurance Plan ☐ USG Part 8 Permit Application ☐
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19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
WHC-SD-W-025-PLN-001 Rev. 3		
DOE/RL-88-20, Supplement 2		

20. Approvals																																																							
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ORIGINAL

Date Received: 4-1-94	INFORMATION RELEASE REQUEST		Reference: WHC-CH-3-4
Complete for all Types of Release			
Purpose ☐ Speech or Presentation ☒ Full Paper (Check only one suffix) ☐ Summary ☐ Abstract ☐ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape		☐ Reference ☒ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☐ Other	ID Number (include revision, volume, etc.) WHC-SD-W025-ATP-001, Revision 2 List attachments. Previously released WHC-SD-W025-ATP-001, Rev. 1 Date Release Required
Title ACCEPTANCE TEST PROCEDURE FOR PROJECT W-025		Unclassified Category UC-721	Impact Level Q
New or novel (patentable) subject matter? ☒ No ☐ Yes If "Yes", has disclosure been submitted by WHC or other company? ☐ No ☐ Yes (Disclosure Noted).		Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? ☒ No ☐ Yes (Identify)	
Copyrights? ☒ No ☐ Yes If "Yes", has written permission been granted? ☐ No ☐ Yes (Attach Permission)		Trademarks? ☒ No ☐ Yes (Identify)	
Complete for Speech or Presentation			
Title of Conference or Meeting N/A		Group or Society Sponsoring	
Date(s) of Conference or Meeting N/A	City/State	Will proceedings be published? ☐ Yes ☐ No	Will material be handed out? ☐ Yes ☒ No
Title of Journal N/A			
CHECKLIST FOR SIGNATORIES			
Review Required per WHC-CH-3-4	Yes	No	Reviewer - Signature Indicates Approval
			Name (printed) Signature Date
Classification/Unclassified Controlled Nuclear Information	☐	☒	<i>Don B. Lenz</i> 3/30/94
Patent - General Counsel	☒	☐	Approved per OGC memo dated 2-4-93
Legal - General Counsel	☒	☐	Approved per OGC memo dated 2-4-93
Applied Technology/Export Controlled Information or International Program	☐	☒	<i>LSG</i>
WHC Program/Project	☒	☒	<i>LSG N/A</i>
Communications	☐	☒	<i>LSG</i>
RL Program/Project	☒	☒	<i>LSG N/A</i>
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Other Program/Project	☐	☒	<i>LSG</i>
Information conforms to all applicable requirements. The above information is certified to be correct.			
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SUBJECT INSTRUMENTATION/ELECTRICAL

LOCATION 200 WEST

PROJECT NUMBER W-025 WORK ORDER TBD

PROJECT TITLE RMW LAND DISPOSAL FACILITY

Prepared By

GOLDER ASSOCIATES INC.
Redmond, Washington

ORIGINAL

For the US Department of Energy
Contract DE-AC06-89RL11615

Rev 2

TEST PROCEDURE APPROVED

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APPENDIX A TEST DATA FORMS

ACCEPTANCE TEST PROCEDURERMW LAND DISPOSAL FACILITYPROJECT W-0251.0 PURPOSE OF THE ACCEPTANCE TEST

This acceptance test procedure (ATP) has been prepared to establish field testing procedures to demonstrate that the Electrical/Instrumentation systems function as intended by the design.

2.0 REFERENCE DRAWINGS AND SPECIFICATIONS2.1 DRAWINGS

H-2-131585	1 OF 1	Leachate Collection Tank & Piping
H-2-131586	1 OF 1	Sump Pump Details
H-2-131587	1 OF 4	Electrical - Control
H-2-131587	2 OF 4	Electrical - Tank & Control Bldg.
H-2-131587	3 OF 4	Electrical Site Plan
H-2-131587	4 OF 4	Electrical Details

2.2 SPECIFICATIONS

WHC-S-045 Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Technical Specifications.

3.0 RESPONSIBILITIES

Each company or organization participating in the conduct of this ATP will designate personnel to assume the responsibilities and duties as defined herein for their respective roles. The names of these designees shall be provided to the Recorder for listing on the Recorder's copy of the Test Execution Sheet prior to the performance of any part of this ATP.

3.1 WHC PROJECT ENGINEER

- 3.1.1 Designate a Test Director.
- 3.1.2 Act as liaison between the participants in acceptance testing.
- 3.1.3 Distribute the approved testing schedule as soon as approval has been obtained (one or more weeks prior to testing).

X

- 3.1.4 Schedule and conduct a pre-ATP kickoff meeting with test participants one or more weeks prior to start of testing.
- 3.1.5 Notify the persons performing and witnessing the test two days prior to the start of testing.
- 3.1.6 Notify all concerned parties when a change is made in the testing schedule.
- 3.1.7 Sign Test Execution Sheet when ATP is approved and accepted.
- 3.1.8 Take necessary action to clear exceptions to the ATP.
- 3.1.9 Sign Exception Sheet when exception has been resolved.
- 3.1.10 Provide a distribution list for the approved and accepted ATP.

3.2 TEST DIRECTOR

- 3.2.1 Coordinate all acceptance testing.
- 3.2.2 Distribute all documents including completed ATP, exceptions, resolutions and approvals.
- 3.2.3 Confirm that field testing and inspection of the system or portion of the system to be tested has been completed.
- 3.2.4 Stop any test which, in the judgement of the Director, may cause damage to the system until the test procedure has been revised.
- 3.2.5 Obtain revisions to the ATP, as necessary, to comply with authorized field changes or to accommodate existing field conditions.
- 3.2.6 Evaluate recorded data, discrepancies, and exceptions.
- 3.2.7 Obtain from Golder Associates Inc. (GAI) any information related to this ATP or changes necessary to clear or resolve objections.
- 3.2.8 Sign Test Execution Sheet when ATP has been performed.
- 3.2.9 Sign Exception Sheet when retest has been executed and accepted.
- 3.2.10 Obtain required signatures on the ATP Master prior to reproduction and distribution.

3.3 WITNESSES

Witnesses shall be provided by participating organizations.

- 3.3.1 Witness the tests.
- 3.3.2 Evaluate results of testing.
- 3.3.3 Assist the Test Director when requested.
- 3.3.4 Sign Test Execution Sheet as a Witness.
- 3.3.5 Sign Exception Sheet as a Witness when retest has been executed and accepted.
- 3.3.6 An Acceptance Inspector will witness the test for the Design Engineer.

3.4 RECORDER

The Recorder will be provided by Golder Construction Services.

- 3.4.1 Record names of all designated personnel on Recorder's copy of ATP prior to start of testing.
- 3.4.2 Observe tests and record test data.
- 3.4.3 Sign the Test Execution Sheet as the Recorder.
- 3.4.4 Initial and date every test step on the Recorder's copy as it is completed, next to the step number or on a table, when provided. On tables where there is not room for both the initial and date, date may be entered in space provided at bottom of column.
- 3.4.5 On the Exception Sheet, record objections or exceptions and test steps which are not performed. Have the information transferred in ink or typed to the Master of the Exception Sheet(s). Additional Exception Sheets are to be added as needed.
- 3.4.6 Orally notify the Test Director at time the objection is made.
- 3.4.7 Assign page numbers to Data Sheets and Exception Sheets, after ATP is complete. Record page numbers for these items and make corrections, as necessary, to page numbers shown for these pages in the index.

3

- 3.4.8 Transfer changes and the final test results with Recorder's signature and dates for each step to the Master in ink or type. Submit the completed Master to Construction Document Control for approval signature routing. Also submit the Recorder's copy for record retention.

3.5 CONSTRUCTION CONTRACTOR

- 3.5.1 Organize and perform this acceptance test under coordination of the Test Director.
- 3.5.2 Confirm that all equipment required for performing this test will be available at the start of testing.
- 3.5.3 Provide equipment required for performing this acceptance test, which has not been designated as being provided by others.
- 3.5.4 Request in writing from the Project Engineer those services, materials, or equipment that have been designated as being supplied by the DOE or others.

3.6 OCCUPATIONAL SAFETY AND HEALTH

Individuals shall carry out their assigned work in a safe manner to protect themselves and others from undue hazards and to prevent damage to property and environment. Facility line managers shall assure the safety of all activities within their areas to prevent injury, property damage, or interruption of operation. Performance of test activities shall always include safety and health aspects as delineated in the most current version of the Federal Occupational Safety and Health Administration/Washington Industrial Safety and Health Act (OSHA/WISHA) safety health codes and standards.

4.0 ACCEPTANCE TEST PROCEDURE CHANGE CONTROL

Acceptance testing shall be conducted in accordance with the steps and requirements specified in this procedure. Any required changes must be authorized in accordance with approved change control procedures for this project and promptly accomplished. Procedure changes during testing must be approved by the WHC project engineer, WHC quality assurance, and the GAI inspector (via initials). The GCS recorder shall note these changes as exceptions (see Section 5.2), provided that these changes do not affect safety and health. The changes shall be incorporated in the final acceptance test report.

5.0 TEST EXECUTION

5.1 WITHOUT EXCEPTION

- 5.1.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed and no exceptions have been recorded.
- 5.1.2 Sign and date Test Execution Sheet in the spaces provided.
- 5.1.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer.

5.2 WITH EXCEPTION/RESOLVED

- 5.2.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed with exceptions recorded and resolved.
- 5.2.2 Sign and date Test Execution Sheet in the spaces provided.
- 5.2.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer

5.3 WITH EXCEPTION/OUTSTANDING

- 5.3.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed with exceptions recorded, in part or all of which are presently outstanding and unresolved.
- 5.3.2 Sign and date Test Execution Sheet in the spaces provided.
- 5.3.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer.

6.0 RECORDING AND RESOLVING EXCEPTIONS

6.1 GENERAL

Exceptions to the ATP are sequentially numbered and recorded on individual Exception Sheets. This enables case-by-case resolution, recording, approval, and distribution of each exception.

6.2 RECORDING

- 6.2.1 Number each exception sequentially as it occurs and record it on an Exception Sheet.

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6.2.2 Enter name and organization of objecting party for each exception.

6.2.3 Enter planned action to resolve each exception when such determination is made.

6.3 RETEST/RESOLUTION

Record the action taken to resolve each exception. Action taken may not be the same as planned action.

6.3.1 When action taken results in an acceptable retest, sign and date Retest Execution and Acceptance section of the Exception Sheet.

6.3.2 When action taken does not involve an acceptable retest, strike out the Retest Execution and Acceptance section of the Exception Sheet. Resolve exception as shown under 6.4. below.

6.4 APPROVAL AND ACCEPTANCE

The WHC Project Engineer provides final approval and acceptance of exceptions by checking one of the following on Exception Sheet:

6.4.1 Retest Approved and Accepted: Applicable when Retest Execution and Acceptance section is completed.

6.4.2 Exception Accepted-as-is: Requires detailed explanation.

6.4.3 Other: Requires detailed explanation.

The Project Engineer signs and dates the Exception Sheet and obtains other internal approvals, if required.

6.5 DISTRIBUTION

Distribute requisite copies of completed Exception Sheets to WHC personnel and departments as directed by the WHC Project Engineer.

7.0 TEST CONDITIONS AND EQUIPMENT REQUIRED

7.1 GENERAL

The following conditions shall exist at the start of the acceptance testing for that portion of the system being tested.

6

- 7.1.1 Systems being tested have been inspected for workmanship and for compliance with design.
- 7.1.2 Continuity tests have been performed on portions of the electrical system being tested.
- 7.1.3 Power is available to components of systems being tested.
- 7.1.4 Continuity tests of instrumentation wiring have been performed in accordance with technical specifications WHC-S-045, latest revision.
- 7.1.5 All test instruments have a valid calibration stamp attached that indicates a calibration traceable to the National Institute of Standards and Technology.
- 7.1.6 Methods of water disposal used in this ATP have been approved by the Facilities Management.
- 7.1.7 Personnel responsible for directing, witnessing and performing the tests described in this ATP are familiar with the equipment to be tested, have reviewed the vendor information pertaining to the operation of the equipment, and are familiar with the requirements of this acceptance test procedure.
- 7.1.8 Values used to simulate process inputs (such as water levels D1, D2, D3, DS-1, DS-2, etc.) and alarm conditions for execution of ATP will be provided by the Design Engineer.

7.2 EQUIPMENT REQUIRED

The Contractor shall supply all test equipment unless otherwise noted.

- 7.2.1 Digital multimeter (DMM): 4-1/2 digit or better, 2 percent accuracy.
- 7.2.2 Seven shorting jumpers with ON-OFF switch, 14-gage wire, 12 inch approximate length.
- 7.2.3 Clamp-on Ammeter (COA): Scale 0-6 amp.
- 7.2.4 One highway water tanker, 5,000 gallon capacity, with discharge capability, with comparable KAMVALOK fitting 1673-A, 3 inches diameter.

- 7.2.5 Water level transducer (WLT): 0-10 psi, precalibrated with sufficient cable to reach from primary sump to control building (approximately 200 feet). Alternatively, a water level indicator or other measuring device as approved by the Project Engineer may be used, provided that real-time communications with personnel in the control room are established.
- 7.2.6 Measuring tape, measuring rod, folding scale, or equivalent: 6 ft (min.), +/- 0.5 in.
- 7.2.7 Dry Ice (summer only).
- 7.2.8 Hairdryer or equivalent forced air heater (winter).
- 7.2.9 Water Container (barrel), 60-inches deep minimum.
- 7.2.10 Receptacle Tester: Hand-held device which verifies correct connections of receptacle and simulates ground-fault condition. Ideal #61-051 or equal.
- 7.2.11 Valve for pump discharge line.
- 7.2.12 Pressure gages for pump discharge line, 0 to 50 psi range (valved) and 0 to 200 psi range.

8.0 ELECTRICAL HEAT TRACE SYSTEM

This procedure will demonstrate the correct functioning of electrical heat trace system and the temperature sensing (thermostat) devices. Verify and record the following:

8.1 TEMPERATURE SENSOR

Record all data on Test Data Form 8-1 (see Appendix A).

- 8.1.1 Energize heat trace circuit (close breaker B8). Disconnect the power conductors to the thermostat.
- 8.1.2 Visually inspect the sensor and contacts for damage.
- 8.1.3 Using digital multimeter set to measure resistance (ohms), place connections on opposite sides of thermostat contacts.
- 8.1.4 Cool or heat (depending upon exterior temperature at time of testing) thermostat sensor to simulate outside temperature changes.

8.1.5 Observe multimeter output during testing. When simulated temperature of thermostat is above 40° F (approximately), the resistance should be high (above 500 ohms), indicating that the contacts are open. When the simulated temperature is below 40° F (approximately), the resistance should be low (below 2 ohms), indicating that the contacts are closed. Verify both conditions.

8.1.6 Remove meter connections and reconnect power conductors.

8.2 HEAT TRACE CABLE

Record all data on Test Data Form 8-2 (see Appendix A).

8.2.1 Energize heat trace circuit (close breaker B8).

8.2.2 Manually force the contacts on the thermostat closed. Measure the current in the conductors to the heat trace cable using COA. Current should be 5 amps minimum (note: current is dependent upon temperature of heat trace cable. The current will increase as the temperature of the cable decreases).

8.2.3 Manually force the contacts on the thermostat open. Measure the current in the conductors to the heat trace cable using COA. The current should be less than 0.1 amps.

9.0 TRANSDUCERS AND METER/CONTROLLERS

This procedure will demonstrate the correct functioning of the level transducers and the associated meter/controllers and relays. See Figure 1 for definitions of water levels and associated pumps and relays. Verify and record the following:

9.1 PRIMARY SUMP

Record all data on Test Data Form 9-1 (see Appendix A).

9.1.1 Remove power to pumps W5P1 and W5P3 by opening circuit breakers B1 and A7.

9.1.2 Through the vertical riser pipe, install the water level transducer (WLT) in the bottom of the primary sump leachate collection well with remote readout in the control building. Verify that the reading is equal to the water level in the sump (if any), as measured with a tape measure, measuring rod, or similar device. Alternatively, measure the water level in the sump with the water level indicator and calculate the depth of water.

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Figure 1. Water Level Definitions.

9.1.3 Energize control panel. Observe readout of primary sump level meter. The primary sump reading should be equal to the actual water depth within ± 1 inch. Adjust meter readings as required.

9.1.4 If the water level in the primary sump is above D1, energize pump WSP1 and pump the sump to below level D1. De-energize WSP1. Verify that relays CR1, CR3, and CR4 are "off" (de-energized) and relay CR2 is "on" (energized) by observing the LED on each relay. *AND CR4 ARE*

9.1.5 Begin adding potable water to the primary sump through the vertical riser pipe. Add water at a uniform rate so that the rise of the water level in the leachate collection well is no more than 2 inches/minute. Take care to avoid excessive turbulence during filling. If necessary, stop filling at 2-inch intervals and allow the water level to stabilize. Record the actual rise in the sump level and on the Primary Sump Level Meter at 2 inch intervals. Both readings should be within ± 1 inch. Continue throughout filling.

9.1.6 Continue adding water to primary sump. Observe relay CR2 being de-energized when the level indicated by WLT reaches D1.

9.1.7 Continue adding water to primary sump. Observe relay CR4 being de-energized at level D3 and relay CR1 being energized at level D2. Stop filling sump.

9.1.8 Confirm that the actual water level and Primary Sump Level Meter are within ± 1 inch.

9.1.9 Manually lift (simulate operation) the high level float on the primary sump vertical riser float switch. Verify that relay CR3 is energized. Lower the float and verify that relay CR3 is de-energized.

9.2 SECONDARY SUMP

Record all data on Test Data Form 9-2 (see Appendix A).

9.2.1 Pump the secondary sump to below level DS-1. Remove power to pump WSP2 by opening circuit breaker B5.

9.2.2 Verify that relay CR5 is "off" (de-energized) and CR6 is "on" (energized) by observing the LED on each relay.

- 9.2.3 Remove secondary sump transducer from installed location. Using the water container, slowly fill the container with water and manually calibrate the transducer over the range of 0" to 48". Use at least 10 data points for the calibration. Attach the calibration sheet to Test Data Form 9-2.
- 9.2.4 Reinstall transducer and observe secondary sump level meter reading. This should be near DS-1.
- 9.2.5 Add water in increments as directed by the Test Director to secondary sump via the secondary slope riser pipe. Record the volume of water added to the sump. Wait 2 minutes after each increment of water, and record the secondary sump level meter reading. Verify that the secondary sump level meter reading increases as water is added.
- 9.2.6 Continue adding water in increments and observe that relay CR6 is de-energized when the level is DS-1, and that CR5 is energized when the level is DS-2. Stop filling sump.

10.0 PUMP TESTS

This procedure will demonstrate the correct functioning of the pumps and associated controls. See Figure 1 for definitions of water levels and associated pumps and relays.

For pumps WSP1, WSP2, WSP3, and WSP4, measure the phase currents prior to beginning pumping tests. Record this information on the top of the test data forms 10-2, 10-3, 10-4, 11-1 respectively. Verify that motor overload devices are sized correctly.

10.1 INITIAL CONDITIONS FOR PUMP TESTS

Prior to testing pumps, verify that relay CR7 (high tank) is de-energized (closed). Record all data on Test Data Form 10-1 (see Appendix A).

10.1.1 Primary Sump

This testing should begin with water in the primary sump above level D2. Verify the following conditions on the control panel:

- a. CR1 is energized.
- b. CR2 is de-energized.
- c. CR3 is de-energized.
- d. CR4 is ~~de~~energized.
- e. Pump failure light for the primary submersible pump is on.
- f. The roof alarm light is on.
- g. The panel lights associated with relays CR1 ^{IS} and CR4 are on, ^{AND CR4 IS OFF.}

10.1.2 Secondary Sump

The water level in the secondary sump should be above the level of the high level switch water level D5-D1. Verify the following conditions on the control panel:

- a. CR5 is energized.
- b. CR6 is de-energized.
- c. Pump failure light for the secondary submersible pump is on.
- d. The roof alarm light is on.
- e. The panel light associated with relay CR5 is on.

10.2 PRIMARY SUBMERSIBLE PUMP (W5P1)

Record all data on Test Data Form 10-2 (see Appendix A).

- 10.2.1 The switch on the control panel for the pump should be in the "off" position. Close circuit breaker 31.
- 10.2.2 Turn the switch for the Primary Submersible Pump to the "hand" position.
- 10.2.3 Verify by direct visual observation that water is being pumped from the sump into the storage tank.
- 10.2.4 Verify that the N/O drain back solenoid valve (W54) is closed (energized).
- 10.2.5 *Sam
OK* Verify that the associated "pump run" light is on. Run the pump until the primary sump is drained below the low water level switch position (below water level D1). *WATER LEVEL D2.*
- 10.2.6 Turn switch on motor controller to "automatic" position. Add water to primary sump until high level relay CR1 is activated water level D2.
- 10.2.7 Verify that the pump starts automatically and that the pump run light is on.
- 10.2.8 Verify by direct visual observation that water is being pumped from the sump into the storage tank.
- 10.2.9 *Sam
OK* Verify that when the water level in the sump reaches low level (water level D1), relay CR2 is energized, and the pump is automatically shut off. *W5P3 MAY BE USED TO ASSIST IN DRAWDOWN.*
- 10.2.10 Add water to the primary sump to above level D1. Manually initiate operation of Timer TM1 and verify that the pump is automatically started.

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H2F

*Sam
6/16*

10.2.11 While pump is running, connect terminals #9 and #10 across F53 using a jumper, to simulate high water level in the storage tank. Verify that the pump is automatically stopped and that the roof alarm is initiated. Remove the jumper and reinitiate the automatic operation.

10.2.12 Turn the switch on the motor starter to the "off" position.

10.3 SECONDARY SUBMERSIBLE PUMP (WSP2)

Record all data on Test Data Form 10-3 (see Appendix A).

10.2.11

*Sam
6/16*

Repeat steps 10.2.1 through 10.2.8 and 10.2.10 except for the secondary submersible pump, adding water to the secondary sump through the secondary riser pipe as required.

10.4 PRIMARY SUMP SELF-PRIMING PUMP (WSP3)

Record all data on Test Data Form 10-4 (see Appendix A).

*Sam
6/16*

10.4.1 The switch on the control panel for pump WSP3 should be in the "off" position. Fill the primary sump with water to above level D2. Close circuit breaker ~~B9~~ ^{A7}.

10.4.2 Turn the switch on the control panel to the "hand" position.

10.4.3 Verify by direct visual observation that the pump is running and that water is being pumped from the sump into the leachate storage tank.

10.4.4 Verify that the "pump run" light is on.

10.4.5 Verify operation for one minute.

10.4.6 Turn the switch on the motor controller to the "automatic" position. Add water to the sump to above level D2.

10.4.7 Manually raise the high level vertical riser float switch to simulate high water condition.

10.4.8 Verify that the pump is automatically started.

10.4.9 Verify that the pump continues running until the water level reaches the low level vertical riser float switch (water level D3), when the pump is automatically shut off.

10.2.11

*Sam
6/16*

10.4.10 Add water to the primary sump and perform step ~~10.2.9~~ ^{10.2.11} for this pump.

10.5 FLOWMETER CALIBRATION

Record all data on Test Data Form 10-5 (see Appendix A).

- 10.5.1 Disconnect the 3-inch-diameter discharge line at a convenient location between the 3-inch flowmeter and the leachate temporary storage tank.
- 10.5.2 Position the water barrel (empty) so that it will collect all discharge through the 3-inch flowmeter.
- 10.5.3 Verify that ball valve W65 is open and ball valve W66 is closed.
- 10.5.4 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.5 Verify that there are at least 200 gallons of pumpable water in the secondary sump.
- 10.5.6 Energize the secondary submersible pump until at least 50 gallons have been pumped into the barrel. De-energize the pump.
- 10.5.7 Measure the depth of water in the barrel and record on Test Data Sheet 10-5. Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.8 Empty the barrel and reposition to receive the discharge through the 3-inch flowmeter.
- 10.5.9 Energize the secondary submersible pump until a constant discharge is achieved (determine by visual observation). Immediately de-energize the pump. Wait 60 seconds. Repeat this cycle 9 more times (total of 10 cycles), in each cycle energizing the pump for the time determined in cycle 1. However, do not allow the barrel to overflow; repeat the cycle fewer than 9 times if necessary. Record the number of cycles and the cycle time on the Test Data Sheet 10-5.
- 10.5.10 Measure the depth of water in the barrel and record on Test Data Sheet 10-5. Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.11 Empty the barrel, empty the secondary sump, and reconnect the 3-inch-diameter discharge line between the 3-inch flowmeter and the leachate temporary storage tank.

10.6 SPARE PUMP TESTS

Test spare pumps at the ground surface to verify that they function. Test submersible pumps in a "barrel" that allows complete immersion. Record all data on Test Data Form 10-6.

- 10.6.1 Install the valve on the pump discharge line to simulate head.
- 10.6.2 Install the pressure gage between the valve and pump to measure the head.
- 10.6.3 Energize the pump and allow it to achieve steady state conditions at a pressure of approximately 90% of the maximum efficiency discharge head as shown on the manufacturer's pump performance curves. Measure the volume of water pumped for at least 30 seconds.
- 10.6.4 Repeat the test with the pressure set at about 110% of the maximum efficiency discharge head.
- 10.6.5 Repeat the test with the discharge valve closed to determine the "shutoff" pressure.
- 10.6.6 Repeat steps 10.6.1 through 10.6.5 for all spare pumps.

11.0 LEACHATE STORAGE TANK

This procedure will demonstrate correct functioning of the transfer pump and controls associated with the leachate storage tank. Verify and record the following:

11.1 LEACHATE STORAGE TANK PUMP (W5F4)

Record all data on Test Data Form 11-1 (see Appendix A).

- 11.1.1 Verify that the storage tank is at least 25 percent full of water. Turn on circuit breaker A1 for the pump.
- 11.1.2 Using the DMM, measure the voltage at the motor terminals (T1, T2, T3). The voltage should read 0 between terminals T1 & T2, T2 & T3, and between T1 and the metal frame.
- 11.1.3 Push the "start" pushbutton on the motor starter. Verify that the motor is operating correctly with proper rotation. Verify by direct visual observation that water is being pumped from the tank.

11.1.4 Using the DMM, measure the voltage at the motor terminals. The voltage should read between 460 and 500 volts between terminals T1 & T2 and between terminals T2 & T3.

11.1.5 Continue pumping for 2 minutes minimum. Push the "stop" pushbutton and verify that the pump stops running.

| 11.2 HIGH LEVEL FLOAT SWITCH (FS3) AND LIMIT SWITCH (L1)

| Record all data on Test Data Forms 11-2A and 11-2B (see Appendix A).

| 11.2.1 Observe that the red "high tank level" light on the control panel is off and that relay CR7 is de-energized. Disconnect limit switch L1.

11.2.2 Fill the storage tank with water to above the high level. Verify that FS3 operates at the selected "high water" level.

| 11.2.3 Observe that relay CR7 is energized and time delay is functional.

11.2.4 Observe that the red "high tank level" light on the control panel is on.

| 11.2.5 Observe that the roof alarm light is on and time delay is functional.

11.2.6 Verify that the submersible pumps and self primary pumps will not operate (3 pumps total) by temporarily turning the appropriate control switches on the control panel to "hand" position and observing that the associated "pump run" light does not come on.

11.2.7 Lower the water level in the tank and observe that FS3 returns to normal condition (repeat step 11.2.1).

| 11.2.8 Reconnect limit switch L1 and disconnect the high level float switch FS3.

| 11.2.9 Repeat steps 11.2.1 through 11.2.7 to test L1. Record all data on Test Data Form 11-2B (see Appendix A).

| 11.2.10 Reconnect high level float switch FS3.

12.0 BUILDING POWER AND LIGHTING

This procedure will demonstrate the correct functioning of control building power and lighting, and area lighting. Verify and record the following:

12.1 BUILDING POWER RECEPTACLE

Record all data on Test Data Form 12-1 (see Appendix A).

12.1.1 Insert receptacle tester into one outlet of the duplex GFI receptacle. Verify that receptacle is correctly wired.

12.1.2 Push the button on the receptacle tester. This will initiate a ground fault current into the receptacle. Verify that the receptacle ground fault device trips. Verify that the outlet is now de-energized (observe that all the lights on the tester are now off).

12.1.3 Repeat Step 12.1.2 for the other outlet.

12.2 BUILDING LIGHTING FIXTURES

Record all data on Test Data Form 12-2 (see Appendix A).

12.2.1 Turn on light switch for fixture in the Control Building. Observe that both fluorescent lamps are illuminated.

12.3 AREA LIGHTING FIXTURES

Record all data on Test Data Form 12-3 (see Appendix A).

12.3.1 Cover the sensors of all photocells to simulate darkness. Observe that the light fixtures are automatically turned on and illuminated to full brightness within 5 minutes.

12.3.2 Observe the operation of the exterior fixtures at 15 minute intervals over a 75 minute period. Verify that the fixtures remain illuminated (do not cycle on and off).

12.3.3 Remove covers from photocell sensors. Verify that all fixtures turn off.

12.4 CONTROL PANEL HEATERS

Record all data on Test Data Form 12-4 (see Appendix A).

12.4.1 Turn thermostat on heater in Control Panel ^C ~~A~~ off. Verify that heater is at ambient temperature. Wait for heater to cool if necessary.

12.4.2 Turn thermostat until it energizes. Verify that heater becomes warm.

~~12.4.3 Repeat procedure for Control Panels B and C~~

ENGINEERING CHANGE NOTICE				ECN 164098 Proj. W-025-025 ECN																																																						
Page 1 of 6																																																										
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 5-27-94																																																						
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level <i>EC</i> <i>EQ</i>																																																						
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) H-2-131585 sk 1 WHC-S-045 Rev. 2, Design Drawings WHC-SD-W025-ATP-001 Rev. 2		9. Related ECN No(s). W-025-17		10. Related PO No. NA																																																						
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bks. 11b, 11c, 11d)		11b. Work Package No. NA		11c. Modification Work Complete NA Cog. Engineer Signature & Date																																																						
11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date																																																										
12. Description of Change Changes to Project W-025 Design Drawings: 1. Drawing No. H-2-131585, Rev. 2: Revise piping between headwall and leachate temporary storage tank as shown on attached Drawing R-7. Major revisions include repositioning flowmeters, adding new ball valve, replacing existing vacuum release valves with vacuum / air release valve (VARV), adding new VARV, and adding VARV drain lines. VARVs shall be mounted on a vertical extension pipe from a T-connection as shown on Drawing R-7. The T-connection and extension pipe shall be the same diameter as the associated discharge line. The extension pipe shall be 4 inches long. At the top of the extension pipe, use reducers as necessary to attach VARV. (Continued on Sheet 3)																																																										
13a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐																																																										
13b. Justification Details Improve accuracy of flowmeters and prevent any leakage of leachate.																																																										
14. Distribution (include name, MSIN, and no. of copies) <table border="0" style="width: 100%;"> <tr> <td colspan="2"><u>WHC DISTRIBUTION</u></td> <td colspan="2"><u>KEH DISTRIBUTION</u></td> <td rowspan="6" style="text-align: center; vertical-align: middle;"> RELEASE STAMP OFFICIAL RELEASE 23 BY WHC DATE JUN 03 1994 <i>Sta #10</i> </td> </tr> <tr> <td>Project Files</td> <td>G6-47 (1)</td> <td>L.R. Tollborn</td> <td>R3-46 (1)</td> </tr> <tr> <td>J.R. McGee</td> <td>G6-47 (1)</td> <td>D.A. Pratt</td> <td>T4-03 (1)</td> </tr> <tr> <td>Station 10</td> <td>A3-67 (2)</td> <td>R.J. Giroir</td> <td>T4-05 (1)</td> </tr> <tr> <td>D.A. Rohl</td> <td>S4-01 (1)</td> <td></td> <td></td> </tr> <tr> <td>E.G. Erpenbeck</td> <td>G6-47 (3)</td> <td></td> <td></td> </tr> <tr> <td>S.R. Briggs</td> <td>G6-47 (1)</td> <td colspan="2"><u>ECOLOGY DISTRIBUTION</u></td> <td><u>DOE DISTRIBUTION</u></td> </tr> <tr> <td>K.D. Johnson</td> <td>H2-58 (1)</td> <td>J. Hensley</td> <td>S6-75 (1)</td> <td>M.S. Collins</td> <td>A5-18 (1)</td> </tr> <tr> <td>J.J. Dorian</td> <td>B2-16 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>G.C. Evans</td> <td>H6-23 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>H.R. Benzal</td> <td>T4-03 (1)</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>					<u>WHC DISTRIBUTION</u>		<u>KEH DISTRIBUTION</u>		RELEASE STAMP OFFICIAL RELEASE 23 BY WHC DATE JUN 03 1994 <i>Sta #10</i>	Project Files	G6-47 (1)	L.R. Tollborn	R3-46 (1)	J.R. McGee	G6-47 (1)	D.A. Pratt	T4-03 (1)	Station 10	A3-67 (2)	R.J. Giroir	T4-05 (1)	D.A. Rohl	S4-01 (1)			E.G. Erpenbeck	G6-47 (3)			S.R. Briggs	G6-47 (1)	<u>ECOLOGY DISTRIBUTION</u>		<u>DOE DISTRIBUTION</u>	K.D. Johnson	H2-58 (1)	J. Hensley	S6-75 (1)	M.S. Collins	A5-18 (1)	J.J. Dorian	B2-16 (1)					G.C. Evans	H6-23 (1)					H.R. Benzal	T4-03 (1)				
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A-7900-013-2 (06/92) GEF095

A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE	Page 2 of 6	1. ECN (use no. from pg. 1) W-025-025
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">ENGINEERING</td> <td style="width: 50%; text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☒ \$0</td> <td>Additional ☒ \$4,500</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☒ \$0	Additional ☒ \$4,500	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 5
ENGINEERING	CONSTRUCTION							
Additional ☒ \$0	Additional ☒ \$4,500							
Savings ☐ \$	Savings ☐ \$							

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/OO	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Pressurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vander Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/EAR	☐	IEPD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Sema. Schedule	☐	Construction Quality Assurance Plan	☒
Environmental Report	☐	Inspection Plan	☐	LLBO Part B Permit Application	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number/Revision

WHC-SD-W-025-PLN-001 Rev. 3
DOE/RL-88-20, Supplement 2

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING			
Cog Engineer <i>[Signature]</i>	6/3/94	ARCHITECT-ENGINEER	
Cog. Mgr. <i>[Signature]</i>	6/3/94	PE <i>[Signature]</i>	5-31-94
QA <i>[Signature]</i>	6-1-94	QA <i>[Signature]</i>	5-31-94
Safety		Safety	
Security		Design	
Environ.		Environ.	
Projects/Programs		Other <i>[Signature]</i>	7/31/94
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation		DEPARTMENT OF ENERGY	
Operations & Support Services		Signature or Letter No.	
IRM			
Other		ADDITIONAL <i>[Signature]</i>	6/2/94

ENGINEERING CHANGE NOTICE CONTINUATION SHEET Page 3 of 6	1. ECN (use no. from pg. 1) W-025-025
<p>Continued from Section 12, page 1:</p> <p>Changes to Project W-025 Specifications:</p> <ol style="list-style-type: none"> 1. Section 15100, Valves: Add new paragraph: <p style="margin-left: 20px;">*2-10 VACUUM / AIR RELEASE VALVES</p> <p style="margin-left: 20px;">Vacuum / air release valves shall be constructed of corrosion-resistant material and function as both air release and vacuum breaker valves. Vacuum / air release valves shall be VA Series manufactured by Midwestco Sinter Tech Inc. (aka FIP), Niles, IL, or approved equal. Valves on submersible pump lines shall be 3/4-inch size. Valve on self-priming pump line shall be 1-1/4-inch size.*</p> 2. Section 15100, Valves: Add new paragraph: <p style="margin-left: 20px;">*2-11 VACUUM / AIR RELEASE VALVE DRAIN LINE</p> <p style="margin-left: 20px;">Drain line for vacuum / air release valves shall be flexible 3/8-inch nylon tubing, capable of supporting negative pressure, or approved equal. Drain line material shall not deteriorate from seasonal temperature changes, moisture, exposure to the atmosphere, age, or exposure to low levels of radiation over the design life of the system (20 years). Alternatively, stainless steel or rigid plastic tubing may be used for drain line.*</p> 3. Section 15100, Valves: Add new paragraphs: <p style="margin-left: 20px;">*3-3. VACUUM / AIR RELEASE VALVE DRAIN LINES</p> <p style="margin-left: 20px;">A. Attach vacuum / air release valve drain lines to associated piping prior to installing heat trace and insulation.</p> <p style="margin-left: 20px;">B. Vacuum / air release drain lines shall penetrate the caps over the end of the riser pipes in a neat manner to provide at least the same quality of seal as other penetrations. Drain lines shall extend 3 to 5 feet into the associated riser pipes.</p> <p style="margin-left: 20px;">3-4. HEAT TRACE AND INSULATION</p> <p style="margin-left: 20px;">Install heat trace and insulation around all piping, valves, and other equipment between headwall and leachate temporary storage tank so as to prevent freezing. Install in accordance with Section 16859 (heat trace) and Section 15250 (pipe insulation) of the Specifications.*</p> <p>Changes to Project W-025 Acceptance Test Procedure:</p> <ol style="list-style-type: none"> 1. Section 10.5, Flowmeter Calibration: Replace in entirety with attached version. 2. Appendix A, Test Data Form 10-S: Replace in entirety with attached version. <p>General Comments on Revisions:</p> <ol style="list-style-type: none"> 1. New ball valve shall conform to requirements for ball valves specified in ECN W-025-017. 2. Stainless steel piping associated with repositioned flowmeters shall be installed as required so that piping can be supported in a solid and workmanlike manner from existing or new pipe supports. Stainless steel piping material and installation shall conform to the requirements of Section 15060 of the Specifications. 3. Perform acceptance testing of revised piping system in conformance with Section 15060 of the Specifications. 4. Submit information on materials, fabrication, and installation as required by pertinent sections of the Specifications for approval prior to installation. 5. Existing heat trace and insulation shall be removed as necessary prior to revising the piping system. 	

CON W-025-025
Sheet 4 of 6

FIGURE R-7
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: LEACHATE PIPING
Golder Associates

LEGEND:
VAV - VACUUM RELEASE VALVE
VAV - VACUUM/AIR RELEASE VALVE
CV - CHECK VALVE

NOTES:
(1) REPLACE EXISTING VAV WITH NEW VAV.

DATE 5/21/96
DESIGNED BY
DRAWN BY
CHECKED BY
REVIEWED BY

10.5 FLOWMETER CALIBRATION

Record all data on Test Data Form 10-5 (see Appendix A).

- 10.5.1 Verify that there is sufficient water in the secondary sump to pump 500 gallons and still maintain a final water level of at least 8 inches.
- 10.5.2 Verify that the water in the sump is clean and will not produce foam when pumped. Flush sump if necessary until clean, non-foaming water is obtained.
- 10.5.3 Verify that ball valve W65 is open and ball valve W66 is closed. Verify that the ball valve in series with the solenoid draindown valve is closed.
- 10.5.4 Measure the water level in the leachate temporary storage tank to the nearest 0.01 foot with a rigid rod. Measure through port in top of tank. If necessary, add water until depth in tank is at least 0.3 feet.
- 10.5.5 Remove 1/4-inch plug immediately upstream of 3-inch flowmeter. Energize secondary submersible pump. Pump until air no longer escapes through 1/4-inch hole. Replace plug. De-energize pump.
- 10.5.6 Measure the water level in the leachate temporary storage tank as described in step 10.5.4. Record on Test Data Sheet 10-5.
- 10.5.7 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.
- 10.5.8 Energize the secondary submersible pump and pump at least 500 gallons into the leachate temporary storage tank.
- 10.5.9 Measure the water level in the leachate temporary storage tank as described in step 10.5.4. Record on Test Data Sheet 10-5.
- 10.5.10 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5. If the meter readings differ from the calculated volume (based on measurements of water depth in the tank) by more than 5 percent, repeat step 10.5.5 using the self-priming pump (primary sump). Ensure that there is sufficient water in the primary sump prior to purging the discharge pipes. Continue the ATP from step 10.5.6 using the secondary submersible pump.
- 10.5.11 Repeat steps 10.5.8 through 10.5.10 twice, for a total pumped volume of about 1500 gallons.

TEST DATA FORM 10-5

PUMP TESTS - FLOWMETER CALIBRATION

Step No.	Activity	Verify	Reading	Date	By
10.5.1	Verify water volume		NA		
10.5.2	Verify water clean		NA		
10.5.3	Ball valve W65 open		NA		
	Ball valve W66 closed		NA		
	Solenoid ball valve closed		NA		
10.5.4	Water level in tank	NA			
10.5.5	Purge air		NA		
10.5.6	Water level in tank	NA			
10.5.7	2-inch flowmeter reading	NA			
	3-inch flowmeter reading	NA			
10.5.8	Pump 500 gallons - 1st cycle		NA		
10.5.9	Water level in tank - 1st cycle	NA			
10.5.10	2-inch flowmeter reading - 1st cycle	NA			
	3-inch flowmeter reading - 1st cycle	NA			
	Purge air		NA		
10.5.11	Pump 500 gallons - 2nd cycle		NA		
	Water level in tank - 2nd cycle	NA			
	2-inch flowmeter reading - 2nd cycle	NA			
	3-inch flowmeter reading - 2nd cycle	NA			
	Pump 500 gallons - 3rd cycle		NA		
	Water level in tank - 3rd cycle	NA			
	2-inch flowmeter reading - 3rd cycle	NA			
	3-inch flowmeter reading - 3rd cycle	NA			

Date Received: 6-3-94 CW		INFORMATION RELEASE REQUEST		Reference: WHC-CH-3-
Complete for all Types of Release				
Purpose		ID Number (include revision, volume, etc.) WHC-SD-W025-ATP-001, Revision 2		
☐ Speech or Presentation	☐ Reference	List attachments.		
☒ Full Paper (Check only one suffix)	☒ Technical Report	ECN-164098		
☐ Summary	☐ Thesis or Dissertation	ECN-W-025-025		
☐ Abstract	☐ Manual	Date Release Required		
☐ Visual Aid	☐ Brochure/Flier			
☐ Speakers Bureau	☐ Software/Databases			
☐ Poster Session	☐ Controlled Document			
☐ Videotape	☐ Other			

Title ACCEPTANCE TEST PROCEDURE FOR PROJECT W-025		Unclassified Category UC-721	Impact Level Q
New or novel (patentable) subject matter? ☒ No ☐ Yes If "Yes", has disclosure been submitted by WHC or other company? ☐ No ☐ Yes (Disclose No(s).)		Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? ☒ No ☐ Yes (Identify)	
Copyrights? ☒ No ☐ Yes If "Yes", has written permission been granted? ☐ No ☐ Yes (Attach Permission)		Trademarks? ☒ No ☐ Yes (Identify)	
Complete for Speech or Presentation			
Title of Conference or Meeting N/A		Group or Society Sponsoring	
Date(s) of Conference or Meeting N/A	City/State	Will proceedings be published? ☐ Yes ☐ No	Will material be handed out? ☐ Yes ☒ No
Title of Journal N/A			

CHECKLIST FOR SIGNATORIES			
Review Required per WHC-CH-3-4	Yes	No	Reviewer - Signature Indicates Approval
			Name (printed) Signature Date
Classification/Unclassified Controlled Nuclear Information	☐	☒	
Patent - General Counsel	☒	☐	Approved per OGC memo dated 2/4/93
Legal - General Counsel	☒	☐	Approved per OGC memo dated 2/4/93
Applied Technology/Export Controlled Information or International Program	☐	☒	
WHC Program/Project	☐	☒	
Communications	☐	☒	
RL Program/Project	☒ CW	☒	
Publication Services	☐	☒	
Other Program/Project	☐	☒	
Information conforms to all applicable requirements. The above information is certified to be correct.			

References Available to Intended Audience ☒ Yes ☐ No Transmit to DOE-HQ/Office of Scientific and Technical Information ☐ Yes ☒ No Author/Requestor (Printed/Signature) Date EG Erpenbeck <i>[Signature]</i> 6/3/94 Intended Audience ☐ Internal ☐ Sponsor ☒ External Responsible Manager (Printed/Signature) Date DR Lucas <i>[Signature]</i> 6/3/94		INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP Stamp is required before release. Release is contingent upon resolution of mandatory comments. Date Cancelled Date Disapproved	
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**Golder
Associates**

SUBJECT Cost Estimate - ECN W-025-025

Job No. 923-A026

Made by FSB

Date 5-27-94

Ref.

Checked MPB

Sheet 1 of 1

Reviewed

<u>Materials</u>			
Air/Vacuum Release Valves	3 @	\$100 ea	\$300
Bull Valve - Solenoid Drain Line		\$250	\$250
Stainless steel Piping	10' @	\$75/ft	\$750
VARV Drain line	50' @	\$1/ft	\$50
Heat Trace + Insulation			\$200
Subtotal materials			\$1550
Markup @ 25.5%			411
		Total	1961
<u>labor</u>			
Reposition Flammeters	8 hrs @	\$56/hr	\$448
Install VARVs	8 hrs @	\$56/hr	448
Heat Trace Insul.	8 hrs @	\$56/hr	448
Testing	2 hrs @	\$56/hr	112
Acceptance Testing	2 x 8 hrs @	\$56/hr	896
			\$2352
Total Mtl's			\$1961
Total Labor			\$2352
Subtotal			\$4313
Prime Contractor Markup @ 5%			216
Grand Total			\$4529

WTFD50/C F2B5
TPEN F2B5

ENGINEERING CHANGE NOTICE				Page 1 of 6	
2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐				3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777	
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		4. Date 6-6-94	
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) Design Drawings		9. Related ECN No(s). NA		7. Impact Level C44N BQ	
10. Related PO No. NA					
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bkcs. 11b, 11c, 11d)		11b. Work Package No. NA		11c. Modification Work Complete NA Cog. Engineer Signature & Date	
11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date					
12. Description of Change Changes to Project W-025 Design Drawings: 1. Drawing No. H-2-131587, Sheet 1, Rev. 2: Show relays CR-2, CR-4, and CR-6 as normally closed, as illustrated on Drawing R-5A, attached. 2. Drawing No. H-2-131585, Rev. 2: Add splice and "tee" for heat trace, as shown on attached Drawing R-7A. 3. Drawing No. H-2-131585, Rev. 2, Detail 18: Show locations of junction boxes and conduit as illustrated on Drawing R-8, attached. 4. Drawing No. H-2-131587, Sheet 2, Rev. 2, Section M: Revise to show locations of panels as illustrated on Drawing R-9, attached.					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details Incorporate minor changes that reflect as-built conditions.					
14. Distribution (include name, MSIN, and no. of copies) * Adv. Copy					
WHC DISTRIBUTION WRAP DMC G3-15 (1) J.R. McGee G3-15 (1) Station 10 A3-87 (1) D.A. Rohf S4-01 (1) E.G. Erpenbeck G3-15 (3) J. Howard A5-56 (1) K.D. Johnson H5-33 (1) J.J. Dorian H6-30 (1) G.C. Evans H6-23 (1) H.R. Benzal T4-03 (1)			KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E6-41 (1) P.L. Rackley S2-55 (1)		
* H.E. Wellsfry G6-47 (1) G. Cummins H6-24 (1) D.A. Pratt T4-03 (1) R.J. Giroir T4-05 (1) D.R. Lucas G3-15 (1) D. Carlyle T4-03 (1) * STA-4 R1-29 (1)			DOE DISTRIBUTION M.S. Collins A5-18 (1) A.K. Crowell R3-80 (1)		
ECOLOGY DISTRIBUTION J. Hensley S6-75 (1)			RELEASE STAMP OFFICIAL RELEASE BY WHC 20 DATE JUL 01 1994 Sta. 21		

A-7900-013-2 (06/92) GEF095

A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE	Page 2 of 6	1. ECN (use no. from pg. 1) W-025-026
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FIGURE R-5A
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: CONTROL SYSTEM
Golder Associates

~~W-025-026~~ 5/6

DETAIL

N.T.S.

NOTES

1. SOME LABELS AND NOTES FROM FULL SCALE DRAWING HAVE BEEN REMOVED FOR CLARITY. PLEASE REFER TO DRAWING H-2-131585 REV. 2 FOR COMPLETE INFORMATION.

FIGURE R-8
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: JUNCTION BOXES AND CONDUITS

Golden Association

DATE 6-7-94 13:18 DRAWN ROL

9331380\42801

BY

W-025-026

FIGURE R-9
PROJECT W-025 RMW LANDFILL
DESIGN CHANGES: PANEL LAYOUT

Golder Associates

CONTROL BUILDING SECTION

M
H-2-131507

N.T.S.

AUG 16 1994 21 KN <i>Sta. 21</i>		ENGINEERING CHANGE NOTICE	1. ECN 5054 Proj. W-025-028 ECN
		Page 1 of 2	

2. ECN Category (mark one) Supplemental ☐ Direct Revision ☐ Change ECN ☒ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐		3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 7-29-94	
		5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility, Second Lobe	6. Bldg./Sys./Fac. No. 200W / 218-W-5	7. Impact Level NA	
		8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-SD-W025-ATP-001 Rev. 2	9. Related ECN No(s). NA	10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bkcs. 11b, 11c, 11d)		11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date		11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date
12. Description of Change Project W-025 Landfill Acceptance Test Procedure (Instrumentation/Electrical) has been revised in its entirety. See Rev. 3 attached.					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details ATP Incorporates changes made as a result of previous ECNs.					
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Complete for all Types of Release					
Purpose ☐ Speech or Presentation ☐ Full Paper (Check only one suffix) ☐ Summary ☐ Abstract ☐ Visual Aid ☐ Speakers Bureau ☐ Poster Session ☐ Videotape			☐ Reference ☒ Technical Report ☐ Thesis or Dissertation ☐ Manual ☐ Brochure/Flier ☐ Software/Database ☐ Controlled Document ☐ Other		
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7. Abstract THIS ATP ESTABLISHES FIELD TESTING PROCEDURES TO DEMONSTRATE THAT THIS ELECTRICAL/INSTRUMENTATION SYSTEM FUNCTIONS AS INTENDED BY DESIGN.		
8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed. PATEENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA. DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.		10. RELEASE STAMP <div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE (21) BY WHC DATE AUG 16 1994 <i>Sta. 21</i> </div>
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(2) Title			
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CHANGE CONTROL RECORD			
(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Coq. Engr.	(6) Coq. Mgr. Date
0	(7) EDT 158811, dated 8/4/92.		
RS 1	Changes were made to page 4, section 3.6. ECN W-025-003 details the changes. EDT 158811 released Revision 0 on August 4, 1992.	EG Erpenbeck 5/25/93	DR Dwyer 5/25/93
RS 2	This is a general revision to the ATP. It incorporates ECNs W-025-007 and W-025-019. ECN W-025-024 details the changes.	EG Erpenbeck 3/31/94	SR Briggs for SLB 3/31/94
RS 3	This general revision incorporates ECN W-025-025 and changes reflected on WHC-SD-W025-AIR-001, Rev. 0	HE Wellsfry 2/15/94	DR Lucas 2/15/94

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SUBJECT INSTRUMENTATION/ELECTRICAL

LOCATION 200 WEST

PROJECT NUMBER W-025 WORK ORDER NA

PROJECT TITLE RMW LAND DISPOSAL FACILITY

Prepared By

GOLDER ASSOCIATES INC.
Redmond, Washington

For Westinghouse Hanford Company
Order MRY-SVV-301407

Rev 3

TEST PROCEDURE APPROVED

GOLDER ASSOCIATES INC.

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N/A General Revision
Programs Date

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Operations Date

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APPENDIX A TEST DATA FORMS

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ACCEPTANCE TEST PROCEDURE

RMW LAND DISPOSAL FACILITY

PROJECT W-025

1.0 PURPOSE OF THE ACCEPTANCE TEST

This acceptance test procedure (ATP) has been prepared to establish field testing procedures to demonstrate that the Electrical/Instrumentation systems function as intended by the design.

2.0 REFERENCE DRAWINGS AND SPECIFICATIONS

2.1 DRAWINGS

H-2-131585	1 OF 1	Leachate Collection Tank & Piping
H-2-131586	1 OF 1	Sump Pump Details
H-2-131587	1 OF 4	Electrical - Control
H-2-131587	2 OF 4	Electrical - Tank & Control Bldg.
H-2-131587	3 OF 4	Electrical Site Plan
H-2-131587	4 OF 4	Electrical Details

2.2 SPECIFICATIONS

WHC-S-045 Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Technical Specifications.

3.0 RESPONSIBILITIES

Each company or organization participating in the conduct of this ATP will designate personnel to assume the responsibilities and duties as defined herein for their respective roles. The names of these designees shall be provided to the Recorder for listing on the Recorder's copy of the Test Execution Sheet prior to the performance of any part of this ATP.

3.1 WHC PROJECT ENGINEER

- 3.1.1 Designate a Test Director.
- 3.1.2 Act as liaison between the participants in acceptance testing.
- 3.1.3 Distribute the approved testing schedule as soon as approval has been obtained (one or more weeks prior to testing).

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- 3.1.4 Schedule and conduct a pre-ATP kickoff meeting with test participants one or more weeks prior to start of testing.
- 3.1.5 Notify the persons performing and witnessing the test two days prior to the start of testing.
- 3.1.6 Notify all concerned parties when a change is made in the testing schedule.
- 3.1.7 Sign Test Execution Sheet when ATP is approved and accepted.
- 3.1.8 Take necessary action to clear exceptions to the ATP.
- 3.1.9 Sign Exception Sheet when exception has been resolved.
- 3.1.10 Provide a distribution list for the approved and accepted ATP.

3.2 TEST DIRECTOR

- 3.2.1 Coordinate all acceptance testing.
- 3.2.2 Distribute all documents including completed ATP, exceptions, resolutions and approvals.
- 3.2.3 Confirm that field testing and inspection of the system or portion of the system to be tested has been completed.
- 3.2.4 Stop any test which, in the judgement of the Director, may cause damage to the system until the test procedure has been revised.
- 3.2.5 Obtain revisions to the ATP, as necessary, to comply with authorized field changes or to accommodate existing field conditions.
- 3.2.6 Evaluate recorded data, discrepancies, and exceptions.
- 3.2.7 Obtain from Golder Associates Inc. (GAI) any information related to this ATP or changes necessary to clear or resolve objections.
- 3.2.8 Sign Test Execution Sheet when ATP has been performed.
- 3.2.9 Sign Exception Sheet when retest has been executed and accepted.
- 3.2.10 Obtain required signatures on the ATP Master prior to reproduction and distribution.

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3.3 WITNESSES

Witnesses shall be provided by participating organizations.

- 3.3.1 Witness the tests.
- 3.3.2 Evaluate results of testing.
- 3.3.3 Assist the Test Director when requested.
- 3.3.4 Sign Test Execution Sheet as a Witness.
- 3.3.5 Sign Exception Sheet as a Witness when retest has been executed and accepted.
- 3.3.6 An Acceptance Inspector will witness the test for the Design Engineer.

3.4 RECORDER

The Recorder will be provided by Golder Construction Services.

- 3.4.1 Record names of all designated personnel on Recorder's copy of ATP prior to start of testing.
- 3.4.2 Observe tests and record test data.
- 3.4.3 Sign the Test Execution Sheet as the Recorder.
- 3.4.4 Initial and date every test step on the Recorder's copy as it is completed, next to the step number or on a table, when provided. On tables where there is not room for both the initial and date, date may be entered in space provided at bottom of column.
- 3.4.5 On the Exception Sheet, record objections or exceptions and test steps which are not performed. Have the information transferred in ink or typed to the Master of the Exception Sheet(s). Additional Exception Sheets are to be added as needed.
- 3.4.6 Orally notify the Test Director at time the objection is made.
- 3.4.7 Assign page numbers to Data Sheets and Exception Sheets, after ATP is complete. Record page numbers for these items and make corrections, as necessary, to page numbers shown for these pages in the index.

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- 3.4.8 Transfer changes and the final test results with Recorder's signature and dates for each step to the Master in ink or type. Submit the completed Master to Construction Document Control for approval signature routing. Also submit the Recorder's copy for record retention.

3.5 CONSTRUCTION CONTRACTOR

- 3.5.1 Organize and perform this acceptance test under coordination of the Test Director.
- 3.5.2 Confirm that all equipment required for performing this test will be available at the start of testing.
- 3.5.3 Provide equipment required for performing this acceptance test, which has not been designated as being provided by others.
- 3.5.4 Request in writing from the Project Engineer those services, materials, or equipment that have been designated as being supplied by the DOE or others.

3.6 OCCUPATIONAL SAFETY AND HEALTH

Individuals shall carry out their assigned work in a safe manner to protect themselves and others from undue hazards and to prevent damage to property and environment. Facility line managers shall assure the safety of all activities within their areas to prevent injury, property damage, or interruption of operation. Performance of test activities shall always include safety and health aspects as delineated in the most current version of the Federal Occupational Safety and Health Administration/Washington Industrial Safety and Health Act (OSHA/WISHA) safety health codes and standards.

4.0 ACCEPTANCE TEST PROCEDURE CHANGE CONTROL

Acceptance testing shall be conducted in accordance with the steps and requirements specified in this procedure. Any required changes must be authorized in accordance with approved change control procedures for this project and promptly accomplished. Procedure changes during testing must be approved by the WHC project engineer, WHC quality assurance, and the GAI inspector (via initials). The GCS recorder shall note these changes as exceptions (see Section 5.2), provided that these changes do not affect safety and health. The changes shall be incorporated in the final acceptance test report.

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5.0 TEST EXECUTION

5.1 WITHOUT EXCEPTION

5.1.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed and no exceptions have been recorded.

5.1.2 Sign and date Test Execution Sheet in the spaces provided.

5.1.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer.

5.2 WITH EXCEPTION/RESOLVED

5.2.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed with exceptions recorded and resolved.

5.2.2 Sign and date Test Execution Sheet in the spaces provided.

5.2.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer

5.3 WITH EXCEPTION/OUTSTANDING

5.3.1 Check applicable space on Test Execution Sheet to show that the ATP has been performed with exceptions recorded, in part or all of which are presently outstanding and unresolved.

5.3.2 Sign and date Test Execution Sheet in the spaces provided.

5.3.3 Distribute requisite copies and send master of ATP to the WHC Project Engineer.

6.0 RECORDING AND RESOLVING EXCEPTIONS

6.1 GENERAL

Exceptions to the ATP are sequentially numbered and recorded on individual Exception Sheets. This enables case-by-case resolution, recording, approval, and distribution of each exception.

6.2 RECORDING

6.2.1 Number each exception sequentially as it occurs and record it on an Exception Sheet.

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- 6.2.2 Enter name and organization of objecting party for each exception.
- 6.2.3 Enter planned action to resolve each exception when such determination is made.

6.3 RETEST/RESOLUTION

Record the action taken to resolve each exception. Action taken may not be the same as planned action.

- 6.3.1 When action taken results in an acceptable retest, sign and date Retest Execution and Acceptance section of the Exception Sheet.
- 6.3.2 When action taken does not involve an acceptable retest, strike out the Retest Execution and Acceptance section of the Exception Sheet. Resolve exception as shown under 6.4, below.

6.4 APPROVAL AND ACCEPTANCE

The WHC Project Engineer provides final approval and acceptance of exceptions by checking one of the following on Exception Sheet:

- 6.4.1 Retest Approved and Accepted: Applicable when Retest Execution and Acceptance section is completed.
- 6.4.2 Exception Accepted-as-is: Requires detailed explanation.
- 6.4.3 Other: Requires detailed explanation.

The Project Engineer signs and dates the Exception Sheet and obtains other internal approvals, if required.

6.5 DISTRIBUTION

Distribute requisite copies of completed Exception Sheets to WHC personnel and departments as directed by the WHC Project Engineer.

7.0 TEST CONDITIONS AND EQUIPMENT REQUIRED

7.1 GENERAL

The following conditions shall exist at the start of the acceptance testing for that portion of the system being tested.

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- 7.1.1 Systems being tested have been inspected for workmanship and for compliance with design.
- 7.1.2 Continuity tests have been performed on portions of the electrical system being tested.
- 7.1.3 Power is available to components of systems being tested.
- 7.1.4 Continuity tests of instrumentation wiring have been performed in accordance with technical specifications WHC-S-045, latest revision.
- 7.1.5 All test instruments have a valid calibration stamp attached that indicates a calibration traceable to the National Institute of Standards and Technology.
- 7.1.6 Methods of water disposal used in this ATP have been approved by the Facilities Management.
- 7.1.7 Personnel responsible for directing, witnessing and performing the tests described in this ATP are familiar with the equipment to be tested, have reviewed the vendor information pertaining to the operation of the equipment, and are familiar with the requirements of this acceptance test procedure.
- 7.1.8 Values used to simulate process inputs (such as water levels D1, D2, D3, DS-1, DS-2, etc.) and alarm conditions for execution of ATP will be provided by the Design Engineer.

7.2 EQUIPMENT REQUIRED

The Contractor shall supply all test equipment unless otherwise noted.

- 7.2.1 Digital multimeter (DMM): 4-1/2 digit or better, 2 percent accuracy.
- 7.2.2 Seven shorting jumpers with ON-OFF switch, 14-gage wire, 12 inch approximate length.
- 7.2.3 Clamp-on Ammeter (COA): Scale 0-6 amp.
- 7.2.4 One highway water tanker, 5,000 gallon capacity, with discharge capability, with comparable KAMVALOK fitting 1673-A, 3 inches diameter.

- 7.2.5 Water level transducer (WLT): 0-10 psi, precalibrated with sufficient cable to reach from primary sump to control building (approximately 200 feet). Alternatively, a water level indicator or other measuring device as approved by the Project Engineer may be used, provided that real-time communications with personnel in the control room are established.
- 7.2.6 Measuring tape, measuring rod, folding scale, or equivalent: 6 ft (min.), +/- 0.5 in.
- 7.2.7 Dry Ice (summer only).
- 7.2.8 Hairdryer or equivalent forced air heater (winter).
- 7.2.9 Water Container (barrel), 60-inches deep minimum.
- 7.2.10 Receptacle Tester: Hand-held device which verifies correct connections of receptacle and simulates ground-fault condition. Ideal #61-051 or equal.
- 7.2.11 Valve for pump discharge line.
- 7.2.12 Pressure gages for pump discharge line, 0 to 50 psi range (valved) and 0 to 200 psi range.

8.0 ELECTRICAL HEAT TRACE SYSTEM

This procedure will demonstrate the correct functioning of electrical heat trace system and the temperature sensing (thermostat) devices. Verify and record the following:

8.1 TEMPERATURE SENSOR

Record all data on Test Data Form 8-1 (see Appendix A).

- 8.1.1 Energize heat trace circuit (close breaker B8). Disconnect the power conductors to the thermostat.
- 8.1.2 Visually inspect the sensor and contacts for damage.
- 8.1.3 Using digital multimeter set to measure resistance (ohms), place connections on opposite sides of thermostat contacts.
- 8.1.4 Cool or heat (depending upon exterior temperature at time of testing) thermostat sensor to simulate outside temperature changes.

8.1.5 Observe multimeter output during testing. When simulated temperature of thermostat is above 40° F (approximately), the resistance should be high (above 500 ohms), indicating that the contacts are open. When the simulated temperature is below 40° F (approximately), the resistance should be low (below 2 ohms), indicating that the contacts are closed. Verify both conditions.

8.1.6 Remove meter connections and reconnect power conductors.

8.2 HEAT TRACE CABLE

Record all data on Test Data Form 8-2 (see Appendix A).

8.2.1 Energize heat trace circuit (close breaker B8).

8.2.2 Manually force the contacts on the thermostat closed. Measure the current in the conductors to the heat trace cable using COA. Current should be 5 amps minimum (note: current is dependent upon temperature of heat trace cable. The current will increase as the temperature of the cable decreases).

8.2.3 Manually force the contacts on the thermostat open. Measure the current in the conductors to the heat trace cable using COA. The current should be less than 0.1 amps.

9.0 TRANSDUCERS AND METER/CONTROLLERS

This procedure will demonstrate the correct functioning of the level transducers and the associated meter/controllers and relays. See Figure 1 for definitions of water levels and associated pumps and relays. Verify and record the following:

9.1 PRIMARY SUMP

Record all data on Test Data Form 9-1 (see Appendix A).

9.1.1 Remove power to pumps W5P1 and W5P3 by opening circuit breakers B1 and A7.

9.1.2 Through the vertical riser pipe, install the water level transducer (WLT) in the bottom of the primary sump leachate collection well with remote readout in the control building. Verify that the reading is equal to the water level in the sump (if any), as measured with a tape measure, measuring rod, or similar device. Alternatively, measure the water level in the sump with the water level indicator and calculate the depth of water.

943 1576/53250/7-29-94

Figure 1. Water Level Definitions.

- 9.1.3 Energize control panel. Observe readout of primary sump level meter. The primary sump reading should be equal to the actual water depth within +/- 1 inch. Adjust meter readings as required.
- 9.1.4 If the water level in the primary sump is above D1, energize pump W5P1 and pump the sump to below level D1. De-energize W5P1. Verify that relays CR1 and CR3 are "off" (de-energized) and relays CR2 and CR4 are "on" (energized) by observing the LED on each relay.
- 9.1.5 Begin adding potable water to the primary sump through the vertical riser pipe. Add water at a uniform rate so that the rise of the water level in the leachate collection well is no more than 2 inches/minute. Take care to avoid excessive turbulence during filling. If necessary, stop filling at 2-inch intervals and allow the water level to stabilize. Record the actual rise in the sump level and on the Primary Sump Level Meter at 2 inch intervals. Both readings should be within +/- 1 inch. Continue throughout filling.
- 9.1.6 Continue adding water to primary sump. Observe relay CR2 being de-energized when the level indicated by WLT reaches D1.
- 9.1.7 Continue adding water to primary sump. Observe relay CR4 being de-energized at level D3 and relay CR1 being energized at level D2. Stop filling sump.
- 9.1.8 Confirm that the actual water level and Primary Sump Level Meter are within +/- 1 inch.
- 9.1.9 Manually lift (simulate operation) the high level float on the primary sump vertical riser float switch. Verify that relay CR3 is energized. Lower the float and verify that relay CR3 is de-energized.

9.2 SECONDARY SUMP

Record all data on Test Data Form 9-2 (see Appendix A).

- 9.2.1 Pump the secondary sump to below level DS-1. Remove power to pump W5P2 by opening circuit breaker B5.
- 9.2.2 Verify that relay CR5 is "off" (de-energized) and CR6 is "on" (energized) by observing the LED on each relay.

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- 9.2.3 Remove secondary sump transducer from installed location. Using the water container, slowly fill the container with water and manually calibrate the transducer over the range of 0" to 48". Use at least 10 data points for the calibration. Attach the calibration sheet to Test Data Form 9-2.
- 9.2.4 Reinstall transducer and observe secondary sump level meter reading. This should be near DS-1.
- 9.2.5 Add water in increments as directed by the Test Director to secondary sump via the secondary slope riser pipe. Record the volume of water added to the sump. Wait 2 minutes after each increment of water, and record the secondary sump level meter reading. Verify that the secondary sump level meter reading increases as water is added.
- 9.2.6 Continue adding water in increments and observe that relay CR6 is de-energized when the level is DS-1, and that CR5 is energized when the level is DS-2. Stop filling sump.

10.0 PUMP TESTS

This procedure will demonstrate the correct functioning of the pumps and associated controls. See Figure 1 for definitions of water levels and associated pumps and relays.

For pumps W5P1, W5P2, W5P3, and W5P4, measure the phase currents prior to beginning pumping tests. Record this information on the top of the test data forms 10-2, 10-3, 10-4, 11-1 respectively. Verify that motor overload devices are sized correctly.

10.1 INITIAL CONDITIONS FOR PUMP TESTS

Prior to testing pumps, verify that relay CR7 (high tank) is de-energized (closed). Record all data on Test Data Form 10-1 (see Appendix A).

10.1.1 Primary Sump

This testing should begin with water in the primary sump above level D2. Verify the following conditions on the control panel:

- a. CR1 is energized.
- b. CR2 is de-energized.
- c. CR3 is de-energized.
- d. CR4 is de-energized.
- e. Pump failure light for the primary submersible pump is on.

- f. The roof alarm light is on.
- g. The panel light associated with relay CR1 is on and the lights associates with relays CR2, CR3, and CR4 are off.

10.1.2 Secondary Sump

The water level in the secondary sump should be above the level of the high level switch (water level DS-2). Verify the following conditions on the control panel:

- a. CR5 is energized.
- b. CR6 is de-energized.
- c. Pump failure light for the secondary submersible pump is on.
- d. The roof alarm light is on.
- e. The panel light associated with relay CR5 is on.

10.2 PRIMARY SUBMERSIBLE PUMP (W5P1)

Record all data on Test Data Form 10-2 (see Appendix A).

- 10.2.1 The switch on the control panel for the pump should be in the "off" position. Close circuit breaker B1.
- 10.2.2 Turn the switch for the Primary Submersible Pump to the "hand" position.
- 10.2.3 Verify by direct visual observation that water is being pumped from the sump into the storage tank.
- 10.2.4 Verify that the N/O drain back solenoid valve (W54) is closed (energized).
- 10.2.5 Verify that the associated "pump run" light is on. Run the pump until the primary sump is drained below the high water level (D2).
- 10.2.6 Turn switch on motor controller to "automatic" position. Add water to primary sump until high level relay CR1 is activated (water level D2).
- 10.2.7 Verify that the pump starts automatically and that the pump run light is on.
- 10.2.8 Verify by direct visual observation that water is being pumped from the sump into the storage tank.
- 10.2.9 Verify that when the water level in the sump reaches low level (water level D1), relay CR2 is energized, and the pump is automatically shut off. W5P3 may be used to assist in primary sump drawdown.

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10.2.10 Add water to the primary sump to above level D1. Manually initiate operation of Timer TM1 and verify that the pump is automatically started.

10.2.11 While pump is running, connect terminals H2F and #10 across FS3 using a jumper, to simulate high water level in the storage tank. Verify that the pump is automatically stopped and that the roof alarm is initiated. Remove the jumper and re-initiate the automatic operation.

10.2.12 Turn the switch on the motor starter to the "off" position.

10.3 SECONDARY SUBMERSIBLE PUMP (W5P2)

Record all data on Test Data Form 10-3 (see Appendix A).

Repeat steps 10.2.1 through 10.2.8 and 10.2.11 except for the secondary submersible pump, adding water to the secondary sump through the secondary riser pipe as required.

10.4 PRIMARY SUMP SELF-PRIMING PUMP (W5P3)

Record all data on Test Data Form 10-4 (see Appendix A).

10.4.1 The switch on the control panel for pump W5P3 should be in the "off" position. Fill the primary sump with water to above level D2. Close circuit breaker A7.

10.4.2 Turn the switch on the control panel to the "hand" position.

10.4.3. Verify by direct visual observation that the pump is running and that water is being pumped from the sump into the leachate storage tank.

10.4.4 Verify that the "pump run" light is on.

10.4.5 Verify operation for one minute.

10.4.6 Turn the switch on the motor controller to the "automatic" position. Add water to the sump to above level D2.

10.4.7 Manually raise the high level vertical riser float switch to simulate high water condition.

10.4.8 Verify that the pump is automatically started.

10.4.9 Verify that the pump continues running until the water level reaches the low level vertical riser float switch (water level D3), when the pump is automatically shut off.

10.4.10 Add water to the primary sump and perform step 10.2.11 for this pump.

10.5 FLOWMETER CALIBRATION

Record all data on Test Data Form 10-5 (see Appendix A).

10.5.1 Verify that there is sufficient water in the secondary sump to pump 500 gallons and still maintain a final water level of at least 8 inches.

10.5.2 Verify that the water in the sump is clean and will not produce foam when pumped. Flush sump if necessary until clean, non-foaming water is obtained.

10.5.3 Verify that ball valve W65 is open and ball valve W66 is closed. Verify that the ball valve in series with the solenoid draindown valve is closed.

10.5.4 Measure the water level in the leachate temporary storage tank to the nearest 0.01 foot with a rigid rod. Measure through port in top of tank. If necessary, add water until depth in tank is at least 0.3 feet.

10.5.5 Remove 1/4-inch plug immediately upstream of 3-inch flowmeter. Energize secondary submersible pump. Pump until air no longer escapes through 1/4-inch hole. Replace plug. De-energize pump.

10.5.6 Measure the water level in the leachate temporary storage tank as described in step 10.5.4. Record on Test Data Sheet 10-5.

10.5.7 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5.

10.5.8 Energize the secondary submersible pump and pump at least 500 gallons into the leachate temporary storage tank.

10.5.9 Measure the water level in the leachate temporary storage tank as described in step 10.5.4. Record on Test Data Sheet 10-5.

10.5.10 Record the readings of the 2-inch and 3-inch flowmeters on Test Data Sheet 10-5. If the meter readings differ from the calculated volume (based on measurements of water depth in the tank) by more than 5 percent, repeat step 10.5.5 using the self-priming pump (primary sump). Ensure that there is sufficient water in the primary sump prior to purging the

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discharge pipes. Continue the ATP from step 10.5.6 using the secondary submersible pump.

- 10.5.11 Repeat steps 10.5.8 through 10.5.10 twice, for a total pumped volume of about 1500 gallons.

10.6 SPARE PUMP TESTS

Test spare pumps at the ground surface to verify that they function. Test submersible pumps in a "barrel" that allows complete immersion. Record all data on Test Data Form 10-6.

- 10.6.1 Install the valve on the pump discharge line to simulate head.
- 10.6.2 Install the pressure gage between the valve and pump to measure the head.
- 10.6.3 Energize the pump and allow it to achieve steady state conditions at a pressure of approximately 90% of the maximum efficiency discharge head as shown on the manufacturer's pump performance curves. Measure the volume of water pumped for at least 30 seconds.
- 10.6.4 Repeat the test with the pressure set at about 110% of the maximum efficiency discharge head.
- 10.6.5 Repeat the test with the discharge valve closed to determine the "shutoff" pressure.
- 10.6.6 Repeat steps 10.6.1 through 10.6.5 for all spare pumps.

11.0 LEACHATE STORAGE TANK

This procedure will demonstrate correct functioning of the transfer pump and controls associated with the leachate storage tank. Verify and record the following:

11.1 LEACHATE STORAGE TANK PUMP (W5P4)

Record all data on Test Data Form 11-1 (see Appendix A).

- 11.1.1 Verify that the storage tank is at least 25 percent full of water. Turn on circuit breaker A1 for the pump.
- 11.1.2 Using the DMM, measure the voltage at the motor terminals (T1, T2, T3). The voltage should read 0 between terminals T1 & T2, T2 & T3, and between T1 and the metal frame.

- 11.1.3 Push the "start" pushbutton on the motor starter. Verify that the motor is operating correctly with proper rotation. Verify by direct visual observation that water is being pumped from the tank.
- 11.1.4 Using the DMM, measure the voltage at the motor terminals. The voltage should read between 460 and 500 volts between terminals T1 & T2 and between terminals T2 & T3.
- 11.1.5 Continue pumping for 2 minutes minimum. Push the "stop" pushbutton and verify that the pump stops running.

11.2 HIGH LEVEL FLOAT SWITCH (FS3) AND LIMIT SWITCH (L1)

Record all data on Test Data Forms 11-2A and 11-2B (see Appendix A).

- 11.2.1 Observe that the red "high tank level" light on the control panel is off and that relay CR7 is de-energized. Disconnect limit switch L1.
- 11.2.2 Fill the storage tank with water to above the high level. Verify that FS3 operates at the selected "high water" level.
- 11.2.3 Observe that relay CR7 is energized and time delay is functional.
- 11.2.4 Observe that the red "high tank level" light on the control panel is on.
- 11.2.5 Observe that the roof alarm light is on and time delay is functional.
- 11.2.6 Verify that the submersible pumps and self primary pumps will not operate (3 pumps total) by temporarily turning the appropriate control switches on the control panel to "hand" position and observing that the associated "pump run" light does not come on.
- 11.2.7 Lower the water level in the tank and observe that FS3 returns to normal condition (repeat step 11.2.1).
- 11.2.8 Reconnect limit switch L1 and disconnect the high level float switch FS3.
- 11.2.9 Repeat steps 11.2.1 through 11.2.7 to test L1. Record all data on Test Data Form 11-2B (see Appendix A).
- 11.2.10 Reconnect high level float switch FS3.

12.0 BUILDING POWER AND LIGHTING

This procedure will demonstrate the correct functioning of control building power and lighting, and area lighting. Verify and record the following:

12.1 BUILDING POWER RECEPTACLE

Record all data on Test Data Form 12-1 (see Appendix A).

- 12.1.1 Insert receptacle tester into one outlet of the duplex GFI receptacle. Verify that receptacle is correctly wired.
- 12.1.2 Push the button on the receptacle tester. This will initiate a ground fault current into the receptacle. Verify that the receptacle ground fault device trips. Verify that the outlet is now de-energized (observe that all the lights on the tester are now off).
- 12.1.3 Repeat Step 12.1.2 for the other outlet.

12.2 BUILDING LIGHTING FIXTURES

Record all data on Test Data Form 12-2 (see Appendix A).

- 12.2.1 Turn on light switch for fixture in the Control Building. Observe that both fluorescent lamps are illuminated.

12.3 AREA LIGHTING FIXTURES

Record all data on Test Data Form 12-3 (see Appendix A).

- 12.3.1 Cover the sensors of all photocells to simulate darkness. Observe that the light fixtures are automatically turned on and illuminated to full brightness within 5 minutes.
- 12.3.2 Observe the operation of the exterior fixtures at 15 minute intervals over a 75 minute period. Verify that the fixtures remain illuminated (do not cycle on and off).
- 12.3.3 Remove covers from photocell sensors. Verify that all fixtures turn off.

12.4 CONTROL PANEL HEATERS

Record all data on Test Data Form 12-4 (see Appendix A).

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- | 124.1 Turn thermostat on heater in Control Panel C off. Verify that heater is at ambient temperature. Wait for heater to cool if necessary.
- 124.2 Turn thermostat until it energizes. Verify that heater becomes warm.
- | 124.3 Repeat procedure for Control Panels A and B.

APPENDIX A

TEST DATA FORMS

A-T

LIST OF FORMS

TEST EXECUTION SHEET

EXCEPTION SHEET

TEST DATA FORM 8-1 HEAT TRACE SYSTEM - TEMPERATURE SENSOR TEST

TEST DATA FORM 8-2 HEAT TRACE SYSTEM - HEAT TRACE CABLE TEST

TEST DATA FORM 9-1 TRANSDUCERS AND METER/CONTROLLERS - PRIMARY SUMP

TEST DATA FORM 9-2 TRANSDUCERS AND METER/CONTROLLERS - SECONDARY SUMP

TEST DATA FORM 10-1 PUMP TESTS - INITIAL CONDITIONS

TEST DATA FORM 10-2 PUMP TESTS - PRIMARY SUBMERSIBLE PUMP (W5P1)

TEST DATA FORM 10-3 PUMP TESTS - SECONDARY SUBMERSIBLE PUMP (W5P2)

TEST DATA FORM 10-4 PUMP TESTS - PRIMARY SUMP SELF-PRIMING PUMP (W5P3)

TEST DATA FORM 10-5 PUMP TESTS - FLOWMETER CALIBRATION

TEST DATA FORM 10-6 PUMP TESTS - SPARE PUMPS

TEST DATA FORM 11-1 LEACHATE STORAGE TANK - TANK PUMP (W5P4)

TEST DATA FORM 11-2A LEACHATE STORAGE TANK - HIGH LEVEL FLOAT SWITCH (FS3)

TEST DATA FORM 11-2B LEACHATE STORAGE TANK - HIGH LEVEL LIMIT SWITCH (L1)

TEST DATA FORM 12-1 BUILDING POWER AND LIGHTING - BUILDING POWER RECEPTACLE

TEST DATA FORM 12-2 BUILDING POWER AND LIGHTING - BUILDING LIGHTING FIXTURES

TEST DATA FORM 12-3 BUILDING POWER AND LIGHTING - AREA LIGHTING FIXTURES

TEST DATA FORM 12-4 BUILDING POWER AND LIGHTING - CONTROL PANEL HEATERS

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TEST EXECUTION SHEET

ATP No. _____
Test No. _____

TEST EXECUTION

Installation Contractor Date

Recorder/Organization Date Test Director/Organization Date

TEST WITNESS

Witness/Organization Date Witness/Organization Date

Witness/Organization Date Witness/Organization Date

TEST ACCEPTANCE

Kaiser Engineers Hanford

____ Without With With
Exception Exception/Resolved Exception/Outstanding

Field Engineer Date

Design Engineer Date Project Engineer Date

TEST APPROVAL AND ACCEPTANCE

Westinghouse Hanford Company

____ Without With With
Exception Exception/Resolved Exception/Outstanding

(Title or Department) Date (Title or Department) Date

(Title or Department) Date (Title or Department) Date

EXCEPTION SHEET

EXCEPTION NO.		Project No.		ATP No.		Rev.		
Recorded by			Organization		Date Recorded		ATP Page No.	
Step No.		Requirement						
Description of Problem								
Objector 1 (Name/Organization)				Objector 2 (Name/Organization)				
Planned Action								
Action Taken								
RETEST EXECUTION AND ACCEPTANCE								
Retest Installation Contractor		Date		Recorder		Date		
Witness 1 (Name/Organization)		Date		Witness 2 (Name/Organization)		Date		
Field Engineering		Date		Test Director (Name/Organization)		Date		
Design Engineering (Author of ATP)		Date		A-E Project Engineer		Date		
APPROVAL AND ACCEPTANCE - OPERATING CONTRACTOR								
☐ Retest approved and Accepted ☐ Exception Accepted-as-is ☐ Other								
Explanation								
Approver 1		Date		Approver 2		Date		
Approver 3		Date		Approver 4		Date		

PROJECT NO. 933-1354-220/27977 DATE 3/10/92 DRAWN BY TB

A-4

TEST DATA FORM 8-1

HEAT TRACE SYSTEM - TEMPERATURE SENSOR TEST

Test Equipment: DMM Manufacturer and Model No. _____
Serial No. _____

Step No.

	Activity	Verify	Reading	Date	By
8.1.1	Disconnect conductors		NA		
8.1.2	Visual inspection		NA		
8.1.3	Connect DMM		NA		
8.1.4	Cool or heat		NA		
8.1.5	Contacts open	NA			
	Contacts closed	NA			
8.1.6	Reconnect conductors		NA		

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TEST DATA FORM 8-2

HEAT TRACE SYSTEM - HEAT TRACE CABLE TEST

Test Equipment: COA Manufacturer and Model No. _____
Serial No. _____

Step No.	Activity	Verify	Reading	Date	By
8.2.1	Energize circuit	NA	NA		
8.2.2	Contacts closed	NA			
8.2.3	Contacts open	NA			

~~A-6~~

TEST DATA FORM 9-1

TRANSDUCERS AND METER/CONTROLLERS - PRIMARY SUMP

Test Equipment: WLT Manufacturer and Model No. _____
 Serial No. _____

Water depths for pump controls: D1 _____
 D2 _____
 D3 _____

Step No.	Activity	Verify	Reading	Date	By
9.1.1	Disconnect pump power		NA		
9.1.2	Install WLT		NA		
	WLT reading	NA			
	Sump water level	NA			
9.1.3	Sump water level	NA			
	Sump level meter reading	NA			
9.1.4	Verify relays are correct		NA		
9.1.5	Water level #1	NA			
	Sump level meter reading #1	NA			
	Water level #2	NA			
	Sump level meter reading #2	NA			
	Water level #3	NA			
	Sump level meter reading #3	NA			
	Water level #4	NA			
	Sump level meter reading #4	NA			
	Water level #5	NA			
	Sump level meter reading #5	NA			
	Water level #6	NA			
	Sump level meter reading #6	NA			
	Water level #7	NA			
	Sump level meter reading #7	NA			

TEST DATA FORM 9-1 (Cont.)

Step No.	Activity	Verify	Reading	Date	By
	Water level #8	NA			
	Sump level meter reading #8	NA			
	Water level #9	NA			
	Sump level meter reading #9	NA			
	Water level #10	NA			
	Sump level meter reading #10	NA			
9.1.6	Verify CR2 de-energized		NA		
	Water level	NA			
9.1.7	Verify CR4 de-energized		NA		
	Water level (CR4)	NA			
	Verify CR1 energized		NA		
	Water level (CR1)	NA			
9.1.8	Water level	NA			
	Sump level meter reading	NA			
9.1.9	Check high level float on		NA		
	Check high level float off		NA		

TEST DATA FORM 9-2

TRANSDUCERS AND METER/CONTROLLERS - SECONDARY SUMP

Water depths for pump controls: DS-1 _____
 DS-2 _____

Step No.	Activity	Verify	Reading	Date	By
9.2.1	Disconnect pump power		NA		
9.2.2	Verify relays are correct		NA		
9.2.3	Calibrate transducer (attach calibration sheet)		NA		
9.2.4	Sump level meter reading	NA			
9.2.5	Water volume #1	NA			
	Sump level meter reading #1	NA			
	Water volume #2	NA			
	Sump level meter reading #2	NA			
	Water volume #3	NA			
	Sump level meter reading #3	NA			
	Water volume #4	NA			
	Sump level meter reading #4	NA			
	Water volume #5	NA			
	Sump level meter reading #5	NA			
	Water volume #6	NA			
	Sump level meter reading #6	NA			
	Water volume #7	NA			
	Sump level meter reading #7	NA			
	Water volume #8	NA			
	Sump level meter reading #8	NA			
	Water volume #9	NA			
	Sump level meter reading #9	NA			
	Water volume #10	NA			
	Sump level meter reading #10	NA			

TEST DATA FORM 9-2 (Cont.)

Step No.	Activity	Verify	Reading	Date	By
9.2.6	Verify CR6 de-energized		NA		
	Sump level meter reading (CR6)	NA			
	Verify CR5 energized		NA		
	Sump level meter reading (CR5)	NA			

ATTACHMENT TO TEST DATA FORM 9-2

CALIBRATION SHEET - SECONDARY SUMP TRANSDUCER

Reading No.	Measured Water Depth	Transducer Reading

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TEST DATA FORM 10-1

PUMP TESTS - INITIAL CONDITIONS

Water depths for pump controls: D1 _____
 D2 _____
 D3 _____
 DS-1 _____
 DS-1 _____

Step No.	Activity	Verify	Reading	Date	By
	Verify CR7 de-energized		NA		
10.1.1	Primary sump water level	NA			
	Verify on control panel:				
	CR1 energized		NA		
	CR2 de-energized		NA		
	CR3 de-energized		NA		
	CR4 de-energized		NA		
	Pump failure light on		NA		
	Roof alarm light on		NA		
	Relay indicator lights:				
	CR1 on		NA		
	CR2, CR3, CR4 off		NA		
10.1.2	Secondary sump water level	NA			
	Verify on control panel:				
	CR5 energized		NA		
	CR6 de-energized		NA		
	Pump failure light on		NA		
	Roof alarm light on		NA		
	Relay indicator lights on:				
	CR5		NA		

TEST DATA FORM 10-2

PUMP TESTS - PRIMARY SUBMERSIBLE PUMP (W5P1)

Step No.	Activity	Verify	Reading	Date	By
10.0	Phase current	NA			
		NA			
		NA			
10.0	Motor overload size		NA		
10.2.1	Energize pump		NA		
10.2.2	Switch to "hand"		NA		
10.2.3	Verify pumping		NA		
10.2.4	Verify W54 energized		NA		
10.2.5	Verify "run" light on		NA		
	Drain sump below high level		NA		
10.2.6	Activate CR1		NA		
	Water level at start	NA			
10.2.7	Verify auto start		NA		
	Verify "run" light on		NA		
10.2.8	Verify pumping		NA		
10.2.9	Verify pump shut off		NA		
	Water level at shut off	NA			
10.2.10	Verify auto start		NA		
10.2.11	Verify automatic stop		NA		
	Verify roof alarm		NA		
10.2.12	Switch motor starter to "off"		NA		

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PUMP TESTS - SECONDARY SUBMERSIBLE PUMP (W5P2)

Step No.	Activity	Verify	Reading	Date	By
10.0	Phase current	NA			
		NA			
		NA			
10.0	Motor overload size		NA		
10.3.1	Energize pump		NA		
10.3.2	Switch to "hand"		NA		
10.3.3	Verify pumping		NA		
10.3.4	Verify "run" light on		NA		
	Drain sump below low level		NA		
10.3.5	Activate CR5		NA		
	Water level at start	NA			
10.3.6	Verify auto start		NA		
	Verify "run" light on		NA		
10.3.7	Verify pumping		NA		
10.3.8	Verify pump shut off		NA		
	Water level at shut off	NA			
10.3.10	Verify automatic stop		NA		
	Verify roof alarm		NA		

TEST DATA FORM 10-4

PUMP TESTS - PRIMARY SUMP SELF-PRIMING PUMP (W5P3)

Step No.	Activity	Verify	Reading	Date	By
10.0	Phase current	NA			
		NA			
		NA			
10.0	Motor overload size		NA		
10.4.1	Add water to sump	NA			
	Energize pump		NA		
10.4.2	Switch to "hand"		NA		
10.4.3	Verify pumping		NA		
10.4.4	Verify "run" light on		NA		
10.4.5	Verify pumping 1 minute		NA		
10.4.6	Switch to "auto"		NA		
	Add water to sump	NA			
10.4.7	Raise high level switch		NA		
10.4.8	Verify auto start		NA		
10.4.9	Verify pump shut off		NA		
	Water level at shut off	NA			
10.4.10	Verify automatic stop		NA		
	Verify roof alarm		NA		

TEST DATA FORM 10-5

PUMP TESTS - FLOWMETER CALIBRATION

Step No.	Activity	Verify	Reading	Date	By
10.5.1	Verify water volume		NA		
10.5.2	Verify water clean		NA		
10.5.3	Ball valve W65 open		NA		
	Ball valve W66 closed		NA		
	Solenoid ball valve closed		NA		
10.5.4	Water level in tank	NA			
10.5.5	Purge air		NA		
10.5.6	Water level in tank	NA			
10.5.7	2-inch flowmeter reading	NA			
	3-inch flowmeter reading	NA			
10.5.8	Pump 500 gallons - 1st cycle		NA		
10.5.9	Water level in tank - 1st cycle	NA			
10.5.10	2-inch flowmeter reading - 1st cycle	NA			
	3-inch flowmeter reading - 1st cycle	NA			
	Purge air		NA		
10.5.11	Pump 500 gallons - 2nd cycle		NA		
	Water level in tank - 2nd cycle	NA			
	2-inch flowmeter reading - 2nd cycle	NA			
	3-inch flowmeter reading - 2nd cycle	NA			
	Pump 500 gallons - 3rd cycle		NA		
	Water level in tank - 3rd cycle	NA			
	2-inch flowmeter reading - 3rd cycle	NA			
	3-inch flowmeter reading - 3rd cycle	NA			

TEST DATA FORM 10-6

PUMP TESTS - SPARE PUMPS

Pressure Gage Model and S/N _____

Pump Type and Serial No.	Volume Pumped (units)	Time	Pressure Head (units)	Date	By

~~WHC-SD-W025-ATP-001 Rev. 3~~TEST DATA FORM 11-1

LEACHATE STORAGE TANK - TANK PUMP (W5P4)

DMM Manufacturer and Model No. _____
 Serial No. _____

Step No.	Activity	Verify	Reading	Date	By
10.0	Phase current	NA			
		NA			
		NA			
10.0	Motor overload size		NA		
11.1.1	Check tank; activate breaker		NA		
11.1.2	Voltage between terminals:				
	T1 and T2	NA			
	T2 and T3	NA			
	T1 and metal frame	NA			
11.1.3	Verify motor rotation		NA		
	Verify pumping		NA		
11.1.4	Voltage between terminals:				
	T1 and T2	NA			
	T2 and T3	NA			
11.1.5	Verify pump shut off		NA		

~~A-18~~

TEST DATA FORM 11-2A

LEACHATE STORAGE TANK - HIGH LEVEL FLOAT SWITCH (FS3)

Tank high water level _____

Step No.	Activity	Verify	Reading	Date	By
11.21	Verify "high tank level" light		NA		
	Verify CR7 de-energized		NA		
11.22	Verify FS3		NA		
	Water level at FS3 turn on	NA			
11.23	Verify CR7 energized and record time delay				
11.24	Verify "high tank level" light		NA		
11.25	Verify roof alarm and record time delay				
11.26	Verify pumps inoperable:				
	W5P1		NA		
	W5P2		NA		
	W5P3		NA		
11.27	Verify "high tank level" light		NA		
	Verify CR7 de-energized		NA		
	Water level at FS3 turn off	NA			

~~WHC-SD-W025-ATP-001 Rev. 3~~TEST DATA FORM 11-2B

LEACHATE STORAGE TANK - HIGH LEVEL LIMIT SWITCH (L1)

Tank high water level _____

Step No.	Activity	Verify	Reading	Date	By
11.2.1	Verify "high tank level" light		NA		
	Verify CR7 de-energized		NA		
11.2.2	Verify L1		NA		
	Water level at L1 turn on	NA			
11.2.3	Verify CR7 energized and record time delay				
11.2.4	Verify "high tank level" light		NA		
11.2.5	Verify roof alarm and record time delay				
11.2.6	Verify pumps inoperable:				
	W5P1		NA		
	W5P2		NA		
	W5P3		NA		
11.2.7	Verify "high tank level" light		NA		
	Verify CR7 de-energized		NA		
	Water level at L1 turn off	NA			

TEST DATA FORM 12-1

BUILDING POWER AND LIGHTING - BUILDING POWER RECEPTACLE

Test Equipment: Receptacle Tester Manufacturer and Model No. _____
Serial No. _____

Step No.	Activity	Verify	Reading	Date	By
12.1.1	Verify receptacle wiring		NA		
12.1.2	Verify that GFI trips (outlet 1)		NA		
12.1.3	Verify that GFI trips (outlet 2)		NA		

~~WHC-SD-W025-ATP-001 Rev. 3~~

TEST DATA FORM 12-2

BUILDING POWER AND LIGHTING - BUILDING LIGHTING FIXTURES

Step No	Activity	Verify	Reading	Date	By
12.2.1	Verify lights function	- - -	- NA	- - -	- - -

TEST DATA FORM 12-3

BUILDING POWER AND LIGHTING - AREA LIGHTING FIXTURES

Step No.	Activity	Verify	Reading	Date	By
12.3.1	Verify initial illumination:				
	P1a		NA		
	P1b		NA		
	P2		NA		
	P3		NA		
	P4		NA		
12.3.2	Verify illumination over time:				
	Time #1	NA			
	P1a		NA		
	P1b		NA		
	P2		NA		
	P3		NA		
	P4		NA		
	Time #2	NA			
	P1a		NA		
	P1b		NA		
	P2		NA		
	P3		NA		
	P4		NA		
	Time #3	NA			
	P1a		NA		
	P1b		NA		
	P2		NA		
	P3		NA		
	P4		NA		

TEST DATA FORM 12-3 (Cont)

Step No.	Activity	Verify	Reading	Date	By	
	Time #4	NA				
	P1a		NA			
	P1b		NA			
	P2		NA			
	P3		NA			
	P4		NA			
	Time #5	NA				
	P1a		NA			
	P1b		NA			
	P2		NA			
	P3		NA			
	P4		NA			
	12.3.3	Verify fixtures turn off:				
		P1a		NA		
P1b			NA			
P2			NA			
P3			NA			
P4			NA			

TEST DATA FORM 124

BUILDING POWER AND LIGHTING - CONTROL PANEL HEATERS

Step No.	Activity	Verify	Reading	Date	By
124.1	Heater at ambient - Control Panel C		NA		
124.2	Heater becomes warm - Control Panel C		NA		
124.3	Heater at ambient - Control Panel A		NA		
	Heater becomes warm - Control Panel A		NA		
	Heater at ambient - Control Panel B		NA		
	Heater becomes warm - Control Panel B		NA		

ENGINEERING CHANGE NOTICE				1. ECN <u>69546</u>	
				Proj. W-025-029 ECN	
<u>W7ED30/CF224</u>					
2. ECN Category (mark one) ☐ Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777		4. Date 8-22-94		
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility		6. Bldg./Sys./Fac. No. 200W / 218-W-5		7. Impact Level 3Q	
8. Document Numbers Changed by this ECN (includes sheet no. and rev.) Design Drawings		9. Related ECN No(s). NA		10. Related PO No. NA	
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date		
12. Description of Change Changes to Project W-025 Design Drawings: 1. All (H-2-131573 through H-2-131594: In title block, change Bldg No. to 218-W-5. (Continued on Sheet 3)					
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐					
13b. Justification Details 1. Editorial 2. Provide cross references to facilitate future use. 3. Provide cross references to facilitate future use.					
14. Distribution (include name, MSIN, and no. of copies)					
WHC DISTRIBUTION S+4-4 WRAP DMC G3-15 (1) J.R. McGee G3-15 (1) Station 10 A3-87 (1) D.A. Rohl S4-01 (1) H.E. Wellisly (4-93) G6-47 (2) J. Howard A5-56 (1) K.D. Johnson H5-33 (1) J.J. Dorlan H6-30 (1) G.C. Evans H6-23 (1) H.R. Benzal T4-03 (1)			* Adv. Copy KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E5-41 (1) P.L. Rackley S2-55 (1)		
ECOLOGY DISTRIBUTION G. Cummins H6-24 (1) D.A. Pratt T4-03 (1) R.J. Giroir T4-05 (1) D.R. Lucas G3-15 (1) D. Carlyle T4-03 (1) V. Resche G3-15 (3) J. Hensley S6-75 (1)			DOE DISTRIBUTION M.S. Collins A5-18 (1) A.K. Crowell R3-80 (1)		
RELEASE STAMP OFFICIAL RELEASE BY WHC DATE AUG 29 1994 (20)					

A-7900-013-2 (06/92) GEF095

A-7900-013-1 (06/92)

ENGINEERING CHANGE NOTICE	Page 2 of 87	1. ECN (use no. from pg. 1) W-025-029
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15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <th style="width: 50%;">ENGINEERING</th> <th style="width: 50%;">CONSTRUCTION</th> </tr> <tr> <td>Additional ☒ \$0</td> <td>Additional ☒ \$0</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>	ENGINEERING	CONSTRUCTION	Additional ☒ \$0	Additional ☒ \$0	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 0																																																																		
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18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.																																																																										
800/00 ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ O&M Manual ☐ FSAR/EAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEPD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fee, Proc. Comp. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Special Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICAS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☐ LLBG Part B Permit Application ☒																																																																								
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.																																																																										
Document Number/Revision	Document Number/Revision	Document Number Revision																																																																								
DOE/RL-88-20, Supplement 2																																																																										
20. Approvals <table style="width: 100%;"> <tr> <th style="width: 40%;">Signature</th> <th style="width: 10%;">Date</th> <th style="width: 40%;">Signature</th> <th style="width: 10%;">Date</th> </tr> <tr> <td colspan="4">OPERATIONS AND ENGINEERING</td> </tr> <tr> <td>Cog Engineer <i>D.R. Lucas for Telecon</i></td> <td><u>8-29-94</u></td> <td>ARCHITECT-ENGINEER</td> <td></td> </tr> <tr> <td>Cog. Mgr. <i>J. R. McGee for Telecon</i></td> <td><u>8-29-94</u></td> <td>PE <i>Frank S. Shiri</i></td> <td><u>8-22-94</u></td> </tr> <tr> <td>QA</td> <td><u>8-29-94</u></td> <td>QA <i>Jan A. Dillie</i></td> <td><u>8-24-94</u></td> </tr> <tr> <td>Safety</td> <td>_____</td> <td>Safety</td> <td>_____</td> </tr> <tr> <td>Security</td> <td>_____</td> <td>Design</td> <td>_____</td> </tr> <tr> <td>Environ.</td> <td>_____</td> <td>Environ.</td> <td>_____</td> </tr> <tr> <td>Projects/Programs</td> <td>_____</td> <td>Other <i>W. Brown</i></td> <td><u>8/23/94</u></td> </tr> <tr> <td>Tank Waste Remediation System</td> <td>_____</td> <td></td> <td>_____</td> </tr> <tr> <td>Facilities Operations</td> <td>_____</td> <td></td> <td>_____</td> </tr> <tr> <td>Restoration & Remediation</td> <td>_____</td> <td>DEPARTMENT OF ENERGY</td> <td></td> </tr> <tr> <td>Operations & Support Services</td> <td>_____</td> <td>Signature or Letter No.</td> <td>_____</td> </tr> <tr> <td>IRM</td> <td>_____</td> <td></td> <td>_____</td> </tr> <tr> <td>Other</td> <td>_____</td> <td>ADDITIONAL</td> <td>_____</td> </tr> <tr> <td></td> <td>_____</td> <td></td> <td>_____</td> </tr> <tr> <td></td> <td>_____</td> <td></td> <td>_____</td> </tr> <tr> <td></td> <td>_____</td> <td></td> <td>_____</td> </tr> </table>			Signature	Date	Signature	Date	OPERATIONS AND ENGINEERING				Cog Engineer <i>D.R. Lucas for Telecon</i>	<u>8-29-94</u>	ARCHITECT-ENGINEER		Cog. Mgr. <i>J. R. McGee for Telecon</i>	<u>8-29-94</u>	PE <i>Frank S. Shiri</i>	<u>8-22-94</u>	QA	<u>8-29-94</u>	QA <i>Jan A. Dillie</i>	<u>8-24-94</u>	Safety	_____	Safety	_____	Security	_____	Design	_____	Environ.	_____	Environ.	_____	Projects/Programs	_____	Other <i>W. Brown</i>	<u>8/23/94</u>	Tank Waste Remediation System	_____		_____	Facilities Operations	_____		_____	Restoration & Remediation	_____	DEPARTMENT OF ENERGY		Operations & Support Services	_____	Signature or Letter No.	_____	IRM	_____		_____	Other	_____	ADDITIONAL	_____		_____		_____		_____		_____		_____		_____
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ENGINEERING CHANGE NOTICE CONTINUATION SHEET

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ECH W-025-029

Date 8-22-94

DRWG/DOC NO	SHEET-NO	REVISION
* H 020131573	001	CD02
* H 020131574	001	CD02
* H 020131575	001	CD02
* H 020131576	001	CD02
* H 020131577	001	CD02
* H 020131578	001	CD02
* H 020131579	001	CD02
* H 020131580	001	CD02
* H 020131581	001	CD02
* H 020131582	001	CD02
* H 020131583	001	CD02
* H 020131584	001	CD02
* H 020131585	001	CD02
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* H 020131587	003	CD02
* H 020131587	004	CD02
* H 020131588	001	CD02
* H 020131589	001	CD02
* H 020131590	001	CD02
* H 020131591	001	CD02
* H 020131592	001	CD02
* H 020131593	001	CD02
* H 020131594	001	CD01

CNT 20 25

ENGINEERING CHANGE NOTICE CONTINUATION SHEET 54/7

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1. ECN (use no. from pg. 1)
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Continued from Section 12, page 1:

2. Add cross references to CVI file #22585 and construction contractor's submittals as follows:

Submittals to be listed on DWG H-2-131575:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
301		01500, 1.4.1.2.1	6" Hot Tap Items
304		01050, 1.5.5	As-Built Survey of Subgrade

Submittals to be listed on DWG H-2-131576:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
16		02224, 1.2.A	Admix Preparation Plan (Bentonite)
16A		02224, 1.2.A	Admix Preparation Plan (Pugmill)
16B		02224, 1.2.A	Admix Preparation Plan (Pugmill)
16.1		02224, 1.2.A	Admix Preparation Plan (Belt Scales)
17		02224, 1.2.B	Soil Liner Placement Plan
17A		02224, 1.2.B	Soil Liner Placement Plan

Submittals to be listed on DWG H-2-131579:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
25		02275, 1.7.A	Geomembrane Installer's QA Manual
25A		02275, 1.7.A	Geomembrane Crystallinity
25B		02275, 1.7.A	Geomembrane/Admix Friction Angle
25.1		02275, 1.7.A	Geomembrane QA/QC Data
25.2		02275, 1.7.A	Extrudate Certification
25.3		02275, 1.7.A	Geomembrane QA/QC Data
25.3A		02275, 1.7.A	Geomembrane Resin Certification
25.4		02275, 1.7.A	Geomembrane QA/QC Data
25.4B		02275, 1.7.A	Geomembrane Env. Stress Crack Certification
25.4C		02275, 1.7.A	Geomembrane Env. Stress Crack Certification
25.5		02275, 1.7.A	Geomembrane Low Temp. Welding Certification
25.6		02275, 1.7.A	Geomembrane QA/QC Documentation
25.6A		02275, 1.7.A	Geomembrane Direct Shear Test Report
25.7		02275, 1.7.A	Geomembrane Resin Documentation
25.8		02275, 1.7.A	Geomembrane Resistance to Soil Burial Data
25.9		02275, 1.7.A	Geomembrane Resistance to Soil Burial Cert.
28		02275, 1.7.B	Geosynthetic Samples

Submittals to be listed on DWG H-2-131580:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
21		02226, 1.2	Granular Drainage Layers, Gravel Samples

Submittals to be listed on DWG H-2-131582:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
35		02725, 1.3.B	HDPE Pipe Fabrication Drawings
35A		02725, 1.3.B	HDPE Collection Well Fabrication Drawings

ENGINEERING CHANGE NOTICE CONTINUATION SHEET

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Continued from Section 12, page 3:

Submittals to be listed on DWG H-2-131583:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
37		02727, 1.2.A	Vertical Riser Pipe
37A		02727, 1.2.A	Precast Concrete Pipe
38		03210, 1.2.A	Rebar and Coating
48		09900, 1.6.A.2	Manhole Coating Manufacturer's Specifications
48A		09900, 1.6.A.2	Manhole Coating Manufacturer's Specifications

Submittals to be listed on DWG H-2-131584:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
31		02511, 1.5	Asphalt Mix Design
31.1		02511, 1.5	Asphalt Seal Coat

Submittals to be listed on DWG H-2-131585:

<u>SUB#</u>	<u>CVI SUP#</u>	<u>#SPEC REF.</u>	<u>DESCRIPTION</u>
39		03210, 1.2.B	Rebar Shop Drawings
40		03310, 1.2.A	Air-entraining Admix Certification
41		03310, 1.2	Concrete Mix Design
42		03310, 1.2	Anchor Bolts
43		03310, 1.2	Waterstops
47		09900, 1.6.A.1	Paint Coating Systems List
48.1		09900, 1.6.A.2	Tank Coating Manufacturer's Specifications
53		13205, 1.3.A	Leachate Tank Fabrication Drawings
53A		13205, 1.3.A	Leachate Tank Fabrication Drawings
53B		13205, 1.3.A	Leachate Tank Liquid Level Indicator
53.1		13205, 1.3.A	Leachate Tank Fabrication Drawings - Vent
53.2		13205, 1.3.A	Leachate Tank Fabrication Drawings - Elbow
53.3		13205, 1.3.A	Leachate Tank Fabrication Drawings
53.4		13205, 1.3.A	Leachate Tank Fabrication Drawings - Letter
53.5		13205, 1.3.A	Leachate Tank Fabrication Dwgs. - ASME Cert.
53.6		13205, 1.3.A	Leachate Tank Fabrication Drawings
57		15060, 1.4.A	Discharge Pipe - Shop Drawings
58		15060, 1.4.B	Leachate Tank Fabrication Drawings - Shell
59		15060, 1.4.C	Stainless Steel Pipe Certification
60		15166, 1.2.A	Hangers, Brackets, Supports - Technical Data
61		15066, 1.2.B	Pipe and Conduit Support System - Calculations
62		15066, 1.2.C	Pipe and Conduit Support System - Drawings
63		15100, 1.3.A	Vacuum Release Valves
64		15100, 1.3.A	Solenoid Drain Valve and Piping
64.1		15100, 1.3.A	Solenoid Drain Valve and Piping
65		15100, 1.3.A	Sample Cocks
66		15100, 1.3.A	Check Valves
67		15100, 1.3.A	Automatic Drain Valve - Manuf. Information
68		15104, 1.2.A	Butterfly Valves
68A		15104, 1.2.A	Butterfly Valves
69		15150, 1.2.A	Turbine Meter
		15150, 1.3.A	Turbine Meter - Installation, Operation, and Maintenance Manual
70		15250, 1.3.A	Leachate Tank and Pipe Insulation - Manuf. Info.
71		15250, 1.3.B	Leachate Tank and Pipe Insulation - Certification

ENGINEERING CHANGE NOTICE CONTINUATION SHEET 6/7 Page 8 of 8				1. ECN (use no. from pg. 1) W-025-029
Continued from Section 12, page 4:				
Submittals to be listed on DWG H-2-131586:				
SUB#	CVI SUP#	#SPEC REF.	DESCRIPTION	
44		05500, 1.2	Vertical Riser Lid and Grating Fab. Drawings	
50		11210, 1.2A	Pumps, Motors, Materials Information	
50.1		11210, 1.2A	Pumps, Motors, Materials Information	
50.1A		11210, 1.2A	Pumps, Motors, Materials Information	
		11210	Transfer Pump - Installation, Operation, and Maintenance Instructions; Parts and Disassembly Instructions	
		11210	Submersible Pump - Installation and Operation Instructions	
		11210, 1-2, A; 2-1	Submersible Pump - Performance Curves	
		11210	Self-Priming Pump - Installation, Operation, and Maintenance Instructions; Spare Parts List; Maintenance Manual	
		11210, 1-2	Volume-Depth Curve: Primary Sump	
300		11210	Final Self-Priming Pump Piggy-Back Arrangement	
Submittals to be listed on DWG H-2-131587 Sheet 1:				
SUB#	CVI SUP#	#SPEC REF.	DESCRIPTION	
54		13340, 1.6A	Pump Controls - Dwgs. and Manuf. Information	
		13340, 1-6	Control Panel	
		13340, 2	Timeswitch	
55		13340, 1.6B	Pump Controls and Electrical System	
56		13340, 1.6C	Electrical Record Drawings	
79		16100, 2.4A	Panel Boards	
87		16100, 2.4B	Panel Boards - Materials	
90		16417, 1.2A	Panel Boards - Shop Drawings	
Submittals to be listed on DWG H-2-131587 Sheet 2:				
SUB#	CVI SUP#	#SPEC REF.	DESCRIPTION	
46		06100, 1.2A	Control Building Door Manuf. Information	
46.1		06100, 1.2A	Control Building Door Frame Manuf. Information	
51		13120, 1.3A	Control Building, Hardware Manuf. Information	
51.1		13120, 1.3A	Control Building Foundation	
51.2		13120, 1.3A	Control Building, Hardware Manuf. Information	
52		13120, 1.3B	Control Building Design Load	
Submittals to be listed on DWG H-2-131587 Sheet 4:				
SUB#	CVI SUP#	#SPEC REF.	DESCRIPTION	
72		16010, 1.7	Electrical System Certification (As-Built Drawings for Underground Conduits)	
		16100	Electrical and Instrumentation Operation and Maintenance	
73		16100, 2.4A	Raceways	
73A		16100, 2.4A	Coating and Conduits	
74		16100, 2.4A	Wire and Cables	
75		16100, 2.4A	Connectors and Terminations	
76		16100, 2.4A	Motor Controllers	
76A		16100, 2.4A	Motor Controllers	
77		16100, 2.4A	Power Service Equipment	
78		16100, 2.4A	Transformers	
78.1		16100, 2.4A	Transformers	
80		16100, 2.4A	Lighting Fixtures and Ballasts - Manuf. Info.	
81		16100, 2.4A	Wood Poles	
82		16100, 2.4A	Open Fuse Cutouts	

ENGINEERING CHANGE NOTICE CONTINUATION SHEET		Page <u>7</u> / <u>7</u> of <u>8</u>	1. ECN (use no. from pg 1) W-025-029
Continued from Section 12, page 5:			
83	16100, 2.4.A	Surge Arrestors - Manuf. Information	
84	16160, 1.2	Push Button Stations	
85	16100, 2.4.A	Pullbox	
86	16100, 2.4.A	Heat Trace	
86A	16100, 2.4.A	Heat Trace	
88	16160, 1.2	Motor Controllers	
88A	16160, 1.2	Motor Controllers	
89	16460, 1.2	Transformers - Shop Drawings	
89.1	16460, 1.2	Dry Type Transformers - Shop Drawings	
91	16500, 1.4.A	Lighting - Certified Lab. Test Report	
91A	16500, 1.4.A	Lighting - Certified Lab. Test Report	
92	16500, 1.4.B	Lighting	
93	16859, 1.3.A	Heat Trace - Manuf. Information	
93A	16859, 1.3.A	Heat Trace	
94	16859, 1.3.B	Heat Trace - QA/QC Documentation	
94A	16859, 1.3.B	Heat Trace - QA/QC Documentation	
3. Add notes to drawings to cross reference with as-built drawings in CQA Report (WHC-SD-W025-RPT-001) as follows:			
<u>Drawing No.</u>	<u>COA Report Reference</u>		
H-2-131575	Subgrade As-Built drawing		
H-2-131576	Top of Secondary Admix As-Built drawing		
H-2-131577	Top of Operations Layer As-Built drawing		
H-2-131579	Secondary HDPE Geomembrane Liner As-Built drawing		
	Primary HDPE Geomembrane Liner As-Built drawing		
H-2-131580	Top of Secondary Gravel As-Built drawing		
	Top of Primary Admix As-Built drawing		
	Top of Primary Gravel As-Built drawing		
H-2-131587, Sheet 1	Pump Control Wiring Diagram		

ENGINEERING CHANGE NOTICE	1. ECN 003-007 Proj. W-025-031 ECN
Page 1 of <u>7</u>	

2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777 5. Project Title/No./Work Order No. XCF212 W-025 RMW Land Disposal Facility 6. Bldg./Sys./Fac. No. 200W / 218-W-5 8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) H-2-131585 Design Drawings, WHC-S-045 Rev. 2	4. Date 9-19-94 7. Impact Level JS/Q 9. Related ECN No(s). NA 10. Related PO No. NA																																													
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date																																													
11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date																																															
12. Description of Change Changes to Project W-025 Design Drawings: 1. <u>Drawing No. H-2-131585: Sheet 1, Rev. 2</u> Leachate Temporary Storage Tank and Piping Plan: Change "TURBINE METER" to "FLOWMETER" throughout. Section N: Change "2-IN TURBINE FLOWMETER" to "1.5-IN FLOWMETER", remove callout for reducers. Section J: Change "TURBINE METER" to "FLOWMETER". Detail 38: Modify per attached Sketches 1 through 3. Changes to Project W-025 Specifications: 2. Section 15150: Replace in entirety with attached.																																															
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	13b. Justification Details 1. Reflect change in flowmeter type and dimensions. 2. Increase flowmeter accuracy.																																														
14. Distribution (include name, MSIN, and no. of copies) * Adv. copy <table style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: left;">WHC DISTRIBUTION</th> <th colspan="2" style="text-align: left;">KEH DISTRIBUTION</th> </tr> <tr> <td style="width: 25%;">WRAP DMC</td> <td style="width: 25%;">R1-29(1)</td> <td style="width: 25%;">J.R. Morton</td> <td style="width: 25%;">S2-55 (3)</td> </tr> <tr> <td>J.R. McGee</td> <td>G3-15 (1)</td> <td>P.G. Beaudet</td> <td>S2-55 (1)</td> </tr> <tr> <td>Station 10</td> <td>A3-87 (1)</td> <td>W.A. Holstein</td> <td>ES-41 (1)</td> </tr> <tr> <td>D.A. Rohl</td> <td>S4-01 (1)</td> <td>P.L. Rackley</td> <td>S2-55 (1)</td> </tr> <tr> <td>V. Roache</td> <td>G3-15 (3)</td> <td></td> <td></td> </tr> <tr> <td>J. Howard</td> <td>A5-58 (1)</td> <th colspan="2" style="text-align: left;">DOE DISTRIBUTION</th> </tr> <tr> <td>K.D. Johnson</td> <td>H5-33 (1)</td> <td>M.S. Collins</td> <td>A5-18 (1)</td> </tr> <tr> <td>J.J. Doran</td> <td>H6-30 (1)</td> <td>A.K. Crowell</td> <td>R3-80 (1)</td> </tr> <tr> <td>G.C. Evans</td> <td>H6-23 (1)</td> <td></td> <td></td> </tr> <tr> <td>H.R. Benzal</td> <td>T4-03 (1)</td> <td></td> <td></td> </tr> </table>		WHC DISTRIBUTION		KEH DISTRIBUTION		WRAP DMC	R1-29(1)	J.R. Morton	S2-55 (3)	J.R. McGee	G3-15 (1)	P.G. Beaudet	S2-55 (1)	Station 10	A3-87 (1)	W.A. Holstein	ES-41 (1)	D.A. Rohl	S4-01 (1)	P.L. Rackley	S2-55 (1)	V. Roache	G3-15 (3)			J. Howard	A5-58 (1)	DOE DISTRIBUTION		K.D. Johnson	H5-33 (1)	M.S. Collins	A5-18 (1)	J.J. Doran	H6-30 (1)	A.K. Crowell	R3-80 (1)	G.C. Evans	H6-23 (1)			H.R. Benzal	T4-03 (1)			RELEASE STAMP OFFICIAL RELEASE BY WHC DATE SEP 23 1994	
WHC DISTRIBUTION		KEH DISTRIBUTION																																													
WRAP DMC	R1-29(1)	J.R. Morton	S2-55 (3)																																												
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A-7900-013-2 (06/92) GEF095

A-7900-013-1 (06/92)

ENGINEERING CHANGE NOTICE				Page 2 of 7	1. ECN (use no. from pg. 1) W-025-031					
15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <table style="width: 100%;"> <tr> <td style="text-align: center;">ENGINEERING</td> <td style="text-align: center;">CONSTRUCTION</td> </tr> <tr> <td>Additional ☐ \$0</td> <td>Additional ☐ \$3,000</td> </tr> <tr> <td>Savings ☐ \$</td> <td>Savings ☐ \$</td> </tr> </table>			ENGINEERING	CONSTRUCTION	Additional ☐ \$0	Additional ☐ \$3,000	Savings ☐ \$	Savings ☐ \$	17. Schedule Impact (days) Improvement ☐ Delay ☒ 5
ENGINEERING	CONSTRUCTION									
Additional ☐ \$0	Additional ☐ \$3,000									
Savings ☐ \$	Savings ☐ \$									
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.										
SDO/DD ☐ Functional Design Criteria ☐ Operating Specification ☐ Criticality Specification ☐ Conceptual Design Report ☐ Equipment Spec. ☐ Const. Spec. ☐ Procurement Spec. ☐ Vendor Information ☐ OM Manual ☐ PSAR/SAR ☐ Safety Equipment List ☐ Radiation Work Permit ☐ Environmental Impact Statement ☐ Environmental Report ☐ Environmental Permit ☐	Seismic/Stress Analysis ☐ Stress/Design Report ☐ Interface Control Drawing ☐ Calibration Procedure ☐ Installation Procedure ☐ Maintenance Procedure ☐ Engineering Procedure ☐ Operating Instruction ☐ Operating Procedure ☐ Operational Safety Requirement ☐ IEDD Drawing ☐ Cell Arrangement Drawing ☐ Essential Material Specification ☐ Fac. Proc. Soma. Schedule ☐ Inspection Plan ☐ Inventory Adjustment Request ☐	Tank Calibration Manual ☐ Health Physics Procedure ☐ Spora Multiple Unit Listing ☐ Test Procedures/Specification ☐ Component Index ☐ ASME Coded Item ☐ Human Factor Consideration ☐ Computer Software ☐ Electric Circuit Schedule ☐ ICRS Procedure ☐ Process Control Manual/Plan ☐ Process Flow Chart ☐ Purchase Requisition ☐ Construction Quality Assurance Plan ☒ LLBG Part B Permit Application ☒								
19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.										
Document Number/Revision		Document Number/Revision		Document Number/Revision						
WHC-SD-W025-PLN-001 Rev. 3										
DOE/RL-88-20, Supplement 2										
20. Approvals:										
Signature		Date	Signature		Date					
OPERATIONS AND ENGINEERING Cog Engineer <i>[Signature]</i> V. Roscha 9/21/94 Cog. Mgr. <i>[Signature]</i> DR LUCAS 9/21/94 QA <i>[Signature]</i> 9/21/94 Safety _____ Security _____ Environ. _____ Projects/Programs _____ Tank Waste Remediation System _____ Facilities Operations _____ Restoration & Remediation _____ Operations & Support Services _____ IRM _____ Other _____			ARCHITECT-ENGINEER PE <i>[Signature]</i> 9-19-94 QA <i>[Signature]</i> 9-19-94 Safety _____ Design _____ Environ. _____ Other <i>[Signature]</i> 9/19/94							
			DEPARTMENT OF ENERGY							
			Signature or Letter No.							
			ADDITIONAL							

L.W. FLY,
09/13/94

SKETCH 1, TRENCH 31 FLOWMETER FIX

L.W. FLY,
09/13/94

SKETCH 2, TRENCH 31 FLOWMETER FIX

ECO: W-025-01 01/13/94

L.W. FLY,
09/13/94

SKETCH 3, TRENCH 31 FLOWMETER FIX

WHC-S-045 Rev. 3

SECTION 15150
FLOWMETERS

PART 1: GENERAL

1-1 SECTION INCLUDES

Furnishing and installing two flowmeters for monitoring the accumulated leachate discharged to the leachate temporary storage tank. One meter shall be located on the combined leachate discharge line, the other shall be on the secondary pump discharge line, as shown on the Drawings. Both meters shall be of the same design and from the same manufacturer.

1-2 SUBMITTALS

- A. Submit product information showing conformance with specifications contained herein.
- B. Submit proposed procedure for calibrating flowmeters.
- C. Submit calibration data and certification of calibration.
- D. Submit in accordance with Section 01300.

PART 2: PRODUCTS

2-1 PERFORMANCE

The flowmeter shall be capable of measuring the accumulated flow through the meter with an accuracy of $\pm 1.5\%$ or better at nominal flow rates from 5-gpm to 160-gpm (combined discharge line) and 5 gpm to 60 gpm (secondary pump discharge line). A flow rate indicator is not required. Piping upstream and downstream of flowmeters shall be straight and of same diameter as flowmeter for at least 10 diameters.

2-2 MANUFACTURERS

Hersey, Rockwell, Badger or approved equal.

PART 3: EXECUTION

3-1 CALIBRATION

Provide certified calibration over full range of flow rates to demonstrate that flowmeter performance satisfies the requirements of these specifications. Actual calibration of each

WHC PROJECT W-025
943-1576

15150-1
September 12, 1994

WHC-S-045 Rev. 3

flowmeter will be required; manufacturer's generic performance data will not be acceptable. Calibration procedure shall be approved by COTR prior to use.

3-2 INSTALLATION

Install flowmeters in accordance with manufacturer's recommendations.

-END -

WHC PROJECT W-025
943-1576

15150-2
September 12, 1994

ENGINEERING CHANGE NOTICE	Page 1 of <u>2</u>	1. ECN 685-130 Proj. W-025-032 ECN
---------------------------	--------------------	---

2. ECN Category (mark one) Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. F.S. Shuri, Golder Associates Inc. (206) 883-0777	4. Date 10-6-94
5. Project Title/No./Work Order No. W-025 RMW Land Disposal Facility	6. Bldg./Sys./Fac. No. 200W / 218-W-5	7. Impact Level SQ / B
8. Document Numbers Changed by this ECN (Includes sheet no. and rev.) WHC-SD-W-025-ATP-001, Rev. 3	9. Related ECN No(s). W-025-031	10. Related PO No. NA
11a. Modification Work ☐ Yes (fill out Bk. 11b) ☒ No (NA Bk. 11b, 11c, 11d)	11b. Work Package No. NA	11c. Modification Work Complete NA Cog. Engineer Signature & Date
11d. Restored to Original Condition (Temp. or Standby ECN only) NA Cog. Engineer Signature & Date		
12. Description of Change Changes to Project W-025 Acceptance Test Procedure: 1. Section 10.5.5: Change "3-inch flowmeter" to "2-inch flowmeter". 2. Section 10.5.7: Change "2-inch and 3-inch flowmeters" to "1.5-inch and 2-inch flowmeters". 3. Section 10.5.10: Change "2-inch and 3-inch flowmeters" to "1.5-inch and 2-inch flowmeters". 4. Test Data Form 10-5, Step Numbers 10.5.7, 10.5.10, 10.5.11: Change "2-inch flowmeter" to "1.5-inch flowmeter" and change "3-inch flowmeter" to "2-inch flowmeter" throughout. Note: Acceptance Test Procedure WHC-SD-W-025-ATP-001, Rev. 3, shall also be used for acceptance testing at the second lobe of Project W-025. The changes in this ECN shall also apply to the acceptance testing for the second lobe. <i>xx Per Telecom w/ V. Roacha - 10/11/94, J. Bishop / Ste. 21</i>		
13a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ As-Found ☐ Facitude Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	13b. Justification Details Refract changes in flowmeter size as described in ECN W-025-031.	
14. Distribution (include name, MSIN, and no. of copies) WHC DISTRIBUTION <i>Central Files 13-04 (Orig.)</i> WRAP DMC G3-15 (1) G. Cummins H5-24 (1) J.R. McGee G3-15 (1) D.A. Pratt T4-03 (1) Station 10 A3-87 (1) R.J. Girou T4-05 (1) D.A. Roth S4-01 (1) D.R. Lucas G3-15 (1) V. Roacha G3-15 (3) D. Carlyle T4-03 (1) J. Howard A5-55 (1) K.D. Johnson H5-33 (1) J.J. Dorian H5-30 (1) G.C. Evans H5-23 (1) H.R. Benzal T4-03 (1)		KEH DISTRIBUTION J.R. Morton S2-55 (3) P.G. Beaudet S2-55 (1) W.A. Holstein E5-41 (1) P.L. Rackley S2-55 (1) DOE DISTRIBUTION M.S. Collins A5-18 (1) A.K. Crowell R3-80 (1)
ECOLOGY DISTRIBUTION J. Hensley S5-75 (1)		RELEASE STAMP OFFICIAL RELEASE BY WHC DATE OCT 11 1994 <i>Ste. 21</i>

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A-7900-013-1 (06/92)

ENGINEERING CHANGE NOTICE

Page 2 of 2

1. ECN (use no. from pg. 1)

W-025-032

15. Design Verification Required

☐ Yes
☒ No

16. Cost Impact

ENGINEERING

Additional Savings

☒ \$0
☐ \$

CONSTRUCTION

Additional Savings ☒ \$0
☐ \$

17. Schedule Impact (days)

Improvement ☐
Delay ☒ 0

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

500/00	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specifications	☐	Interface Control Drawing	☐	Spent Muds Unit Listing	☐
Criticality Specifications	☐	Calibration Procedure	☐	Test Procedures/Specifications	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Specs.	☐	Maintenance Procedure	☐	ASME Codes Item	☐
Control Specs.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Specs.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
PSAR/EAR	☐	IEPD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Comp. Schedule	☐	Construction Quality Assurance Plan	☒
Environmental Report	☐	Inspection Plan	☐	USG Part 8 Permit Application	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
WHC-SD-W025-PLN-001 Rev. 3		
DOE/RL-88-20, Supplement 2		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer <i>[Signature]</i>	10-6-94	PE <i>[Signature]</i>	10-6-94
Cog. Mgr. <i>[Signature]</i>	10/10/94	QA <i>[Signature]</i>	10-6-94
QA <i>[Signature]</i>	10-6-94	Safety	
Safety		Design	
Security		Environ.	
Environ.		Other <i>[Signature]</i>	10-6-94
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations			
Restoration & Remediation			
Operations & Support Services			
IRM			
Other			

INFORMATION RELEASE REQUEST PUBLIC DOCUMENT CHANGE/REVISION (Short Form No. 1)	
1. Base Document ID Number: ECN-W025-032 (SD-W025-ATP-001 REV 3)	
2. Base Document Title: Acceptance Test Procedure W-025	
3. Change/Revision Number: 3	
4. Change/Revision Date: 08/16/94	
5. Unclassified Category:* UC - N/A	
6. Budget & Reporting Code:* B&R - N/A	
I verify this change/revision to the base document indicated above: <ul style="list-style-type: none">• Complies with the provisions of WHC-CM-3-4• Contains no Limited-Use information• Contains no classified or Applied Technology references• Does not change the intent or meaning of the base document• And, the base document itself is approved for public release.	
7. Responsible Manager: DR Lucas	
MSIN: 63-15	Telephone Number: 376-0060
(Signature)	10/11/94 (Date)
8. Information Release Administration Specialist:* * .	
_____ (Signature)	_____ (Date)
*Required only for full revisions transmitted to OSTI. **Required only for full revisions.	

A-6001-401.1 (07/94)

CONTRACTOR: <u>DELHUR IND. INC.</u>		LOG NUMBER: <u>13</u>
To Be Completed By Originator		
Contractor Field Problem No:		Date: <u>1/28/94</u>
Addressee: <u>Golder Assoc. Frank Shuri</u>	Project Title/NO: <u>KEH-5346</u>	Subcontract No:
Originator/Company: <u>DELHUR IND. INC.</u>	References: Drawings/Specifications	
Subject: <u>Substituting 7 oz. Geotextile in-Place of 16 oz.</u>		
Problem/Deficiency: <u>Clarification</u> ☒ <u>Change</u>		
<p>A shortage of 16 oz. Geotextile has enabled Geopacific to complete the deployment of fabric on the truck staging area.</p>		
<p>Recommended Solution: COST <u>Yes</u> ☒ <u>No</u> SCHEDULE <u>Yes</u> ☒ <u>No</u></p> <p>In-Place of the specified 16 oz. textile on the truck staging area, Geopacific proposes deploying 3 layers of 7 oz. fabric instead. Each layer will be overlapped and latched together and the 3 layers will be perpendicular to one another.</p>		
To Be Completed By Architect Engineer / Project Manager / Construction Engineer		
<p>Solution: <u>OK</u>, provided total thickness is greater than that provided by 16 oz geotextile. Overlap panels ~ 6" before latching. Place 2nd layer 90° to first, place 3rd layer at 45° to first 2 layers.</p>		
EC's Required: <u>Yes</u> ☐ <u>No</u> ☐		
<p>Submittal Date Required: <u>Yes</u> ☐ <u>No</u> ☐</p> <p><u>Frank S. Shuri</u> Architect Engineer/Date <u>1-28-94</u> Project Manager/Date</p>		
Construction Engineer/Date		
Project Manager to determine requirement for AE review/signature approval		
To Be Completed By Subcontract Administrator / Field Contract Engineer		
<p>Decision: <u>Clarification</u> ☐ <u>Change Order No. ()</u> ☐ <u>Other</u> ☐ <u>Estimate</u> ☐</p>		Distributions:
Field Contract Engineer/Date		Attachment:
Subcontract Administrator/Date		

APPENDIX D
SOIL MATERIALS LABORATORY TEST RESULTS

APPENDIX D-1
EXCAVATION AND BACKFILL

EXCAVATION AND BACKFILL MATERIALS EVALUATIONS

Project W-025

GCS Project No. 933-1354

VISUAL CLASSIFICATIONS

DATE	EXCAVATED SOIL DESCRIPTION	USCS CLASSIFICATION	STOCKPILE
09-13-93	Brown, silty, fine Sand, w/ roots and sagebrush	N/A	Spoils Stockpile
09-14-93	Olive gray, silty, fine Sand	SM	Eolian Sand Stockpile
09-15-93	Olive gray, fine, sandy Silt to silty, fine Sand	SM	Eolian Sand Stockpile
09-16-93	Olive gray, silty, fine Sand	SM	Eolian Sand Stockpile
09-16-93	Olive gray, silty, fine Sand	SM	Eolian Sand Stockpile
09-17-93	Olive gray, silty, fine Sand	SM	Eolian Sand Stockpile
09-20-93	Olive gray, silty, fine Sand	SM	Eolian Sand Stockpile
09-21-93	Olive gray, f-c Sand, little f-c gravel, tr. silt, tr. cobbles	SW w/ gravel	General Stockpile
09-22-93	Olive gray, silty, fine Sand	SM	General Stockpile
09-22-93	Olive gray, gravelly, f-c Sand, tr. cobbles	SW w/ gravel	General Stockpile
09-23-93	Olive gray, silty, fine Sand	SM	General Stockpile
09-23-93	Olive gray, gravelly, f-c Sand, tr. cobbles	SW w/ gravel	General Stockpile
09-24-93	Olive black, gravelly, f-c Sand Dk yellowish brown, fine sandy Silt Olive gray, f-m Sand, tr silt	SW w/ gravel Sandy ML SW	General Stockpile

BACKFILL MATERIALS LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	MAXIMUM DENSITY (lbs/CF)	OPTIMUM MOISTURE (%)	PERCENT PASSING NO. 4 SIEVE (%)	PERCENT PASSING NO. 200 SIEVE (%)	CLAY SIZE FRACTION (% finer than 0.005 mm)	PLASTICITY INDEX	USCS CLASSIFICATION
ES-22	109.0	14.3	100.0	21.6	2.2	Non-plastic	SM
GF-01	127.0	9.9	90.4	12.7	0.4	Non-plastic	SM
GF-32	124.5	9.0	95.4	15.5	1.5	Non-plastic	SM

APPENDIX D-2

EOLIAN SAND

**EOLIAN SAND
LABORATORY TESTING SUMMARY**

PROJECT W-025

GCS PROJECT NO. 933-1354

SAMPLE NO.	MOISTURE CONTENT (%)	% FINER THAN #200 SIEVE	% CLAY SIZE FRACTION (.005mm)
ES-01	11.3	22.1	3.2
ES-02	3.5	19.8	2.0
ES-03	5.9	17.2	1.7
ES-04	3.5	23.3	1.1
ES-05	6.3	25.2	2.1
ES-06	4.3	18.1	2.1
ES-07	3.6	28.3	1.1
ES-08	4.7	21.4	1.4
ES-09	4.9	19.1	1.9
ES-10	5.0	19.4	0.7
ES-11	3.6	21.8	1.7
ES-12	4.4	21.5	1.5
ES-13	4.8	19.0	1.1
ES-14	4.7	19.3	0.7
ES-15	4.3	17.4	0.6
ES-16	7.3	20.4	0
ES-17	3.6	21.3	1.1
ES-18	3.2	22.0	0.7
ES-19	4.1	20.7	0.2
ES-20	5.9	19.8	0
ES-21	4.0	20.4	0
ES-22	4.8	21.6	2.2
ES-23	4.9	21.9	2.8
ES-24	4.2	20.0	2.8

EOLIAN SAND
LABORATORY TESTING SUMMARY

PROJECT W-025

GCS PROJECT NO. 933-1354

SAMPLE NO.	MOISTURE CONTENT (%)	% FINER THAN #200 SIEVE	% CLAY SIZE FRACTION (.005mm)
ES-25	4.9	19.3	2.5
ES-26	5.4	19.2	2.6
ES-27	6.5	20.1	2.8
ES-28	4.6	21.6	2.8
ES-29	4.5	19.5	3.1
ES-30	4.9	19.2	2.9
ES-31	4.8	20.1	2.6
ES-32	5.3	25.0	2.8
ES-33	4.2	19.6	2.7
ES-34	4.7	20.3	2.1
ES-35	4.4	20.5	1.7
ES-36A	N/A	25.1	2.2
ES-36	4.4	18.5	2.2
ES-37	4.6	19.5	1.2
ES-38A	N/A	24.6	0
ES-38	4.4	34.1	0
ES-39	N/A	19.0	2.4
ES-40	5.1	26.3	0

APPENDIX D-3

BENTONITE

APPENDIX D-3.1
CQA LABORATORY TEST RESULTS

BENTONITE PRECONSTRUCTION TEST SUMMARY

Project W-025

GCS Project No. 933-1354

Sample No.	Free Swell (ml)	Wet Screen Analysis (% retained on No. 200 sieve)	Moisture Content (%)	Filtrate (ml)	Marsh Funnel Viscosity (sec.)
Specifications	25 ml minimum	4.0% maximum	10.0% maximum	15 ml maximum	36.5 sec. minimum
B-1	25	2.8	7.9	15	69
B-2	26	2.8	7.3	15	98
B-3	26	2.1	8.2	13.5	165
B-4	27	2.8	6.0	15	208
B-5	26	1.9	7.5	15	91
B-6	25	1.2	7.6	15	80
B-7	26	1.4	7.2	13.5	84
B-8	26	1.4	6.6	13.6	83
B-9	26	2.1	7.1	15	115

APPENDIX D-3.2
VISCOSITY CORRELATION

**PACIFIC
PROCESS
& LINER, INC.**
"Representing Intelligent Solutions"

- FAX TRANSMITTAL -

Date: 9/30/93
Pages: 5 (Including Cover)
To: Cliff Knitter Golder Associates
Fax Phone: 206-882-5498
From: Jim Coskey
Subject: Correlation-viscosity/barrel yield/marsh funnel

If there are any problems in transmission, please call 503-929-4400.

Cliff,

There is a qualitative correlation between viscosity, barrel yield and the marsh funnel test. The barrel yield can be approximated via marsh funnel testing to determine viscosity of a given quantity bentonite in a given volume water.

Using the attached graph and appropriate calculations the following approximation might be made:

A slurry with 22.5 grams of bentonite/350 cc of water and a viscosity of 15 or greater will have a barrel yield of 91 or greater.

Explanation: a 15 centipose slurry of 22.5 g/350 cc H₂O equals 91 BBY. The minimum 15 centipose viscosity is determined by timing the required volume of slurry thru the Marsh funnel in approximately 36 to 37 seconds (per the attached graph). Keep in mind, this is only an approximation and a viscometer is required to confirm these measurements to assure accuracy.

Figure 11.16. These curves show the relationship of viscosity values to Marsh funnel measurements for a polymer and Wyoming bentonite.

AMERICAN COLLOID COMPANY

1800 W. SHAW DRIVE • ARLINGTON HEIGHTS, IL 60004-1436
 (708) 991-4900 • FAX (708) 996-8199
 TELEX: ITT 6330331 AMER COL

ISSUE DATE 4-1-83

REVISION NO. 1

REVISION DATE 6-22-90

technical data

BARREL YIELD - API

Page 3 of 3

FORMULA:

$$\frac{2000}{\% \text{ GRAINE PER 350 CC. AT 15 CPS.}} = 2.3 = \text{"BARREL YIELD"}$$

NOTE: The 2.3 is the volume occupied by one ton of bentonite in water.

APPROVED BY:

Bl Fox

ISSUE DATE 4-1-83

REVISION NO. 1

REVISION DATE 6-22-90

BARREL YIELD - API

Page 2 of 3

PROCEDURE (Continued)

5. If Apparent Viscosity is above 15 centipoises, prepare fresh samples using 12, 15, or 18 grams per 350 ccs., mixing as outlined.
6. If Apparent Viscosity is below 15 centipoises, prepare fresh samples using 23, 26, or 30 grams per 350 ccs., mixing as outlined.

NOTE: Barrel yield is computed from solids content needed to develop 15 centipoise drill fluid. One fluid should be slightly below 15 cps., one slightly above 15 cps.

7. Age overnight in sealed jars.
8. Remix for 5 minutes with a Multimixer, measure Apparent Viscosity.

CALCULATION

WATER	WATER	CPS.	BARREL YIELD
10.1 GR.	350 CC.	15 AV	200 BBL.
11.25 GR.	350 CC.	15 AV	180 BBL.
13.5 GR.	350 CC.	15 AV	150 BBL.
15.0 GR.	350 CC.	15 AV	136 BBL.
16.3 GR.	350 CC.	15 AV	125 BBL.
18.0 GR.	350 CC.	15 AV	113 BBL.
20.0 GR.	350 CC.	15 AV	102 BBL.
22.5 GR.	350 CC.	15 AV	91 BBL.
25.0 GR.	350 CC.	15 AV	82 BBL.
30.0 GR.	350 CC.	15 AV	69 BBL.

$$AV = 600 \text{ rpm dial reading} + 2$$

SECTION 2 VISCOSITY AND GEL STRENGTH

2.1 Description

a. The following instruments are used to measure viscosity and/or gel strength of drilling fluids:

1. Marsh Funnel — a simple device for indicating viscosity on a routine basis.
2. Direct-indicating viscometer — a mechanical device for measurement of viscosity at varying shear rates.

b. Viscosity and gel strength are measurements that relate to the flow properties of muds. The study of deformation and flow of matter is rheology. An in-depth discussion of rheology is made in API Bulletin 13D1, *The Rheology of Oil-Well Drilling Fluids*.

MARSH FUNNEL

2.2 Equipment

a. Marsh Funnel

A Marsh Funnel (see Fig. 2.1) is calibrated to out-flow one quart (946 cm³) of fresh water at a temperature of 70 ± 5°F (21 ± 3°C) in 26 ± 0.5 seconds. A graduated cup is used as a receiver.

Specifications

Funnel Cone

Length.....12.0 in. (305 mm)
Diameter.....6.0 in. (153 mm)
Capacity to bottom of screen.....1600 cm³

Orifice

Length.....2.0 in. (50.8 mm)
Inside Diameter.....2 1/8 in. (4.7 mm)

Screen.....12 mesh
Has 1/16 in. (1.6 mm) openings and is fixed at a level 3/4 in. (19.0 mm) below top of funnel.

b. Graduated cup: one-quart

c. Stopwatch

d. Thermometer: 32-250°F (0-128°C)

2.3 Procedure

a. Cover the funnel orifice with a finger and pour freshly sampled drilling fluid through the screen into the clean, upright funnel. Fill until fluid reaches the bottom of the screen.

b. Remove finger and start stopwatch. Measure the time for mud to fill to one-quart (946 cm³) mark of the cup.

c. Measure temperature of fluid in degrees F (C).

d. Report the time to nearest second as Marsh Funnel viscosity. Report the temperature of fluid to nearest degree F (C).

DIRECT-INDICATING VISCOMETER

2.4 Equipment

a. Direct-indicating viscometers are rotational types of instruments powered by an electric motor or a hand crank. Drilling fluid is contained in the annular space between two concentric cylinders. The outer cylinder or rotor sleeve is driven at a constant rotational velocity (rpm). The rotation of the rotor sleeve in the fluid produces a torque on the inner cylinder or bob. A torsion spring restrains the movement of the bob, and a dial attached to the bob indicates displacement of the bob.

Instrument constants have been adjusted so that plastic viscosity and yield point are obtained by using readings from rotor sleeve speeds of 800 rpm and 600 rpm.

Specifications — Direct-indicating viscometer

Rotor Sleeve

Inside diameter.....1.450 in. (36.83 mm)
Total length.....2.423 in. (61.00 mm)
Scribed line.....2.30 in. (58.4 mm)

above the bottom of sleeve.
Two rows of 1/8 in. (3.18 mm) holes spaced 120 deg (2.09 radians) apart, around rotor sleeve just below scribed line.

FIG. 2.1
MARSH FUNNEL AND CUP

APPENDIX D-3.3
CERTIFICATES OF ANALYSIS

BENTONITE RAILCAR INVENTORY

Project W-025

GCS Project No. 933-1354

CAR NUMBER	TONS DELIVERED	CUMULATIVE TONS
1. BN 452458	98.5	98.5
2. BN 446747	98.2	196.7
3. BN 450671	98.0	294.7
4. BN 445837	95.0	389.7
5. ABIX 150	96.1	485.8
6. BN 457400	95.9	581.7
7. BN 464546	96.0	677.7
8. BN 464510	95.6	773.3
9. BN 450659	95.3	868.6
10. BN 464544	98.1	966.7
11. BN 464547	98.8	1065.5
12. BN 450657	96.2	1161.7
13. BN 453131	95.0	1256.7
14. BN 453312	95.1	1351.8
15. BN 453353	96.1	1447.9
16. BN 453859	95.9	1543.8
17. BN 453202	95.0	1638.8
18. BN 453527	95.2	1734.0
19. BN 453430	95.0	1829.0
20. BN 453023	95.0	1924.0
21. BN 458353	95.2	2019.2
22. BN 453167	95.3	2114.5
23. BN 453454	95.9	2210.4
24. BN 454435	95.9	2306.3
25. BN 453129	96.2	2402.5
26. BN 453444	96.2	2498.7
27. BN 449457	96.8	2595.5
28. BN 453242	96.2	2691.7
29. BN 453443	95.8	2787.5
30. BN 454349	95.7	2883.2
31. BN 464310	97.2	2980.4
32. BN 480812	95.1	3075.5
33. BN 464507	95.1	3170.6
34. BN 449539	96.1	3266.7
35. BN 446747	95.2	3361.9
36. BN 453186	95.1	3457.0
37. BN 453613	95.0	3552.0
38. BN 453213	95.3	3647.3
39. BN 450671	96.0	3743.3

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-11-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN452458
on 10-11-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>22.5</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.2</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.6</u>
<u>Free Swell</u>	<u>none</u>	<u>32.0</u>
<u>moisture</u>	<u>12.0% max</u>	<u>7.5</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>73.8</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WG

APPROVED BY: LeW.
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019125.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-13-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN450671
on 10-13-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

<u>TEST</u>	<u>SPECIFICATION</u>	<u>RESULTS</u>
<u>Visc</u>	<u>15.0 min</u>	<u>22.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.1</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.4</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>9.8</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>70.6</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: JMC

APPROVED BY: J.W.
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019131.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA. 93620-0201

DATE 10-14-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN457400
on 10-14-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>22.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.4</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.6</u>
<u>Free Swell</u>	<u>None</u>	<u>28.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>73.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: SM

APPROVED BY: JW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019134.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-15-93

RECEIVED
OCT 28 1993

ATTN: Rick Hurworth

Ans'd.....

A shipment of C/S-200 left our Upton plant in ABIX 150
on 10-15-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>24.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.4</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.2</u>
<u>Free Swell</u>	<u>none</u>	<u>26.6</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>8.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>74.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LMAPPROVED BY: FW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019136.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-16-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 450659
on 10-16-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>28.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.7</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>30.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>7.8</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>71.8</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: BE

RECEIVED
OCT 25 1993

APPROVED BY: Lee
AMERICAN COLLOID COMPANY

Ans'd.....

In any correspondence regarding this shipment, please refer to our Order No. 019137.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 10-16-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 464544
on 10-16-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>31.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.8</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>7.6</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>71.6</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: PMAPPROVED BY: JW.

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019140.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 10-16-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA. 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 464547
on 10-16-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

<u>TEST</u>	<u>SPECIFICATION</u>	<u>RESULTS</u>
<u>Visc</u>	<u>15.0 min</u>	<u>31.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.8</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>moisture</u>	<u>12.0% max</u>	<u>7.6</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WGAPPROVED BY: Jess-

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019133

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA. 93620-0201

DATE 10-18-93ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 464510
on 10-18-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>26.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.3</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.8</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>8.6</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>76.4</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LMAPPROVED BY: SW-

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019138.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-18-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN464546
on 10-18-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>26.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.4</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>27.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>7.8</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.0</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LM

APPROVED BY: SW-

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019139.

RECEIVED

NOV 01 1993

Ans'd.....

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY

1500 W. SHURE DRIVE

ARLINGTON HEIGHTS, ILLINOIS 60004

TO:

Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-19-93

ATTN:

Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 450657
 on 10-19-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>30.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>3.0</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>None</u>	<u>28.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>71.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: ImAPPROVED BY: fw

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019141.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-20-93

RECEIVED
OCT 28 1993
Ans'd.....

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 453131
on 10-20-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>23.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>1.9</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.2</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>7.9</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.6</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LM

APPROVED BY: JW-
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019142.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 453023
on 10-26-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>24.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.0</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>7.3%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>73.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: (Signature)

APPROVED BY: _____

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 17146.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN453167
on 10-26-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>30.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.7</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.2</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>9.6%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>74.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: W.G.

APPROVED BY: _____

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019153

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 453202
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>28.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.8</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.2</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>8.0</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>74.0</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LDG

APPROVED BY: JW-

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19149.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 10-26-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 453312
on 10-26-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>28.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.3</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.8</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>71.1</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: W.G.

APPROVED BY: FW.
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019144.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 10-26-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in DA 453353
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

<u>TEST</u>	<u>SPECIFICATION</u>	<u>RESULTS</u>
<u>Visc</u>	<u>15.0 min</u>	<u>30.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.6</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.8</u>
<u>Free Swell</u>	<u>none</u>	<u>25.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>7.8%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>7.7%</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: 125APPROVED BY: SW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19147

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BU 453 4.30
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>29.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.1</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.4</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>moisture</u>	<u>12.0% max</u>	<u>7.92</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>73.6</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WJG

APPROVED BY: JW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19151

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 10-26-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in DN 453454
on 10-26-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>29.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.5</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.2</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>73.6</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: S.M.APPROVED BY: [Signature]

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019151.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93420-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in Buys 3527
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>24.5</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>1.8</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.0</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>8.5</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>82.1</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LOG

APPROVED BY: LW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19150.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-92

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BU453859
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>29.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.2</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.2</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>7.42</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.5</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: 125

APPROVED BY: _____
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19148

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

RECEIVED

NOV 08 1993

Ans'd.....

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 454435
on 10-26-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>27.5</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>3.0</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.8</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.7</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>70.8</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: L.M.

APPROVED BY: Lee

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019270

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10-26-93

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in Bu 458353
on 10-26 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>22.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>1.7</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.2</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>8.2</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>80.9</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WG

APPROVED BY: LW.
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 19145

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries DATE 11-1-93
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 480812
on 11-1-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>30.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>3.0</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.2</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>6.8</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>75.2</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WJG

APPROVED BY: Lee

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019163

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 11/13/63

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA. 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN453129
on 10/21/63 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>24.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.4</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>8.2%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.5/200</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: JHAPPROVED BY: JW

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 11-1-63

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 11/17/77

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 453444
on 11/17/77 as requested on your order number .

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>25.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.2</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.8</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>moisture</u>	<u>12.0% max</u>	<u>9.3%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>71.8/200</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: J. C.APPROVED BY: J. C.

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. .

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 11-1-93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 464310
on 11-1-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>19.5</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>1.5</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.4</u>
<u>Free Swell</u>	<u>none</u>	<u>23.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>7.0</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>81.4</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: WG

APPROVED BY: See -
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019162.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries DATE 11-1-93
P.O. Box 1116
Port Angeles, WA 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BN 464507
on 11-1-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>26.0</u>
<u>PV/PP Ratio</u>	<u>3 to 1 max</u>	<u>2.3</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.0</u>
<u>Free Swell</u>	<u>none</u>	<u>26.0</u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.5</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>75.0</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: JM

APPROVED BY: JW
AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019164.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA 93620-0201

DATE 10/21/93

ATTN: Rick Hurworth

RECEIVED
NOV 08 1993

Ans'd.....

A shipment of C/S-200 left our Upton plant in Port Angeles
on 10/21/93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>28.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.7</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.4</u>
<u>Free Swell</u>	<u>none</u>	<u>24.0</u>
<u>Moisture</u>	<u>12.0% max</u>	<u>8.3%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>75.8/200</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: [Signature]

APPROVED BY: [Signature]

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 5175

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries DATE 11-2-93
P.O. Box 1116
Port Angeles, WA 93620-0201 RECEIVED
 NOV 18 1993

ATTN: Rick Hurworth Ans'd.....

A shipment of C/S-200 left our Upton plant in BN453186
 on 11-2-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>27.0</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u>2.5</u>
<u>FL</u>	<u>15.0 max</u>	<u>14.0</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>7.1</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>72.4</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: SM

APPROVED BY: SW
 AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019160.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

DATE 11/4/93

TO: Delhur Industries
P.O. Box 1116
Port Angeles, WA. 93620-0201

ATTN: Rick Hurworth

A shipment of C/S-200 left our Upton plant in BU 453213
on 11/4/93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>28.5</u>
<u>PV/VP Ratio</u>	<u>3 to 1 max</u>	<u> </u>
<u>FL</u>	<u>15.0 max</u>	<u> </u>
<u>Free Swell</u>	<u>none</u>	<u> </u>
<u>moisture</u>	<u>12.0 % max</u>	<u>8.5%</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>78.0/300</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY:

APPROVED BY: _____

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 819167.

CERTIFICATE OF ANALYSIS

AMERICAN COLLOID COMPANY
1500 W. SHURE DRIVE
ARLINGTON HEIGHTS, ILLINOIS 60004

TO: Delhur Industries DATE 11-2-93
P.O. Box 1116
Port Angeles, WA 93620-0201

RECEIVED
NOV 18 1993

ATTN: Rick Hurworth

Ans'd.....

A shipment of C/S-200 left our Upton plant in BN446747
 on 11-2-93 as requested on your order number _____.

A sample from this shipment was tested, and gave the following results

TEST	SPECIFICATION	RESULTS
<u>Visc</u>	<u>15.0 min</u>	<u>27.0</u>
<u>PV/YP Ratio</u>	<u>3 to 1 max</u>	<u>2.5</u>
<u>FL</u>	<u>15.0 max</u>	<u>13.6</u>
<u>Free Swell</u>	<u>none</u>	<u>28.0</u>
<u>Moisture</u>	<u>12.0 % max</u>	<u>7.8</u>
<u>-200 mesh</u>	<u>70/200 min.</u>	<u>81.4</u>
<u>BBL Yield</u>	<u>90 min</u>	<u>92.0</u>

We hereby certify that the test results shown above represent this shipment. Tests were conducted using American Colloid Company and/or customer approved laboratory procedures.

TEST CONDUCTED BY: LM

APPROVED BY: SW.

AMERICAN COLLOID COMPANY

In any correspondence regarding this shipment, please refer to our Order No. 019161.

WHC-SD-W025-RPT-001, Rev. 0

APPENDIX D-4
ADMIX/SOIL LINER

ADMIX PRECONSTRUCTION TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

Sample No.	Moisture Content (%)	Percent Passing No. 200 Sieve (%)	Clay Size Fraction (% finer than 0.005 mm)	Calculated Bentonite Content (%)	Plasticity Index	Standard Proctor Max. Dry Density (lbs/SF)	Optimum Moisture Content (%)	Permeability Test Result (cm/s)
AX-01	18.8							
AX-02	17.8							
AX-03	18.0							
AX-04	20.4							
AX-05	19.9	30.7	11.2	11.6				
AX-06	19.5							
AX-07	17.5							
AX-08	21.8							
AX-09	22.0	30.8	11.6	11.7	20	108.7	17.7	4E - 08
ES-22		21.6	2.2					
AX-10	21.9							
AX-11	18.6							
AX-12	21.3	30.7	11.5	11.6				
AX-13	20.4							
AX-14	18.1							
AX-15	19.0							
AX-16	19.4	30.3	11.6	11.1				
ES-23		21.9	2.8					
AX-17	19.9							
AX-18	21.2							
AX-19	21.1	31.3	11.6	12.0				
ES-24		20.0	2.8					
AX-20	21.1	32.1	12.8	15.1				
AX-21	20.7	29.1	13.6	11.4	19.5	109.0	17.0	4E - 08
AX-22	20.3	28.9	12.6	11.1				
AX-23	19.9							
AX-24	20.8	29.9	12.4	13.1				
ES-25		19.3	2.5					
AX-25	23.0	29.4	12.6	12.6	23	107.6	17.5	2E - 08
ES-26		19.2	2.6					
AX-26	22.0	30.5	12.2	13.0				
ES-27		20.1	2.8					
AX-27	25.2	30.6	13.0	11.5				
ES-28		21.6	2.8					
AX-28	21.7	29.9	12.5	12.9				
ES-29		19.5	3.1					
AX-29	21.9	30.5	13.2	14.0	21	108.2	18.2	2E - 08
ES-30		19.2	2.9					
AX-30	22.6	30.4	12.3	12.9				

ADMIX PRECONSTRUCTION TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

Sample No.	Moisture Content (%)	Percent Passing No. 200 Sieve (%)	Clay Size Fraction (% finer than 0.005 mm)	Calculated Bentonite Content (%)	Plasticity Index	Standard Proctor Max. Dry Density (lbs/SF)	Optimum Moisture Content (%)	Permeability Test Result (cm/s)
ES-31		20.1	2.6					
AX-31	21.6	33.9	12.9	11.9				
ES-32		25.0	2.8					
AX-32	22.3	30.5	12.0	13.6				
ES-33		19.6	2.7					
AX-33	20.7	29.7	12.4	11.8				
ES-34		20.3	2.1					
AX-34	21.1	29.3	11.0	11.1				
ES-35		20.5	1.7					
AX-35	19.3	35.5	12.1	13.9	33	109.0	18.0	2E - 08
ES-36A		25.1	2.2					
ES-36		18.5	2.2					
AX-36	22.6	30.8	12.2	14.0				
ES-37		19.5	1.2					
AX-37	22	34.5	11.7	13.1	23	109.0	18.0	2E - 08
ES-38A		24.6	0					
ES-38		34.1	0.0					
AX-38	21.1	28.6	11.4	11.9				
ES-39		19.0	2.4					
AX-39	21.6	34.6	9.2	11.3				
ES-40		26.3	0.0					

Notes:

A Sample No. with a prefix of AX denotes an admix sample obtained during the production of the admix.
Permeability tests performed on the AX samples were laboratory recompacted permeability tests.

A Sample No. with a prefix of ES indicates an eolian sand sample obtained just prior to mixing with bentonite.

A Sample No. with a suffix of A indicates a retest.

ADMIX PRECONSTRUCTION TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

EXAMPLE CALCULATION OF BENTONITE CONTENT:

PROBLEM - Determine the percentages of the sand and bentonite components of the admixture based on dry weights of the materials.

KNOWN - 30.5% of the admix (A) passes the #200 sieve.
20.2% of the sand (S) passes the #200 sieve.

ASSUME - 100.0% of the bentonite (B) passes the #200 sieve.

Based on the %'s passing the #200 sieve for each of the components (A, B, & S), the %'s of sand and bentonite comprising the admix can be determined as follows:

$$(B \times \% \text{ passing } \#200) + (S \times \% \text{ passing } \#200) = (A \times \% \text{ passing } \#200)$$

$$(B \times 100.0) + (S \times 20.2) = (A \times 30.5) \quad \text{or} \quad 100.0B + 20.2S = 30.5A$$

A = 100% of the admix; and bentonite (B) + sand (S) = 100% of the admix,
so B + S = 100; and S = 100 - B

$$\text{Therefore: } 100.0B + [20.2 \times (100 - B)] = 100 \times 30.5$$

$$100.0B + 2020 - 20.2B = 3050$$

Solving the equation for B, the bentonite content, B = 12.91.

The bentonite comprises 12.91% of the admix.

SOIL LINER LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

Sample No.	Percent Passing No. 200 Sieve (%)	Clay Size Fraction (% finer than 0.005 mm)	Plasticity Index	Permeability Test Result (cm/s)
SL-03	32.3	12.6	N/A	N/A
SL-12	30.9	11.5	25	1E - 08
SL-55	32.5	13.1	22	5E - 08
SL-86	31.3	11.5	18	1E - 06
SL-86A	33.8	11.3	24	1E - 08
SL-129	31.2	11.9	21	3E - 08
SL-136	33.6	12.5	32	3E - 08
SL-153	33.6	11.6	23	2E - 08
SL-154	32.3	11.0	25	8E - 09
SL-160	34.5	11.3	29	3E - 08
SL-161	33.5	10.4	27	3E - 08
SL-162	30.8	10.9	28	5E - 09
PL-15	N/A	N/A	N/A	1E - 08

Notes:

A Sample No. with a prefix of SL indicates a sample from the compacted secondary soil liner.
Permeability tests were performed on relatively undisturbed Shelby tube samples of this material.

A Sample No. with a prefix of PL indicates a sample from the compacted primary soil liner.
Permeability test was performed on a relatively undisturbed Shelby tube sample of this material.

A Sample No. with a suffix of A indicates a retest.

WHC-SD-W025-RPT-001, Rev. 0

APPENDIX D-5
GRANULAR DRAINAGE MATERIALS

DRAINAGE GRAVEL AND SUMP GRAVEL LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	SLAKE DURABILITY (%)	PERMEABILITY (cm/s)	SIEVE ANALYSES							
			Percent Finer than U.S. Standard Sieve Size							
			1 in.	3/4"	3/8"	#4	#40	#100	#200	
Drainage Gravel Specifications	<1.0	>1E-02	N/A	100	80 - 100	20 - 85	0 - 10	0 - 5	0 - 5	
GD-1 (Preconstruction)	0.04	7.8E-01	N/A	100.0	100.0	21.1	7.3	0.8	0.3	
GD-2 (Preconstruction)	0.01	3.4E-01	N/A	100.0	100.0	24.2	7.8	1.1	0.7	
GD-3 (Preconstruction)	0.16	4.9E-01	N/A	100.0	100.0	24.4	8.1	1.0	0.4	
GD-4 (Preconstruction)	0.04	5.7E-01	N/A	100.0	100.0	31.7	8.1	1.5	0.9	
GD-5 (Secondary Layer)	N/A	8.1E-01	N/A	100.0	100.0	30.5	8.9	1.8	1.2	
GD-6 (Secondary Layer)	N/A	9.7E-01	N/A	100.0	100.0	30.1	8.2	1.6	0.9	
GD-7 (Secondary Layer)	N/A	5.3E-01	N/A	100.0	100.0	28.7	8.9	1.6	0.9	
GD-8 (Secondary Layer)	N/A	6.1E-01	N/A	100.0	100.0	31.4	9.8	1.7	1.2	
GD-9 (Primary Layer)	N/A	7.9E-01	N/A	100.0	100.0	33.1	9.4	2.1	1.4	
GD-10 (Primary Layer)	N/A	6.4E-01	N/A	100.0	99.7	31.7	9.7	2.2	1.4	
GD-11 (Primary Layer)	N/A	6.2E-01	N/A	100.0	99.9	32.5	9.2	2.2	1.5	
GD-12 (Primary Layer)	N/A	5.0E-01	N/A	100.0	99.7	31.0	8.4	2.1	1.5	

DRAINAGE GRAVEL AND SUMP GRAVEL LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	SLAKE DURABILITY (%)	PERMEABILITY (cm/s)	SIEVE ANALYSES						
			Percent Finer than U.S. Standard Sieve Size						
			1 in.	3/4"	3/8"	#4	#40	#100	#200
Sump Gravel Specifications	<1.0	>1E - 02	100	80 - 100	10 - 40	0 - 4	0 - 4	N/A	0 - 2
GS-1 (Preconstruction)	0.87	2.6E - 01	100.0	93.8	22.6	0.3	0.1	N/A	0.0
GS-2 (Secondary Layer)	N/A	4.3	100.0	90.0	13.5	0.1	0.0	N/A	0.0
GS-3 (Primary Layer)	N/A	4.0	100.0	89.8	14.6	0.5	0.3	N/A	0.2

Notes:

Sample Nos. with a prefix of "GD" indicate drainage gravel samples.

Sample Nos. with a prefix of "GS" indicate sump gravel samples.

APPENDIX D-6

TOP COURSE

TOP COURSE LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	CONSTRUCTION PHASE	SIEVE ANALYSIS						MAXIMUM DENSITY (lbs/GF)	OPTIMUM MOISTURE (%)
		PERCENT FINER THAN U.S. STANDARD	3/4 IN.	5/8 IN.	1/4 IN.	# 40	# 200		
	Specifications	100	100	100.0	55 - 75	8 - 24	0 - 10	N/A	N/A
TC-01	Preconstruction	100.0	100.0	100.0	59.6	16.2	5.3	140.5	8.1
TC-02	Construction	100.0	100.0	100.0	59.5	15.4	4.7	N/A	N/A
TC-03	Construction	100.0	100.0	100.0	58.9	19.0	5.4	N/A	N/A
TC-04	Construction	N/A	N/A	N/A	N/A	N/A	N/A	138.2	8.0
TC-05	Construction	N/A	N/A	N/A	N/A	N/A	N/A	140.8	8.1

APPENDIX D-7
OPERATIONS LAYER

**OPERATIONS LAYER
PRECONSTRUCTION LABORATORY TESTING SUMMARY**

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	MOISTURE CONTENT (%)	% FINER THAN # 4 SIEVE	% FINER THAN #200 SIEVE	% CLAY SIZE FRACTION (.005mm)	USCS CLASSIFICATION
ES-01	11.3	100.0	22.1	3.2	SM
ES-02	3.5	100.0	19.8	2.0	SM
ES-03	5.9	100.0	17.2	1.7	SM
ES-04	3.5	100.0	23.3	1.1	SM
ES-05	6.3	100.0	25.2	2.1	SM
ES-06	4.3	100.0	18.1	2.1	SM
ES-07	3.6	100.0	28.3	1.1	SM
ES-08	4.7	100.0	21.4	1.4	SM
ES-09	4.9	100.0	19.1	1.9	SM
ES-10	5.0	100.0	19.4	0.7	SM
ES-11	3.6	100.0	21.8	1.7	SM
ES-12	4.4	100.0	21.5	1.5	SM
ES-13	4.8	100.0	19.0	1.1	SM
ES-14	4.7	100.0	19.3	0.7	SM
ES-15	4.3	100.0	17.4	0.6	SM
ES-16	7.3	100.0	20.4	0	SM
ES-17	3.6	100.0	21.3	1.1	SM
ES-18	3.2	100.0	22.0	0.7	SM
ES-19	4.1	100.0	20.7	0.2	SM
ES-20	5.9	100.0	19.8	0	SM
ES-21	4.0	100.0	20.4	0	SM
GF-01	2.4	90.4	12.7	0.4	SM
GF-32	6.6	95.4	15.5	1.5	SM

OPERATIONS LAYER MATERIAL
CONSTRUCTION LABORATORY TESTING SUMMARY

Project W-025

GCS Project No. 933-1354

SAMPLE NO.	PERCENT FINER THAN U.S. STANDARD SIEVE SIZE										USCS CLASSIFICATION
	2"	1"	3/4"	3/8"	# 4	# 10	# 20	# 40	# 100	# 200	
OPS-1	100.0	100.0	100.0	100.0	100.0	99.9	95.7	84.8	57.2	20.7	SM
OPS-2	100.0	100.0	100.0	100.0	100.0	99.9	97.2	87.9	62.4	23.4	SM
OPS-3	100.0	100.0	100.0	100.0	100.0	100.0	97.9	89.2	63.7	24.0	SM
OPS-4	100.0	100.0	100.0	100.0	100.0	100.0	95.5	89.9	57.3	20.9	SM
OPS-5	100.0	100.0	100.0	100.0	100.0	100.0	96.1	85.2	59.5	21.5	SM
OPS-6	100.0	100.0	100.0	100.0	100.0	100.0	99.4	96.7	60.1	15.1	SM
OPS-7	100.0	74.8	70.8	63.7	56.7	44.4	35.7	27.4	15.7	7.9	SM w/ gravel
OPS-8	100.0	87.0	86.1	81.2	76.3	67.3	52.0	38.3	25.2	12.6	SM w/ gravel

APPENDIX E
GEOMEMBRANE CONFORMANCE TESTS

APPENDIX E-1
SURVEILLANCE INSPECTION REPORTS

P-10.0-3-
SURVEILLANCE INSPECTION

Revision Level 3

June 1992
Page 6 of 6

Exhibit A

SURVEILLANCE INSPECTION REPORT

SIR

Page 1 of 3No.: 056Inspected Activity or Test: OBSERVE MANUFACTURING OF
HDPE GEOMEMBRANE AT SLT AMERICA (HOUSTON)Job Number: 933-1354Personnel Contacted: BOB SCHULER (LEAD MAN), RICARDO
IBARRA (SECOND) & NATHAN IVY (LAB TECH.)Reference Requirements: CQA Plan for NDO
Spec 6045 24-29
000 (WHC-3-045 Rev 2)Insp. Date: Oct. 16, 1993 Start Time: 2:40 pm End Time: 6:25 pmEquipment Condition/Calibration Status: Fowler 5A175 Outside
micrometer - Calibration due March, '94.

Observation and Comments (Use Extra Sheets as Required):

SEE SHEETS 2 & 3 of 3NCIR Reference (if any): NONEAction Items Requiring Correction (Use Extra Sheets as Required): NONEInspector: Durwood H. Gregory Date: Oct. 18, 1993Closed By QA Manager: M. J. J. J. Date: 10-21-93Action Item Closure Date: NA

Comments:

GOLDER ASSOCIATES INC.

DOE/NDO CQA/WA
IN-PLANT CQA REPORT

Durwood H. Gregory of Golder Associates arrived on site at the SLT, America, Inc. plant (Hardy Rd.) at 1445 hrs. on Saturday, Oct. 16, 1993 and met with Bob Schuler (lead man) and Ricardo Ibarra (second) at 2:48 pm. The scope of work was to observe manufacture of 60 mil HDPE geomembrane for project (DOE/NDO CQA/WA), Project # 933-1354 at the Hanford Nuclear Reservation in Eastern Washington, SLT customer # 8491 for Hanford/ Geopacific (contractor). At the time of arrival, SLT was just completing roll # AC-7679 for another project, and was projecting to start roll # AC-7680 at 3:00 for this project. Mr. Gregory walked to lab at 2:55 pm, met with Nathan Ivy, (laboratory technician), and discussed project, (only 3 personnel in-plant at this time). At 3:00, the end cut of roll -7679 and start of -7680 was observed.

A slight ribbing finish was observed on the bottom side of geomembrane, a micrometer reading at this area (approximately 3 ft wide at approximately the middle of roll (width)), even at the "valley" still read a 64 mil reading. Lead man (Bob) had already observed said incongruity, and adjusted the heat to rectify the situation.

Micrometer readings were taken along trail edge of roll -7679. The low of 62.5 mil, and the average was 63 mil thickness.

At 3:12, Mr. Gregory walked around "machine", observed process, machinery and hopper, and noticed regrind through observation window and around hopper distributor. He brought this to the attention of the lead-man, who explained that this regrind was from edging they trim off each side (1.25 in. wide) which was sent through a regrinder and, then sent in measured portions back into the hopper. It appeared that the regrind constituted no more than 1% of raw resin, but no documentation was available. At 3:20, the ribbing was observed to have increased in width, (not intensity). The lead-man told of turning down the temperature.

Mr. Gregory observed the cut of roll -7680, at 3:35 and start of roll -7681; The trailing edge of roll -7680 was measured using a micrometer to be 62.5 mil min. and 63.5 mil avg. The roll length was 480 ft and the sheet width was 23.5 ft wide.

The remainder of the manufacturing process for roll -7681 was observed and the ribbing had completely disappeared by end of -7681, (4:10). At 4:15, coupons and dog-bones were observed cut from the sample from roll #AC-7681. Testing procedures and results observed were: impact, tensile's, tear resistance, puncture and dimensional stability.

At the control panel, the computer readings were observed:

time:	Avg.	Max.	Min.	Std. Dev.	Scans
4:33	63.59	65.92	61.26	.53	24
4:50	63.83	65.32	61.52	.55	5

(Scans = computer "micrometer" scanning across sheet.

Mr. Gregory walked around "machine", observed process, machinery and hopper, observe cut of AC-7682 at 4:47 and start of -7683. To lab at 5:00, take micrometer readings, on trail -7682, low 62.5, average 63.5 mil thick, prepare paper work, observe testing.

Mr. Gregory returned to the manufacturing line at 5:15, observe cut of AC-7683 at 5:23. The trailing edge of roll -7683 was measured to be 63.5 min. and high of 64, with an average reading of 64 mil thick.

At control panel, readings:

time:	Avg.	Max.	Min.	Std. Dev.	Scans
5:25	63.98	65.22	62.20	.45	4
5:47	63.61	65.22	61.41	.51	30
5:52	63.59	65.22	61.41	.50	36

The trailing edge cut was observed at 5:57 (1757 hrs) of roll #AC-7684 (the fifth (5th) and final roll of this project today). Mr. Gregory followed sample from roll # AC-7684 to the lab at 6:03, micrometer readings showed a low of 63 mil, a high of 64 mil, with an average of 63.5 mil thick. Observed partial testing of this roll.

Mr. Gregory received the raw resin letter certificate. The Roll Test Data Reports (certifications) will be available Monday (Oct. 18), along with a list of previously accepted rolls. *

Off-site at 6:25 pm to office.

* Note: Certs, data reports & list were forwarded to S. Mathers, GAI CGA Engineer.
WJH per DJH
10-21-93

page 3 of 3

SURVEILLANCE INSPECTION REPORT

SIRPage 1 of 3No.: 057Inspected Activity or Test: OBSERVE MANUFACTURING OF
HDPE GEOMEMBRANE AT SLT, AMERICA (HOUSTON)Job Number: 933 1354Personnel Contacted: Harold Henderson (Plant Manager),
RAY Johnson (LEAD), Jeff Dobrowski (Second) & Melody Adams
(LAB MANAGER)Reference Requirements: CQA Plan for NDO
& Specifications (pp 24-29)
(WHC-045 Rev 2)Insp. Date: Oct. 19, 1993 Start Time: 10:35 am End Time: 2:50 pmEquipment Condition/Calibration Status: Fowler 5A175 Outside
Microwave - Calibration due March, 94

Observation and Comments (Use Extra Sheets as Required):

SEE SHEETS 2 & 3 of 3NCIR Reference (if any): NoneAction Items Requiring Correction (Use Extra Sheets as Required): SEE REPORT to follow,
Pages 2 & 3 of 3, regarding recycled Polymer.Inspector: Durwood H. Gregory Date: Oct. 19, 1993Closed By QA Manager: M. Johnson Date: 11-15-93Action Item Closure Date: 11-15-93Comments: Copy of letter dated October 27, 1993
required for action item closure.
Attached.
WJH.**RECEIVED**

OCT 20 1993

GOLDER ASSOCIATES INC.

Golder Associates

933-1354

E-14

DOE/NDO CQA/WA
IN-PLANT CQA REPORT

Durwood H. Gregory of Golder Associates arrived on site at the SLT, America, Inc. plant (Hardy Rd.) at 1035 hrs. on Tuesday, Oct. 19, 1993 and met with Harold Henderson (plant manager), Ray Johnson (lead), and Jeff Dobrowski (second) at 2:48 pm. The scope of work was to observe manufacture of 80 mil HDPE geomembrane for project (DOE/NDO CQA/WA), Project # 933-1354 at the Hanford Nuclear Reservation in Eastern Washington, SLT customer # 8491 for Hanford/ Geopacific (contractor). At the time of arrival, SLT was just completing roll # AC-7788 for another project, and was projecting to start roll # AC-7789 shortly for this project. Mr. Gregory walked to lab at 10:40 pm, met with Melody Adams, (laboratory manager), and discussed scope. At 10:55, the end cut of roll -7788 and start of -7789 was observed.

Micrometer readings were taken along trail edge of roll -7788. The low of 82 mil, and the average was 82.5 mil thickness.

At 11:02, Mr. Gregory walked around "machine", observed process, machinery and hopper, and noticed an exorbitant amount of regrind being dispensed into the hopper distributor. He observed dispensing for four (4) hopper loads, and determined this to be above the "less than 2%" as stated in the specifications. He brought this to the attention of the plant manager, asking Mr. Henderson how much regrind was being added, stating the possible conflict with the specifications. Mr. Henderson said they can shut the regrind off, however, this would take two (2) full rolls to clean out, and would re-start for this project in an hour or so. Mr. Henderson also stated that the edging referenced in Surveillance Inspection Report (SIR) No. 056 constituted only 1% of the volume.

Offsite at 11:20 pm, to go to the office to call Mr. Scott Matthees (Golder - Project CQA Engineer and Receiving Inspector), and Ms. Joey Gorman (Golder - ~~CQA Coordinator~~ *QA Manager* ¹⁰⁻²¹⁻⁹³).

Durwood H. Gregory of Golder Associates arrived on site at the SLT, America, Inc. plant (Hardy Rd.) at 1315 hrs. on Tuesday, Oct. 19, 1993 and met with Ray Johnson (lead).

Mr. Johnson informed Mr. Gregory that SLT was assigning this roll (AC-7793) to this project along with the next roll that Mr. Gregory would observe. Mr. Gregory observed the trail cutting of roll -7793, at 1:46 and start of roll -7794; The trailing edge of roll -7793 was measured using a micrometer to be 82 mil min. and 83 mil avg. The roll length was 360 ft and the sheet width was 23.5 ft wide.

~~page 2 of 3~~

Mr. Gregory spoke with Mr. Henderson regarding documentation assuring the previous rolls (60mil) accepted for this project do meet the specifications, specifically the fifth bullet on page 26, of WHC-SD-W025-PLN-001, Rev. 3, dated May 21, 1993, stating recycled polymer not exceed 2% by weight. Mr. Henderson retrieved the "daily production report" (SLT) and explained to Mr. Gregory that the reports for those two days showed zero recycled polymer (regrind) was used. Mr. Henderson also stated that Mr. Bill Walling (Director of Engineering Services) will certify/ensure in a letter this fact. Mr. Gregory should be able to receive this letter on Wednesday, Oct. 20, 1993.

At the control panel, the computer readings were observed:

	Avg.	Max.	Min.	Std. Dev.	Scans
time:					
1355	80.85	82.71	79.30	.50	15
1409	80.82	82.71	79.24	.44	32
1415	80.77	82.71	77.63	.49	39

(Scans = computer "micrometer" scanning across sheet.

The remainder of the manufacturing process for roll -7794 was observed and was completed without action items requiring correction. At 2:21, roll AC-7794 was sampled for SLT laboratory testing and quality assurance. Mr. Gregory tracked this sample to the laboratory and observed the following tests: impact, tensile's, and tear resistance.

Mr. Gregory received the Roll Test Data Report forms from SLT, including the raw resin letter certificate.*

Off-site at 2:50 pm to office.

**Note: Data Report &
certs were forwarded
to S. Mathews, GAI
C&A Engineer.
Mgt per D.S.
10-21-93*

NORTH AMERICA, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

TEL: (713) 330-3833
SALES FAX: (408) 273-2800
ADMIN. FAX: (408) 273-2800

October 22, 1993

GeoPacific Lining Inc.
1300 Dexter Ave. N., Suite 250
Seattle, Washington 98109

Attn: El Hafuschak

RE: DOE Hanford
Radioactive Waste Disposal Facility
SLT Project No. 8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the geomembrane for the above referenced project was manufactured from first quality resin which contains no reclaimed polymer and less than 2% of recycled trim.

Melody A. Adams
Engineer

MAA/m

Received
by Holder
11-15-93
per S. Mathews.
WJF

For environmental lining solutions...the world comes to SLT.™

SIR**SURVEILLANCE INSPECTION REPORT**

Page 1 of 2

No.: 058

Inspected Activity or Test: Observe Texturing or "Friction Flexing" of
HDPE Geomembrane at the SLT America Plant (Conroe, TX)Job Number: 933-1354Personnel Contacted: Dan Llewellyn (MGR. of Manuf.), Steve
Westerman (Morn. Crew Leader), And Chuck Bernbski (After Crew Leader)Reference Requirements: CQA Plan from NDO
Attached Specifications (6 pages) (sheets 4-9 of 9)Insp. Date: Oct. 22, 93 Start Time: 1345 hrs End Time: 1740 hrsEquipment Condition/Calibration Status: NoneObservation and Comments (Use Extra Sheets as Required): See sheets 243 of 9NCIR Reference (if any): NoneAction Items Requiring Correction (Use Extra Sheets as Required): NoneInspector: Durwood H. Gregory Date: Oct. 25, 1993Closed By QA Manager: M. J. [Signature] Date: 11-5-93Action Item Closure Date: na

Comments:

GOLDER ASSOCIATES INC.

933-1354

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DOE/NDO CQA/WA
IN-PLANT CQA REPORT SIR no. 058

Durwood H. Gregory of Golder Associates arrived on site at the Conroe (North) plant of SLT, America, Inc. at 1330 hrs. on Friday, Oct. 22, 1993 and met with Dan Llewellyn (manager of manufacturing), and Steve Westerman (Crew Leader) at 1:45 pm. The scope of work was to observe the texturing or "Friction Flex"ing of 60+ mil HDPE geomembrane previously manufactured at the South plant (Hardy Rd.). This texturing of geomembrane is for project (DOE/NDO CQA/WA), Project # 933-1354 at the Hanford Nuclear Reservation in Eastern Washington, SLT customer # 8491 for Hanford/ Geopacific (contractor). At the time of arrival, SLT was spraying roll # AC-6910, which is to be the first roll for this project.

At 1:55, Mr. Gregory began observing the machinery and process, to be described below.

The rolls AC-6904 through AC-6917, were shipped to the Conroe plant from the Hardy plant to be "Flexed", as per FAX from Melody Adams (Lab Manager) on October, 18, 1993. Mr. Gregory was informed that, when produced, a roll of geomembrane that is to be Flexed, is run twice as long and assigned two roll numbers. This is to make the Flexing process run more expediently by cutting the "changing of rolls" time in half. Mr. Gregory observed the following rolls in the yard... AC-6904/6905, 6906/6907, 6908/6909, 6912/6913, and 6916/6917. One roll was mislabeled, and found to be AC-6914/6915.

Based on a telephone conversation with Claudia Blackman, (production), Mr. Gregory was informed that there will be twenty-nine (29) rolls Friction-Flexed and three (3) rolls of smooth (60+mil). It was determined that all rolls were not on site at the time.

The process for Friction Flexing consists of un-rolling the pre-manufactured double length rolls of geomembrane through a set of rollers and between two spraying devices, assigned to spraying HDPE specs or Flex onto the geomembrane. The two sets of sprayers (one on each side of geomembrane) are affixed to carriages set on tracks that are trolled back and forth spraying the Flex, as the geomembrane is pulled through.

Shift change occurred at 2:30 pm, bringing on Chuck Bernoski as Crew Leader.

SAP DSB

The "Flex"ing is a slow process, taking 2.7 ft per minute, with rolls running 475 ft. long, taking approximately 3 hours per roll.

At 3:20 pm, Mr. Gregory was informed of a clogged nozzle; SLT would have to shut down and cool the line to clean or blow-out the nozzles, then heat back up. This procedure should take approximately 1 hour and is a standard problem that typically happens with very high humidity. At 4:35 pm the process was back on line. Mr. Gregory observed the area where "spitting" or "splattering" occurred, and could not discern any significant difference.

Mr. Gregory left production line at 5:30, and was away from plant at 5:40pm.

SPECS

WHC-S-045 Rev. 2

1-6 GEOCOMPOSITE

Geocomposite consists of geonet with a layer of geotextile thermally bonded to each side. Geocomposite is used on the side slopes of the landfill above the primary and secondary geomembrane.

1-7 SUBMITTALS

- A. Manufacturers of the various geosynthetic materials shall submit all required quality assurance and quality control documentation as described in the following sections and the CQA Plan.
- B. The Contractor shall submit samples of all proposed geosynthetic materials for "fingerprinting" analyses and conformance testing to determine acceptability. Sampling shall be performed in accordance with the following sections of this specification and the CQA Plan. Conformance testing will be performed by the CQA Engineer. Acceptability shall be determined by the COTR. Unacceptable materials shall be removed and disposed of at Contractor's expense.
- C. The Geosynthetics Installer shall submit a quality assurance program for installation of geosynthetic materials as well as a list of proposed geomembrane seaming personnel and their experience records.
- D. All submittals shall conform to the requirements of Section 01300.

PART 2: PRODUCTS

2-1 GEOMEMBRANE LINER

A. General

Three types of geomembrane are shown on the Drawings: TYPE I geomembrane will be used for both primary and secondary FML on the landfill side slopes and access ramp. TYPE II geomembrane will be used for both primary and secondary FML on the base of the landfill. TYPE III geomembrane will be used to line the truck unloading area at the entrance to the landfill access ramp and to line the containment basin under the leachate storage tank. The three TYPES are defined as follows:

- TYPE I - 60 mil thickness, textured (roughened) both sides
- TYPE II - 60 mil thickness, smooth both sides
- TYPE III - 80 mil thickness, smooth both sides

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SPECS

WHC-S-045 Rev. 2

All geomembrane, regardless of type, shall consist of unreinforced high density polyethylene (HDPE) sheet.

The Geomembrane Manufacturer shall be a commercial entity normally engaged in manufacture of HDPE geomembranes for landfill applications. Examples of potential manufacturers include SLT Environmental Inc., Houston, Texas; Gundle Lining Systems Inc., Houston, Texas; and Poly-Flex, Inc., Grand Prairie, Texas. Use of these examples is not intended to restrict potential manufacturers.

B. Specific FML Properties

1. The raw material shall be new polyethylene resin containing no more than 2% clean recycled polymer by weight.
2. The resin shall meet the following specifications:
 - Specific Gravity (ASTM D792 Method A or ASTM D1505): > 0.935
 - Melt Index (ASTM D1238 Condition 190/2.16): 0.1 - 1.1 g/10 min
3. Physical, mechanical, and environmental properties shall meet or exceed the values specified in the table contained in this Part of the Specifications.
4. Geomembrane shall have a crystallinity of 50 to 60 percent, or as approved by the COTR, as determined by Differential Scanning Calorimetry (DSC).
5. The residual friction angle between the textured geomembrane and the soil/bentonite admix used in the landfill liner (see Section 02224) shall have a minimum value of 27.5° under a normal load of 400 psf ± 50 psf and a displacement of at least 2 inches. Friction angle shall be determined by direct shear testing.

C. Manufacturing Quality Control

1. * Geomembrane Manufacturing

Quality control testing shall be carried out by the Manufacturer to demonstrate that the product meets the specifications listed in Part 2-1.B. Additional testing may be carried out for purposes of determining conformance by the CQA Engineer. If the results of the Manufacturer's and the CQA Engineer's testing differ significantly, the testing shall be repeated by the CQA Engineer, and the Manufacturer shall be allowed to monitor this testing. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

SPEC S

REQUIRED GEOMEMBRANE PROPERTIES

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PROPERTY	QUALIFIER	UNIT	SPECIFIED VALUE			TEST METHOD
			TYPE I	TYPE II	TYPE III	
<u>Physical Properties</u>						
Thickness	minimum avg	mils	60	60	80	ASTM D1593
Thickness	minimum	mils	54	54	72	
Specific Gravity	minimum	N/A	0.94	0.94	0.94	
Melt Index	range	g/10 min	0.1-1.1	0.1-1.1	0.1-1.1	ASTM D792 Method A or ASTM D1505 ASTM D1238 condition 190/2.16
<u>Mechanical Properties</u>						
Tensile Properties (each direction)						ASTM D638
1. Force per unit width at yield	minimum	lb/in	132	132	176	ASTM D1004 Die C FTMS 101C/2065
2. Tensile strength (force per unit width at break)	minimum	lb/in	228	228	304	
3. Elongation at yield	minimum	%	12	12	12	
4. Elongation at break	minimum	%	550	550	550	
Tear Resistance	minimum	lb	42	42	56	
Puncture Resistance	minimum	lb	90	80	105	
<u>Environmental Properties</u>						
Low Temperature	maximum	°F	-75	-75	-75	ASTM D746 Procedure B
Carbon Black Content	range	%	2-3	2-3	2-3	ASTM D1603
Carbon Black Dispersion	N/A		A1/A2	A1/A2	A1/A2	ASTM D3015
Dimensional Stability (each direction)	max. change	%	±1	±1	±1	ASTM D1204
Resistance to Soil Burial	% strength retained		95	90	90	ASTM D3083 (as modified in NSF Appendix A)
Environmental Stress Crack	minimum	hrs	3000	2000	2000	ASTM D1693 (as modified in NSF Appendix A Condition C at 100°C)

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Prior to the delivery of any geomembrane material, the Manufacturer shall provide the COTR and the CQA Engineer with the following information:

- the origin (Resin Supplier's name, resin production plant), identification (brand name, number) and production date of the resin;
- a list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane;
- a copy of the quality control certificates issued by the Resin Supplier;
- reports on the tests conducted by the Manufacturer and/or the CQA Engineer to confirm that the quality of the resin used to manufacture the geomembrane satisfies these Specifications [these tests shall include specific gravity (ASTM D792 Method A or ASTM D1505) and melt index (ASTM D1238 Condition 190/2.16)];
- a statement that no recycled polymer is added to the resin or that recycled polymer is clean and does not exceed 2% by weight;
- a properties sheet including, at a minimum, all specified properties on the table in Section 2-1.B, measured using test methods indicated in the specifications, or equivalent;
- reports on the tests, including sampling procedures, conducted by the Manufacturer and/or the CQA Engineer to confirm that the geomembrane meets the project specifications;
- a certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The CQA Engineer will review these documents and report any discrepancies with the above requirements to the COTR. The CQA Engineer will confirm that:

- the property values certified by the Geomembrane Manufacturer meet all of the specifications; and
- the measurements of properties by the Geomembrane Manufacturer are properly documented and that the test methods used are acceptable.

SPELS

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WHC-S-045 Rev. 2

In addition, the CQA Engineer may, at the request of the COTR, visit the manufacturing plant, preferably during the production of the particular geomembrane for this project, in order to evaluate the Manufacturer's quality control procedures.

2. Rolls

Prior to shipment, the Geomembrane Manufacturer shall provide the COTR and the CQA Engineer with a quality control certificate for each roll of geomembrane provided. The quality control certificate shall be signed by a responsible party employed by the Geomembrane Manufacturer, such as the production manager. The quality control certificate shall include:

- roll numbers and identification, resin lot and batch numbers; and
- sampling procedures and results of quality control tests. As a minimum, results shall be given for thickness, tensile strength, and tear resistance, evaluated in accordance with the methods indicated in these Specifications or equivalent methods approved by the Design Engineer. Tests shall be conducted on each production lot of geomembrane or every 50,000 square feet, whichever results in the greater number of tests.

The CQA Engineer will:

- confirm that the quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it; and
- review the quality control certificates and confirm that the certified roll properties meet the specifications.

3. Manufacturing Plant Visit

The Manufacturer shall allow the COTR or his designated representative to visit the manufacturing plant, if the COTR so chooses. If possible, the visit shall be prior to or during the manufacturing of the geomembrane rolls for the specific project. The COTR or his designated representative shall review the manufacturing process, quality control, laboratory facilities, and testing procedures.

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May 26, 1993

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During the visit, visiting personnel will also:

- confirm that the measurements of properties by the Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and confirm that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation procedures to confirm that these procedures are not damaging the geomembrane;
- confirm that roll packages have a label indicating the name of the manufacturer, type of geomembrane, thickness, and roll number; and
- if applicable, confirm that extrusion rods and/or beads are derived from the same base resin type as the geomembrane.

The Geomembrane Manufacturer shall accommodate these activities.

4. Conformance Testing.

a. Tests

Upon delivery of the rolls of geomembrane, the CQA Engineer will obtain samples at a frequency of one per production lot or one per 50,000 square feet of geomembrane, whichever results in the greater number of tests. The CQA Engineer will test the samples to determine conformance to both the design specifications and the list of guaranteed properties.

As a minimum, tests to determine the following characteristics will be performed on geomembranes:

- specific gravity (ASTM D792 Method A or ASTM D1505);
- carbon black content and visual inspection to evaluate carbon black dispersion (ASTM D1603);
- thickness (ASTM D1593);
- tensile characteristics (yield strength, elongation at yield, break strength, elongation at break; ASTM D638); and

SURVEILLANCE INSPECTION REPORT

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CLASSIFICATION

No.: 059

Inspected Activity or Test: Observed Texturing or Friction Flexing of
HDPE Geomembrane at the SLT America Plant (Conroe, TX)Job Number: 933-1354Personnel Contacted: Steve Westerman (Morning Crew Leader)Reference Requirements: CDA Plan P - NDD
See Attached SPECIFICATIONS - (Six (6) pages)Insp. Date: Oct. 24, 1993 Start Time: 0900 hrs End Time: 1230 hrsEquipment Condition/Calibration Status: NONEObservation and Comments (Use Extra Sheets as Required): SEE Sheets 2 of 8NCIR Reference (if any): NONEAction Items Requiring Correction (Use Extra Sheets as Required): NONEInspector: Durwood H. Gregory Date: Oct. 25, 1993Closed By QA Manager: W. J. Miller Date: 11-5-93Action Item Closure Date: NA

Comments:

GOLDER ASSOCIATES INC.

DOE/NDO CQA/WA
IN-PLANT CQA REPORT SIR no. 059

Durwood H. Gregory of Golder Associates arrived on site at the Conroe (North) plant of SLT, America, Inc. at 0900 hrs. on Sunday, Oct. 24, 1993 and met with Steve Westerman (Crew Leader). The scope of work was to observe the texturing or "Friction Flex"ing of 60+ mil HDPE geomembrane previously manufactured at the South plant (Hardy). This texturing of geomembrane is for project (DOE/NDO CQA/WA), Project # 933-1354 at the Hanford Nuclear Reservation in Eastern Washington, SLT customer # 8491 for Hanford/ Geopacific (contractor). At the time of arrival, SLT was spraying roll # AC-6912, which is to be the fifteenth roll for this project.

After reviewing the two previous days production report, Mr. Gregory began observing the machinery and process. Roll # 6912 was in the process of being Flexed.

The following rolls had been Friction Flexed over Friday, Saturday and up to now... AC-6910 & 6911, AC-6914 & 6915, 6927 & 6928, AC-6916 & 6917, AC-6929 & 6930, AC-6931 & 6932, and 6898 & 6899.

At 11:14am, Mr. Gregory observed the trail cutting of roll # AC-6912 and the lead of roll # AC-6913.

Mr. Gregory observed the manufacturing process for the next 45 minutes; at 1200 hrs, Mr. Gregory was informed of a clogged nozzle. SLT would have to shut down and cool the line to clean or blow-out the nozzles, then heat back up. This procedure should take approximately 1 hour and is a standard problem that typically happens in rainy weather.

Mr. Gregory left production line at 12:20 pm and was away from plant at 1230 hrs.

SPECS

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WHC-S-045 Rev. 2

1-6 GEOCOMPOSITE

Geocomposite consists of geonet with a layer of geotextile thermally bonded to each side. Geocomposite is used on the side slopes of the landfill above the primary and secondary geomembrane.

1-7 SUBMITTALS

- A. Manufacturers of the various geosynthetic materials shall submit all required quality assurance and quality control documentation as described in the following sections and the CQA Plan.
- B. The Contractor shall submit samples of all proposed geosynthetic materials for "fingerprinting" analyses and conformance testing to determine acceptability. Sampling shall be performed in accordance with the following sections of this specification and the CQA Plan. Conformance testing will be performed by the CQA Engineer. Acceptability shall be determined by the COTR. Unacceptable materials shall be removed and disposed of at Contractor's expense.
- C. The Geosynthetics Installer shall submit a quality assurance program for installation of geosynthetic materials as well as a list of proposed geomembrane seaming personnel and their experience records.
- D. All submittals shall conform to the requirements of Section 01300.

PART 2: PRODUCTS

2-1 GEOMEMBRANE LINER

A. General

Three types of geomembrane are shown on the Drawings: TYPE I geomembrane will be used for both primary and secondary FML on the landfill side slopes and access ramp. TYPE II geomembrane will be used for both primary and secondary FML on the base of the landfill. TYPE III geomembrane will be used to line the truck unloading area at the entrance to the landfill access ramp and to line the containment basin under the leachate storage tank. The three TYPES are defined as follows:

- TYPE I - 60 mil thickness, textured (roughened) both sides
- TYPE II - 60 mil thickness, smooth both sides
- TYPE III - 80 mil thickness, smooth both sides

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May 26, 1993

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SPECS

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All geomembrane, regardless of type, shall consist of unreinforced high density polyethylene (HDPE) sheet.

The Geomembrane Manufacturer shall be a commercial entity normally engaged in manufacture of HDPE geomembranes for landfill applications. Examples of potential manufacturers include SLT Environmental Inc., Houston, Texas; Gundle Lining Systems Inc., Houston, Texas; and Poly-Flex, Inc., Grand Prairie, Texas. Use of these examples is not intended to restrict potential manufacturers.

B. Specific FML Properties

1. The raw material shall be new polyethylene resin containing no more than 2% clean recycled polymer by weight.
2. The resin shall meet the following specifications:
 - Specific Gravity (ASTM D792 Method A or ASTM D1505): > 0.935
 - Melt Index (ASTM D1238 Condition 19Q/2.16): $0.1 - 1.1 \text{ g/10 min}$
3. Physical, mechanical, and environmental properties shall meet or exceed the values specified in the table contained in this Part of the Specifications.
4. Geomembrane shall have a crystallinity of 50 to 60 percent, or as approved by the COTR, as determined by Differential Scanning Calorimetry (DSC).
5. The residual friction angle between the textured geomembrane and the soil/bentonite admix used in the landfill liner (see Section 02224) shall have a minimum value of 27.5° under a normal load of $400 \text{ psf} \pm 50 \text{ psf}$ and a displacement of at least 2 inches. Friction angle shall be determined by direct shear testing.

C. Manufacturing Quality Control

1. Geomembrane Manufacturing

Quality control testing shall be carried out by the Manufacturer to demonstrate that the product meets the specifications listed in Part 2-1.B. Additional testing may be carried out for purposes of determining conformance by the CQA Engineer. If the results of the Manufacturer's and the CQA Engineer's testing differ significantly, the testing shall be repeated by the CQA Engineer, and the Manufacturer shall be allowed to monitor this testing. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

SPEC S

REQUIRED GEOMEMBRANE PROPERTIES

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PROPERTY	QUALIFIER	UNIT	SPECIFIED VALUE			TEST METHOD
			TYPE I	TYPE II	TYPE III	
<u>Physical Properties</u>						
Thickness	minimum avg	mils	60	60	80	ASTM D1593
Thickness	minimum	mils	54	54	72	
Specific Gravity	minimum	N/A	0.94	0.94	0.94	ASTM D792
Melt Index	range	g/10 min	0.1-1.1	0.1-1.1	0.1-1.1	Method A or ASTM D1505 ASTM D1238 condition 190/2.16
<u>Mechanical Properties</u>						
Tensile Properties (each direction)						ASTM D638
1. Force per unit width at yield	minimum	lb/in	132	132	176	
2. Tensile strength (force per unit width at break)	minimum	lb/in	228	228	304	
3. Elongation at yield	minimum	%	12	12	12	
4. Elongation at break	minimum	%	550	550	550	
Tear Resistance	minimum	lb	42	42	56	ASTM D1004
Puncture Resistance	minimum	lb	90	80	105	Dir C FTMS 101C/2065
<u>Environmental Properties</u>						
Low Temperature	maximum	°F	-75	-75	-75	ASTM D746 Procedure B
Carbon Black Content	range	%	2-3	2-3	2-3	ASTM D1603
Carbon Black Dispersion	N/A		A1/A2	A1/A2	A1/A2	ASTM D3015
Dimensional Stability (each direction)	max. change	%	±1	±1	±1	ASTM D1204
Resistance to Soil Burial	% strength retained		95	90	90	ASTM D3083 (as modified in NSF Appendix A)
Environmental Stress Crack	minimum	hrs	3000	2000	2000	ASTM D1693 (as modified in NSF Appendix A Condition C at 100°C)

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May 26, 1993

SPECS

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WHC-S-045 Rev. 2

Prior to the delivery of any geomembrane material, the Manufacturer shall provide the COTR and the CQA Engineer with the following information:

- the origin (Resin Supplier's name, resin production plant), identification (brand name, number) and production date of the resin;
- a list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane;
- a copy of the quality control certificates issued by the Resin Supplier;
- reports on the tests conducted by the Manufacturer and/or the CQA Engineer to confirm that the quality of the resin used to manufacture the geomembrane satisfies these Specifications [these tests shall include specific gravity (ASTM D792 Method A or ASTM D1505) and melt index (ASTM D1238 Condition 190/2.16)];
- a statement that no recycled polymer is added to the resin or that recycled polymer is clean and does not exceed 2% by weight;
- a properties sheet including, at a minimum, all specified properties on the table in Section 2-1.B, measured using test methods indicated in the specifications, or equivalent;
- reports on the tests, including sampling procedures, conducted by the Manufacturer and/or the CQA Engineer to confirm that the geomembrane meets the project specifications;
- a certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The CQA Engineer will review these documents and report any discrepancies with the above requirements to the COTR. The CQA Engineer will confirm that:

- the property values certified by the Geomembrane Manufacturer meet all of the specifications; and
- the measurements of properties by the Geomembrane Manufacturer are properly documented and that the test methods used are acceptable.

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933-1287

02275-5
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SPECS

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In addition, the CQA Engineer may, at the request of the COTR, visit the manufacturing plant, preferably during the production of the particular geomembrane for this project, in order to evaluate the Manufacturer's quality control procedures.

2. Rolls

Prior to shipment, the Geomembrane Manufacturer shall provide the COTR and the CQA Engineer with a quality control certificate for each roll of geomembrane provided. The quality control certificate shall be signed by a responsible party employed by the Geomembrane Manufacturer, such as the production manager. The quality control certificate shall include:

- roll numbers and identification, resin lot and batch numbers; and
- sampling procedures and results of quality control tests. As a minimum, results shall be given for thickness, tensile strength, and tear resistance, evaluated in accordance with the methods indicated in these Specifications or equivalent methods approved by the Design Engineer. Tests shall be conducted on each production lot of geomembrane or every 50,000 square feet, whichever results in the greater number of tests.

The CQA Engineer will:

- confirm that the quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it; and
- review the quality control certificates and confirm that the certified roll properties meet the specifications.

3. Manufacturing Plant Visit

The Manufacturer shall allow the COTR or his designated representative to visit the manufacturing plant, if the COTR so chooses. If possible, the visit shall be prior to or during the manufacturing of the geomembrane rolls for the specific project. The COTR or his designated representative shall review the manufacturing process, quality control, laboratory facilities, and testing procedures.

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During the visit, visiting personnel will also:

- confirm that the measurements of properties by the Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and confirm that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation procedures to confirm that these procedures are not damaging the geomembrane;
- confirm that roll packages have a label indicating the name of the manufacturer, type of geomembrane, thickness, and roll number; and
- if applicable, confirm that extrusion rods and/or beads are derived from the same base resin type as the geomembrane.

The Geomembrane Manufacturer shall accommodate these activities.

4. Conformance Testing.

a. Tests

Upon delivery of the rolls of geomembrane, the CQA Engineer will obtain samples at a frequency of one per production lot or one per 50,000 square feet of geomembrane, whichever results in the greater number of tests. The CQA Engineer will test the samples to determine conformance to both the design specifications and the list of guaranteed properties.

As a minimum, tests to determine the following characteristics will be performed on geomembranes:

- specific gravity (ASTM D792 Method A or ASTM D1505);
- carbon black content and visual inspection to evaluate carbon black dispersion (ASTM D1603);
- thickness (ASTM D1593);
- tensile characteristics (yield strength, elongation at yield, break strength, elongation at break; ASTM D638); and

APPENDIX E-2
CQA CONFORMANCE TESTS

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES, INC.
GEOMEMBRANE INVENTORY CONTROL RECORD
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANDFORD NUCLEAR RESERVATION

933-1354
05/10/94
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SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Thick (mil)	Tested (Y/N)	Date Sent	Results Received	Test P/F
9	AC6893FF	40681	SLT	11/12/93	426.	23.5	60.	N			
9	AC6894FF	40681	SLT	11/12/93	505.	23.5	60.	Y	11/13/93	11/15/93	Pass
5	AC6895FF	40681	SLT	11/01/93	475.	23.5	60.	N			
5	AC6896FF	40681	SLT	11/01/93	407.	23.5	60.	N			
3	AC6898FF	40681	SLT	10/29/93	450.	23.4	60.	Y	10/30/93	11/03/93	Pass
3	AC6899FF	40681	SLT	10/29/93	450.	23.4	60.	N			
4	AC6904FF	40682	SLT	11/01/93	450.	23.5	60.	N			
3	AC6905FF	40682	SLT	10/29/93	450.	23.5	60.	N			
4	AC6906FF	40682	SLT	11/01/93	475.	23.5	60.	Y	11/02/93	11/04/93	Pass
5	AC6907FF	40682	SLT	11/01/93	415.	23.5	60.	N			
3	AC6908FF	40682	SLT	10/29/93	450.	23.5	60.	N			
4	AC6909FF	40682	SLT	11/01/93	450.	23.5	60.	N			
3	AC6910FF	40682	SLT	10/29/93	450.	23.5	60.	Y	10/30/93	11/03/93	Pass
3	AC6911FF	40682	SLT	10/29/93	450.	23.5	60.	Y	11/02/93	11/04/93	Pass
4	AC6912FF	40682	SLT	11/01/93	450.	23.5	60.	N			
5	AC6913FF	40682	SLT	11/01/93	450.	23.5	60.	N			
3	AC6914FF	40682	SLT	10/29/93	450.	23.5	60.	N			
3	AC6915FF	40682	SLT	10/29/93	450.	23.5	60.	N			
3	AC6916FF	40682	SLT	10/29/93	495.	23.5	60.	Y	10/30/93	11/03/93	Pass
3	AC6917FF	40682	SLT	10/29/93	380.	23.5	60.	N			
5	AC6923FF	40682	SLT	11/01/93	450.	23.5	60.	Y	11/02/93	11/04/93	Pass
4	AC6924FF	40682	SLT	11/01/93	450.	23.5	60.	N			
5	AC6925FF	40682	SLT	11/01/93	450.	23.5	60.	N			
4	AC6926FF	40682	SLT	11/01/93	450.	23.5	60.	N			
3	AC6927FF	40682	SLT	10/29/93	450.	23.5	60.	N			
5	AC6928FF	40682	SLT	11/01/93	450.	23.5	60.	N			
4	AC6929FF	40682	SLT	11/01/93	450.	23.5	60.	N			
4	AC6930FF	40682	SLT	11/01/93	450.	23.5	60.	N			
5	AC6931FF	40682	SLT	11/01/93	450.	23.5	60.	Y	11/02/93	11/04/93	Pass
3	AC6932FF	40682	SLT	10/29/93	450.	23.5	60.	N			
4	AC7680	40687	SLT	11/01/93	475.	23.5	60.	N			
5	AC7681FF	40687	SLT	11/01/93	475.	23.5	60.	N			
4	AC7682	40687	SLT	11/01/93	475.	23.5	60.	Y	11/02/93	11/04/93	Pass
9	AC7683FF	40687	SLT	11/12/93	475.	23.5	60.	Y	11/15/93	11/16/93	Pass
4	AC7684	40687	SLT	11/01/93	475.	23.5	60.	N			
11	AC9604FF	40031	SLT	01/12/94	475.	23.7	60.	Y	01/12/94	01/13/94	Pass
11	AC9605FF	40031	SLT	01/12/94	495.	23.7	60.	N			
4	AC7794	40680	SLT	11/01/93	355.	23.7	80.	Y	11/02/93	11/04/93	Fail
9	AC8309	45726	SLT	11/12/93	355.	23.7	80.	Y	11/13/93	11/15/93	Pass
10	AC8388	45727	SLT	12/07/93	355.	23.7	80.	Y	12/11/93	12/13/93	Pass

Square Feet Delivered = 420685.

NOVEMBER 1993

SUMMARY OF TEXTURED GEOMEMBRANE CONFORMANCE TEST RESULTS

933-1354

DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON
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ROLL DESIGNATION	AC-6898	AC-6910	AC-6916	AC-6906	AC-6911	AC-6923	AC-6931	AC-6894	AC-7683	AC-9604
THICKNESS (mils)	67.6	67.2	67.7	66.9	67.5	67.8	67.0	67.5	68.4	68.3
ASTM D 1593										
DENSITY (g/cc)	0.943	0.944	0.943	0.944	0.943	0.943	0.943	0.942	0.944	0.945
ASTM D 1505										
STRENGTH AT YIELD (ppi)	156.8	159.7	157.6	156.7	155.8	154.9	154.4	156.6	161.4	168.8
MD/TD (1)	153.5	160.5	152.7	157.6	155.2	156.0	155.8	154.4	161.6	166.3
ASTM D 638										
STRENGTH AT BREAK (ppi)	338.2	326.8	321.8	333.5	348.1	320.6	341.5	315.9	319.6	319.2
MD/TD (1)	327.0	307.0	332.7	328.4	338.7	318.3	319.4	320.4	308.9	304.5
ASTM D 638										
ELONGATION AT YIELD (%)	22.1	23.7	22.5	25.5	24.2	22.9	22.8	25.5	22.1	24.2
MD/TD (1)	23.1	23.9	21.2	24.7	24.1	23.1	23.4	24.8	21.1	25.3
ASTM D 638										
ELONGATION AT BREAK (%)	838	774	806	792	830	822	836	770	788	810
MD/TD (1)	816	760	822	832	796	838	862	798	788	790
ASTM D 638										
MELT INDEX (g/10min)	0.55	-	0.54	-	-	-	-	-	-	-
ASTM D 1238										
CARBON BLACK CONTENT (%)	2.80	2.86	2.80	2.91	2.84	2.84	2.82	2.74	2.85	2.76
ASTM D 1603										
CARBON BLACK DISPERSION(2)	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
ASTM D 3015										
CRYSTALLINITY (%)	44	-	44	-	-	-	-	-	-	-
ASTM D 3417										

(1) MD/TD corresponds to Machine Direction / Transverse Direction.

(2) Carbon black dispersion was tested according to ASTM D3015 and reported according to the ASTM D2663 dispersion classification chart.

NOVEMBER 1993

SUMMARY OF SMOOTH GEOMEMBRANE CONFORMANCE TEST RESULTS
DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON

933-1354

ROLL DESIGNATION	AC-7682	-	-	-	-	-	-	-	-	-
THICKNESS (mils)	63.7	-	-	-	-	-	-	-	-	-
ASTM D 1593										
DENSITY (g/cc)	0.943	-	-	-	-	-	-	-	-	-
ASTM D 1505										
STRENGTH AT YIELD (psi)	159.0	-	-	-	-	-	-	-	-	-
MD/TD (1)	158.1	-	-	-	-	-	-	-	-	-
ASTM D 638										
STRENGTH AT BREAK (psi)	350.5	-	-	-	-	-	-	-	-	-
MD/TD (1)	343.3	-	-	-	-	-	-	-	-	-
ASTM D 638										
ELONGATION AT YIELD (%)	25.2	-	-	-	-	-	-	-	-	-
MD/TD (1)	25.4	-	-	-	-	-	-	-	-	-
ASTM D 638										
ELONGATION AT BREAK (%)	828	-	-	-	-	-	-	-	-	-
MD/TD (1)	822	-	-	-	-	-	-	-	-	-
ASTM D 638										
MELT INDEX (g/10min)	-	-	-	-	-	-	-	-	-	-
ASTM D 1238										
CARBON BLACK CONTENT (%)	2.85	-	-	-	-	-	-	-	-	-
ASTM D 1603										
CARBON BLACK DISPERSION(2)	A1	-	-	-	-	-	-	-	-	-
ASTM D 3015										
CRYSTALLINITY (%)	-	-	-	-	-	-	-	-	-	-
ASTM D 3417										

(1) MD/TD corresponds to Machine Direction / Transverse Direction.

(2) Carbon black dispersion was tested according to ASTM D3015 and reported according to the ASTM D2663 dispersion classification chart.

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SUMMARY OF SMOOTH GEOMEMBRANE
CONFORMANCE TEST RESULTS

933-1354

DEPARTMENT OF ENERGY
NON DRAG-OFF CQA
WASHINGTON

ROLL										
DESIGNATION	AC-7794	AC-8309	AC-8388	-	-	-	-	-	-	-
THICKNESS (mils)	81.9	81.1	81.0	-	-	-	-	-	-	-
ASTM D 1593										
DENSITY (g/cc)	0.938	0.940	0.942	-	-	-	-	-	-	-
ASTM D 1505										
STRENGTH AT YIELD (ppi)	194.9	191.5	200.4	-	-	-	-	-	-	-
MD/TD (1)	193.6	186.9	195.8	-	-	-	-	-	-	-
ASTM D 638										
STRENGTH AT BREAK (ppi)	382.0	411.0	437.7	-	-	-	-	-	-	-
MD/TD (1)	414.9	441.9	410.8	-	-	-	-	-	-	-
ASTM D 638										
ELONGATION AT YIELD (%)	22.9	23.2	27.2	-	-	-	-	-	-	-
MD/TD (1)	23.1	22.6	28.0	-	-	-	-	-	-	-
ASTM D 638										
ELONGATION AT BREAK (%)	874	852	854	-	-	-	-	-	-	-
MD/TD (1)	870	888	850	-	-	-	-	-	-	-
ASTM D 638										
MELT INDEX (g/10min)	-	-	-	-	-	-	-	-	-	-
ASTM D 1238										
CARBON BLACK CONTENT (%)	1.74	2.21	2.54	-	-	-	-	-	-	-
ASTM D 1603										
CARBON BLACK DISPERSION(2)	A1	A1	A1	-	-	-	-	-	-	-
ASTM D 3015										
CRYSTALLINITY (%)	-	-	-	-	-	-	-	-	-	-
ASTM D 3417										

(1) MD/TD corresponds to Machine Direction / Transverse Direction.

(2) Carbon black dispersion was tested according to ASTM D3015 and reported according to the ASTM D2663 dispersion classification chart.

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6898

THICKNESS (mils)	MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)	CARBON BLACK DISPERSION (rating)
1. 67.7	1. 0.56	1. 2.80	1. A1
2. 68.9	2. 0.53	2. 2.80	2. A1
3. 67.8			3. A1
4. 67.4	0.55	2.80	4. A1
5. 67.5			5. A1
6. 67.6			6. A1
7. 67.0	DENSITY	PERCENT	
8. 67.0	(g/cc)	CRYSTALLINITY	
9. 66.5		(%)	
10. 68.2	1. 0.943		
	2. 0.943		
	3. 0.943		
AVG 67.6	0.943	44	A1

YIELD STRENGTH (lb/in. width)	ELONGATION AT YIELD (%)	BREAK STRENGTH (lb/in. width)	ELONGATION AT BREAK (%)
MD TD	MD TD	MD TD	MD TD
1. 162.0 154.0	21.5 23.1	334.6 319.6	810 800
2. 160.0 158.0	22.3 23.1	345.2 314.0	850 790
3. 156.2 150.4	22.3 23.9	345.8 346.0	850 860
4. 152.4 151.0	23.1 22.3	349.2 316.8	860 800
5. 153.4 154.2	21.5 23.1	316.4 338.8	820 830
AVG 156.8 153.5	22.1 23.1	338.2 327.0	838 816

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6910

THICKNESS (mils)	MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)	CARBON BLACK DISPERSION (rating)
1. 67.1	1. -	1. 2.85	1. A1
2. 68.1	2. -	2. 2.87	2. A1
3. 66.8			3. A1
4. 67.2	0.00	2.86	4. A1
5. 66.9			5. A1
6. 66.7			6. A1
7. 67.1	DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)	
8. 67.2			
9. 67.8			
10. 66.6	1. 0.944		
	2. 0.944		
	3. 0.944		
AVG 67.2	0.944	-	A1

YIELD STRENGTH (lb/in. width)	ELONGATION AT YIELD (%)	BREAK STRENGTH (lb/in. width)	ELONGATION AT BREAK (%)
MD TD	MD TD	MD TD	MD TD
1. 159.0 156.0	25.4 23.7	316.6 299.2	770 720
2. 157.5 158.9	22.9 25.1	347.0 315.8	810 790
3. 160.1 157.1	23.8 24.2	333.2 333.1	760 790
4. 160.8 167.5	23.5 23.7	339.6 312.5	790 780
5. 161.3 162.8	23.0 22.8	297.6 274.2	740 720
AVG 159.7 160.5	23.7 23.9	326.8 307.0	774 760

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)	
1.	68.2	1. 0.56	1.	2.79	1.	A1
2.	68.7	2. 0.52	2.	2.81	2.	A1
3.	67.7				3.	A1
4.	67.2	0.54		2.80	4.	A1
5.	68.6				5.	A1
6.	67.6				6.	A1
7.	67.2	DENSITY	PERCENT			
8.	66.9	(g/cc)	CRYSTALLINITY			
9.	67.4		(%)			
10.	67.4	1. 0.943				
		2. 0.943				
		3. 0.943				
AVG	67.7	0.943	44		A1	

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	162.2 155.6	22.3 23.1		325.6 308.8		770 790	
2.	154.4 151.6	23.1 22.3		324.6 321.8		810 820	
3.	157.8 159.4	22.3 23.1		341.2 341.8		830 840	
4.	158.0 152.0	22.3 23.1		319.2 346.2		830 900	
5.	155.8 144.8	22.3 14.6		298.6 344.8		790 760	
AVG	157.6 152.7	22.5 21.2		321.8 332.7		806 822	

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GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6906

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)		
1.	68.4	1.	-	1.	2.91	1.	A1
2.	66.1	2.	-	2.	2.91	2.	A1
3.	66.5					3.	A1
4.	66.4		0.00		2.91	4.	A1
5.	67.6					5.	A1
6.	66.3					6.	A1
7.	66.9	DENSITY (g/cc)		PERCENT CRYSTALLINITY (%)			
8.	66.8	1.	0.944				
9.	67.0	2.	0.944				
10.	67.0	3.	0.944				
AVG	66.9		0.944		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	158.1 155.2	26.1	27.0	355.4	339.6	820	860
2.	154.6 157.8	24.2	24.9	339.0	311.3	800	810
3.	157.6 159.2	22.9	24.6	337.7	350.3	800	840
4.	157.1 158.0	26.0	22.9	299.0	317.5	740	850
5.	156.2 157.8	28.4	24.3	336.5	323.1	800	800
AVG	156.7 157.6	25.5	24.7	333.5	328.4	792	832

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6911

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)		
1.	68.0	1.	-	1.	2.83	1.	A1
2.	68.0	2.	-	2.	2.84	2.	A1
3.	67.6					3.	A1
4.	67.0		0.00		2.84	4.	A1
5.	67.1					5.	A1
6.	66.8					6.	A1
7.	66.7	DENSITY		PERCENT			
8.	66.9	(g/cc)		CRYSTALLINITY			
9.	68.4			(%)			
10.	68.4	1.	0.943				
		2.	0.943				
		3.	0.943				
AVG	67.5		0.943		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	155.5 154.6	24.2	25.1	357.6	335.0	840	800
2.	159.2 153.7	24.7	25.3	354.2	350.3	830	820
3.	153.4 156.0	24.4	24.4	344.0	328.2	810	770
4.	152.4 155.0	23.9	22.6	339.4	355.9	800	800
5.	158.3 156.8	23.9	23.3	345.4	323.9	870	790
AVG	155.8 155.2	24.2	24.1	348.1	338.7	830	796

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GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6923

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)	
1.	67.0	1. -	1.	2.84	1.	A1
2.	67.5	2. -	2.	2.84	2.	A1
3.	67.3				3.	A1
4.	68.7	0.00	2.84		4.	A1
5.	68.2				5.	A1
6.	68.0				6.	A1
7.	67.7	DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)			
8.	67.6					
9.	68.4					
10.	67.8					
		1. 0.943				
		2. 0.943				
		3. 0.943				
AVG	67.8	0.943	-		A1	

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	152.2 155.8	23.1	23.1	299.2	302.4	770	870
2.	155.2 154.4	23.1	23.1	343.4	312.0	800	800
3.	155.4 156.8	23.1	23.1	318.6	320.4	880	810
4.	155.4 158.2	23.1	23.1	314.2	322.6	840	870
5.	156.4 154.8	22.3	23.1	327.4	334.2	820	840
AVG	154.9 156.0	22.9	23.1	320.6	318.3	822	838

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6931

THICKNESS (mils)	MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)	CARBON BLACK DISPERSION (rating)
1. 66.6	1. -	1. 2.81	1. A1
2. 68.7	2. -	2. 2.83	2. A1
3. 66.2			3. A1
4. 66.5	0.00	2.82	4. A1
5. 66.5			5. A1
6. 67.7			6. A1
7. 66.1	DENSITY	PERCENT	
8. 67.6	(g/cc)	CRYSTALLINITY	
9. 67.2		(%)	
10. 67.3	1. 0.943		
	2. 0.943		
	3. 0.943		
AVG 67.0	0.943	-	A1

YIELD STRENGTH (lb/in. width)	ELONGATION AT YIELD (%)	BREAK STRENGTH (lb/in. width)	ELONGATION AT BREAK (%)
MD TD	MD TD	MD TD	MD TD
1. 155.8 155.6	23.1 23.1	333.4 292.4	820 830
2. 153.6 152.2	23.8 24.6	346.4 323.8	840 890
3. 152.8 158.0	23.1 23.1	320.0 332.4	820 850
4. 155.0 156.6	22.3 23.1	355.0 319.0	850 880
5. 155.0 156.8	21.5 23.1	352.8 329.2	850 860
AVG 154.4 155.8	22.8 23.4	341.5 319.4	836 862

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-6894

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)	
1.	66.6	1. -	1.	2.72	1.	A1
2.	69.1	2. -	2.	2.75	2.	A1
3.	68.0				3.	A1
4.	67.2	0.00		2.74	4.	A1
5.	68.5				5.	A1
6.	67.3				6.	A1
7.	66.9	DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)			
8.	67.3					
9.	66.5					
10.	67.9					
		1. 0.942				
		2. 0.942				
		3. 0.942				
AVG	67.5	0.942		-	A1	

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	157.4 152.7	26.2	23.9	305.9	317.3	790	770
2.	157.5 155.8	25.9	25.8	313.4	304.5	760	780
3.	158.2 150.8	24.6	23.9	331.9	339.2	760	820
4.	154.3 157.8	25.6	25.9	314.0	333.5	770	810
5.	155.6 155.1	25.2	24.7	314.1	307.6	770	810
AVG	156.6 154.4	25.5	24.8	315.9	320.4	770	798

November 1993.

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354.

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-7683

THICKNESS		MELT	CARBON BLACK		CARBON BLACK		
(mils)		INDEX	CONTENT		DISPERSION		
		(g/10 min)	(%)		(rating)		
1.	68.0	1.	-	1.	2.86	1.	A1
2.	68.5	2.	-	2.	2.84	2.	A1
3.	67.9					3.	A1
4.	68.2		0.00		2.85	4.	A1
5.	68.1					5.	A1
6.	69.5					6.	A1
7.	67.8						
8.	69.1						
9.	67.6						
10.	68.9						
		1.	0.944				
		2.	0.944				
		3.	0.944				
AVG	68.4		0.944		-		A1

	YIELD STRENGTH		ELONGATION		BREAK STRENGTH		ELONGATION	
	(lb/in. width)		AT YIELD		(lb/in. width)		AT BREAK	
	MD	TD	MD	TD	MD	TD	MD	TD
1.	158.2	162.8	23.1	16.2	324.2	289.0	800	750
2.	160.4	160.8	21.5	22.3	342.0	298.2	810	820
3.	164.6	162.8	21.5	21.5	322.6	319.0	840	780
4.	163.4	160.6	21.1	23.1	292.4	328.4	740	800
5.	160.2	161.2	23.1	22.3	316.8	309.8	750	790
AVG	161.4	161.6	22.1	21.1	319.6	308.9	788	788

January 1994

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-9604

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)		
1.	66.9	1.	-	1.	2.76	1.	A1
2.	70.0	2.	-	2.	2.75	2.	A1
3.	67.3					3.	A1
4.	68.1		0.00		2.76	4.	A1
5.	68.4					5.	A1
6.	67.5					6.	A1
7.	68.1	DENSITY (g/cc)		PERCENT CRYSTALLINITY (%)			
8.	68.9	1.	0.946				
9.	69.2	2.	0.945				
10.	68.5	3.	0.945				
AVG	68.3		0.945		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	167.1 168.0	24.1	24.9	303.4	306.2	790	780
2.	169.9 171.7	22.7	25.5	308.3	327.7	780	820
3.	169.4 164.2	24.4	26.0	328.2	274.4	820	750
4.	169.4 168.2	24.7	26.3	325.5	296.3	840	810
5.	168.0 159.2	24.9	23.9	330.5	317.8	820	790
AVG	168.8 166.3	24.2	25.3	319.2	304.5	810	790

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-7682

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)		
1.	64.6	1.	-	1.	2.85	1.	A1
2.	61.9	2.	-	2.	2.85	2.	A1
3.	63.0					3.	A1
4.	62.6		0.00		2.85	4.	A1
5.	64.3					5.	A1
6.	64.0					6.	A1
7.	64.5						
8.	64.0	DENSITY (g/cc)		PERCENT CRYSTALLINITY (%)			
9.	64.0						
10.	64.0	1.	0.943				
		2.	0.943				
		3.	0.944				
AVG	63.7		0.943		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	155.1 160.8	25.5	24.2	353.2	342.6	880	810
2.	154.5 152.5	26.1	24.6	314.7	317.3	780	810
3.	157.4 159.0	25.5	24.2	372.7	369.3	830	850
4.	168.0 159.2	25.2	23.8	366.8	326.3	820	790
5.	160.0 159.2	24.5	29.0	345.2	360.8	820	850
AVG	159.0 158.1	25.4	25.2	350.5	343.3	826	822

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-7794

THICKNESS (mils)	MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)	CARBON BLACK DISPERSION (rating)
1. 82.1	1. -	1. 1.74	1. A1
2. 81.6	2. -	2. 1.72	2. A1
3. 80.3		3. 1.75	3. A1
4. 80.1	0.00	1.74	4. A1
5. 81.7			5. A1
6. 81.9			6. A1
7. 83.3	DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)	
8. 82.9	1. 0.939		
9. 83.0	2. 0.938		
10. 82.4	3. 0.938		
AVG 81.9	0.938	-	A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1. 194.8	193.4	23.1	22.3	304.0	373.6	770	830
2. 193.8	187.0	22.3	24.6	348.4	398.6	820	860
3. 194.0	191.2	23.1	23.1	373.0	435.2	860	880
4. 196.4	199.4	24.6	22.3	441.6	419.6	960	880
5. 195.4	197.0	21.5	23.1	443.2	447.6	960	900
AVG 194.9	193.6	22.9	23.1	382.0	414.9	874	870

November 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-8309

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)	
1.	81.0	1. -	1.	2.21	1.	A1
2.	80.8	2. -	2.	2.20	2.	A1
3.	80.7				3.	A1
4.	80.4	0.00		2.21	4.	A1
5.	81.2				5.	A1
6.	81.4				6.	A1
		DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)			
7.	81.5					
8.	81.5					
9.	80.5	1. 0.940				
10.	81.6	2. 0.940				
		3. 0.940				
AVG	81.1	0.940		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	188.8 185.8	22.3	23.1	439.6	424.4	870	840
2.	188.8 186.6	23.9	23.1	322.0	436.4	720	870
3.	193.4 187.6	22.3	21.5	420.4	437.2	900	880
4.	193.2 188.6	23.8	22.3	442.4	462.4	890	940
5.	193.2 185.8	23.8	23.1	430.8	449.2	880	910
AVG	191.5 186.9	23.2	22.6	411.0	441.9	852	888

December 1993

933-1354

GEOMEMBRANE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: AC-8388

THICKNESS (mils)		MELT INDEX (g/10 min)	CARBON BLACK CONTENT (%)		CARBON BLACK DISPERSION (rating)	
1.	81.6	1. -	1.	2.53	1.	A1
2.	81.6	2. -	2.	2.55	2.	A1
3.	80.8				3.	A1
4.	80.3	0.00		2.54	4.	A1
5.	81.3				5.	A1
6.	81.1				6.	A1
7.	80.6	DENSITY (g/cc)	PERCENT CRYSTALLINITY (%)			
8.	80.6					
9.	81.1					
10.	81.4					
		1. 0.942				
		2. 0.942				
		3. 0.942				
AVG	81.0	0.942		-		A1

YIELD STRENGTH (lb/in. width)		ELONGATION AT YIELD (%)		BREAK STRENGTH (lb/in. width)		ELONGATION AT BREAK (%)	
MD	TD	MD	TD	MD	TD	MD	TD
1.	200.0 195.6	26.6	27.2	402.4	387.9	810	800
2.	198.3 197.4	25.8	28.2	444.4	448.8	880	880
3.	205.1 198.4	27.2	29.0	426.0	447.2	840	870
4.	199.8 194.8	28.1	28.4	444.4	323.0	860	780
5.	198.6 193.0	28.2	27.3	471.2	447.2	880	920
AVG	200.4 195.8	27.2	28.0	437.7	410.8	854	850

SOIL ADMIX/TEXTURED HDPE ROLL 6898

Figure

Golden Associates

Figure

Direct Shear Test

Test Number	: ADMIX-2A
Test Date	: 10 NOV 83
Shear Disp. Rate	: 2.38 in/hr
Sample Area	: 144 sq in
Sample Height	: 8.08 in
Normal Stress	: 1.38 psi
Dry Density	: 87 pcf
Moisture Content	: 22 %
Sample Description	: ADMIXTURE/ TEXTURED HDPE ROLL 8898
Test Description	: INTERNAL FRICTION

PROJECT NO. 933-1354 DRAWN BY DATE 10 NOV 83
 REVIEWED BY

Figure

Direct Shear Test

Test Number	: ADMIX-4
Test Date	: 04 NOV 83
Shear Disp. Rate	: 2.38 in/hr
Sample Area	: 144 sq in
Sample Height	: 5.81 in
Normal Stress	: 2.75 psi
Dry Density	: 87 pcf
Moisture Content	: 22 %
Sample Description	: ADMIX/TEXTURE HDPE
Test Description	: INTERNAL FRICTION

Roll 6897

Golder Associates

Figure

Direct Shear Test

Test Number	: ADMIX-8
Test Date	: 04 NOV 83
Shear Disp. Rate	: 2.34 in/hr
Sample Area	: 144 sq in
Sample Height	: 5.81 in
Normal Stress	: 4.17 psi
Dry Density	: 97 pcf
Moisture Content	: 22 %
Sample Description	: ADMIX/TEXTURED HDPE
	: Roll 6898
Test Description	: INTERNAL FRICTION

PROJECT No. 300-2018
 DRAWN
 REVIEWED
 DATE 04 NOV 83

SOIL ADMIX/TEXTURED HDPE ROLL 6916

Figure

Golden Associates

E-2-23

933-1354

Figure

Direct Shear Test

Test Number	: ADMIX-2
Test Date	: 04 NOV 93
Shear Disp. Rate	: 2.43 in/hr
Sample Area	: 144 sq in
Sample Height	: 6.81 in
Normal Stress	: 1.39 psi
Dry Density	: 97 pcf
Moisture Content	: 22 %
Sample Description	: ADMIX/TEXTURED HDPE
Test Description	: INTERNAL FRICTION

R.116916

Golder Associates

Figure

Direct Shear Test

Test Number	: ADMIX-4A
Test Date	: 10 NOV 93
Shear Disp. Rate	: 2.38 in/hr
Sample Area	: 144 sq in
Sample Height	: 8.09 in
Normal Stress	: 2.78 psi
Dry Density	: 87 pcf
Moisture Content	: 22 %
Sample Description	: ADMIXTURE/ TEXTURED HOPE ROLL 8818
Test Description	: INTERNAL FRICTION

Figure

Direct Shear Test

Test Number	: ADMIX-8A
Test Date	: 10 NOV 93
Shear Disp. Rate	: 2.8 in/hr
Sample Area	: 144 sq in
Sample Height	: 8.08 in
Normal Stress	: 4.17 psi
Dry Density	: 87 pcf
Moisture Content	: 22 %
Sample Description	: ADMIXTURE/
	: TEXTURED HOPE ROLL 681B
Test Description	: INTERNAL FRICTION
	:

Golder Associates

APPENDIX E-3

MANUFACTURER'S AND INSTALLER'S QC DOCUMENTATION

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

September 24, 1993

GeoPacific Lining Inc.
1300 Dexter Ave. North, Suite 250
Seattle, Washington 98109

ATTN: El Haluschak

RE: D.O.E Hanford
Radioactive Waste Disposal Facility
SLT Project No. 93-8491

Regarding comment 1 of the specification review by Golder Associates, Inc. for submittal 25 dated September 21, 1993, a value of 45-50% for the crystallinity of the HDPE resin rather than 50-60% will not effect the mechanical properties, chemical resistance or the life expectancy of the material.

Crystallinity

In order to see a significant effect on material properties the difference in crystallinity must be greater than 15%. As crystallinity decreases elongation, chemical resistance and environmental stress crack resistance increases; in turn, the tensile strength decreases slightly. Once again, the difference in crystallinity must be greater than 15% for any significant effect to be of concern.

The measurement of crystallinity can be determined in basically three different manners: (a) DSC - Differential Scanning Calorimetry, (b) Calculation based on density or (c) X-ray diffraction. The values provided by SLT North America, Inc. were determined using the DSC method which cannot measure the complete content of crystallites in the material.

This method consists of heating the sample over a temperature range of 50°C to 200°C the crystallinity is determined by integrating the peak area of the DSC curve

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GeoPacific Lining Inc.

9/24/93

Page 2

generated. Polyethylene has some small crystals which melt at room temperature (22.7 °C) and therefore, are not included in the value derived from this method. The following is the equation used:

$$K = (\Delta H / \Delta H_K) * 100 \quad [J/g] / [J/g]$$

Where ΔH_K is the theoretical enthalpy of fusion for 100% crystalline polyethylene. In addition to small crystals not being measured, the theoretical value for enthalpy of fusion (heat of fusion) can be chosen from values ranging from 55 to 70 cal/g leading to varied results which are all considered legitimate.

Sincerely,

A handwritten signature in cursive script that reads "Melody A. Adams".

Melody A. Adams
Engineer

maa

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SLT North America, Inc.
Hanford Radioactive Waste
SLT Project No. 8491
Roll No. AC6898

04-Nov-93

Property	Test Method	Value	Units
Density	ASTM D 792	0.945	[g/cc]
Crystallinity		35.96	[%]
Low Load Melt Flow (I2)	ASTM D 1238 E	0.499	[g/10 min]
High Load Melt Flow (I5)	ASTM D 1238 E	1.494	[g/10 min]
Melt Flow Ratio	ASTM D 1238 E	3.0	

QA Approved

AC6898 11/93

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

November 19, 1993

TO: El Haluschak
GeoPacific Lining, Inc.

FROM: Melody Adams *MAA*
SLT North America, Inc.

RE: Crystallinity Test Results - Hanford

Recently we supplied test results for crystallinity of our HDPE liner specifically roll number AC6898. The result was 35.96% which did not meet the required 45-50% as accepted by GeoPacific. If you would reference the letter I sent dated September 24 of this year which discussed crystallinity and how it is determined. I had noted that the theoretical 100% crystalline value used in calculating crystallinity was in fact a range, 55 to 70 cal/g (230 to 293 J/g). When the test was performed here in the lab, the technician who made the calculation was new and was not aware of the range of constants that are used. Therefore, we ran two more tests and came up with a range of acceptable values:

K = 36.2 to 45.7%
35.2 to 44.8%

The constant used to calculate the original value of 35.96% was 290 J/g so the other end of the range will be 45.34% based on 230 J/g. Therefore, depending on what constant is used for the heat of fusion for 100% crystalline material you will obtain a range of values that are all acceptable.

If you have any questions concerning this explanation please feel free to call me at (713)-847-9188. I apologize for the delay in this response.

MAA/ma

EL-11111 11/93

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TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

November 19, 1993

GeoPacific Lining, Inc.
1300 Dexter Ave. North, Suite 250
Seattle, Washington 98109

Attn: El Haluschak

RE: Crystallinity Test Results-Hanford

Recently we supplied test results for crystallinity of our HDPE liner specifically roll number AC6898. The result submitted was calculated using the incorrect constant for heat of fusion of a 100% crystallinity material. The constant to be used is 230 J/g to result in a crystallinity of 45.3%. We also performed two more tests on the sample roll using the same constant as stated above to get the following:

45.7% and 44.8%

If you have any questions concerning this explanation please feel free to call me at (713)-847-9188.

Sincerely,

A handwritten signature in dark ink, appearing to read "Melody A. Adams". The signature is fluid and cursive, with the first name "Melody" being more prominent and the last name "Adams" following in a similar style.

Melody A. Adams
Project Engineer/Laboratory Supervisor

MAA/ma

LET11192

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GEOSYNTEC CONSULTANTS

Geomechanical and Environmental Laboratory
5775 Peachtree Dunwoody Road • Suite 10D
Atlanta, Georgia 30342 • USA
Tel. (404) 705-9500 • Fax: (404) 705-9300

14 January 1994

Mr. Tony Samples
DELHUR Industries, Inc.
P.O. Box 1116
Port Angeles, Washington 98362

Subject: Final Report
Interface Direct Shear Testing
W-025 Landfill - Hanford Site
Eastern Washington

RECEIVED

JAN 19 1994

Ans'd.....

Dear Mr. Samples:

GeoSyntec Consultants (GeoSyntec) is pleased to present the results of the interface direct shear testing program recently performed for DELHUR Industries, Inc. (DELHUR). The interface direct shear testing was conducted at GeoSyntec's Geomechanics and Environmental Laboratory in Atlanta, Georgia. This letter report was prepared by Mr. Robert H. Swan, Jr. and Dr. Zehong Yuan, both of GeoSyntec. The report was reviewed by Dr. Gary R. Schmertmann, P.E. (Georgia) also of GeoSyntec, in accordance with the internal peer review policy of the firm.

The testing program was conducted in accordance with the test procedures defined in DELHUR Purchase Order No. 25818DHI, issued to GeoSyntec on 22 September 1993. GeoSyntec understands that the purpose of the testing program was to evaluate the interface shearing resistance between: (i) a soil-bentonite admix soil and 60-mil (1.5-mm) thick SLT North America, Inc. (SLT) textured high density polyethylene (HDPE) geomembrane; (ii) a SLT double-sided geocomposite and 60-mil (1.5-mm) thick SLT textured HDPE geomembrane; and (iii) an operations layer material and SLT double-sided geocomposite, using the direct shear method. The SLT double-sided geocomposite consisted of a nonwoven geotextile heat-bonded to each side of a geonet component. GeoSyntec also understands that the sample preparation procedures and testing conditions used in the testing program were selected by DELHUR based on the project specifications. The interface direct shear tests were conducted under two types of moisture conditions: (i) "as-placed" where the geomembrane was tested dry and the soil was tested under as-placed moisture conditions; and (ii) "saturated" where the entire interface was thoroughly moistened with tap water under fully submerged conditions.

GL3479/GEL93300

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Huntington Beach, CA

933-1354

♻️ RECYCLED AND RECYCLABLE ♻️

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The remaining sections of this letter report present: (i) a description of the configuration of the test specimens used in the interface direct shear tests; (ii) the testing procedures used in the interface direct shear tests; and (iii) the test results.

CONFIGURATION OF THE TEST SPECIMEN

Three interface direct shear test series were conducted to evaluate the shearing resistance of the selected soil-geomembrane, geocomposite-geomembrane, and soil-geocomposite interfaces under as-placed or saturated moisture conditions. Each test series consisted of three interface direct shear tests with each test conducted at a different level of normal stress ranging from 200 to 600 psf (10 to 29 kPa) using a freshly prepared test specimen. Table 1 summarizes the general testing conditions that were used for the interface direct shear tests. The configurations of the test specimens in the three test series were as follows:

- *Test Series Number 1:* interface between soil-bentonite admix soil and 60-mil (1.5-mm) thick SLT textured HDPE geomembrane. From top to bottom, each test specimen consisted of:
 - soil-bentonite admix soil;
 - 60-mil (1.5-mm) thick SLT textured HDPE geomembrane; and
 - concrete sand.
- *Test Series Number 2:* interface between SLT double-sided geocomposite and 60-mil (1.5-mm) thick SLT textured HDPE geomembrane (under saturated conditions). From top to bottom, each test specimen consisted of:
 - porous rigid substrate;
 - SLT double-sided geocomposite;
 - 60-mil (1.5-mm) thick SLT textured HDPE geomembrane; and
 - soil-bentonite admix soil.

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- *Test Series Number 3:* interface between operations layer material and SLT double-sided geocomposite (under saturated conditions). From top to bottom, each test specimen consisted of:
 - operations layer material;
 - SLT double-sided geocomposite; and
 - soil-bentonite admix soil.

Bulk samples of the geomembrane, geocomposite, soil-bentonite admix soil, and operations layer material were provided to GeoSyntec by DELHUR. The concrete sand was provided by GeoSyntec to fill the lower shear box and serve as a bedding layer below the test interface in Test Series 1.

TESTING PROCEDURES

The interface direct shear tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Standard Test Method D 5321, *"Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method."* The tests were conducted in a large direct shear device containing an upper and lower shear box. The upper shear box measures 12 in. by 12 in. (300 mm by 300 mm) in plan and 3 in. (75 mm) in depth. The lower shear box measures 12 in. by 14 in. (300 mm by 350 mm) in plan and 3 in. (75 mm) in depth.

A summary of the test equipment and conditions used to conduct the interface direct shear tests is presented in Table 2. This table indicates the size of the shear box, the initial compaction condition for the soil components (i.e., dry unit weight and moisture content), the normal stress applied during consolidation, time for consolidation, the moisture content of the soil at the completion of testing, the normal stress applied to the soil or rigid substrate during shearing, and the horizontal displacement rate for each test.

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For each test series, fresh geosynthetic specimens were used for each normal stress condition. For each test, the test specimens were set up and tested as described below to achieve the desired moisture conditions and to cause shearing to occur at the desired interface.

- *Test Series Number 1:* a fresh geomembrane specimen was cut from the bulk sample of geomembrane provided by DELHUR and attached to the lower shear box with mechanical compression clamps. Fresh specimens of the soil-bentonite admix soil were moisture-conditioned and compacted away from the geomembrane specimen by hand tamping to the reported dry unit weight for each normal stress condition, as specified by DELHUR. The compacted admix soil specimen was then placed on the geomembrane for testing. This set-up caused shearing to occur at the interface between soil-bentonite admix soil and geomembrane. Each test specimen was tested under as-placed moisture conditions.
- *Test Series Number 2:* fresh specimens of the soil-bentonite admix soil were moisture-conditioned and compacted into the lower shear box by hand tamping to the reported dry unit weight for each normal stress condition, as specified by DELHUR. Fresh geocomposite and geomembrane specimens were cut from the bulk samples of geosynthetic materials provided by DELHUR and attached to the upper and lower shear box, respectively, with mechanical compression clamps. This set-up caused shearing to occur at the geocomposite-geomembrane interface. For each test, the test specimen was saturated by pouring tap water into the upper shear box. The tap water flowed through the porous rigid substrate and geocomposite specimen and drained at the geocomposite-geomembrane interface. Pouring was continued until the geocomposite and geomembrane specimens were completely submerged in the tap water. The normal stress used for shearing was applied to the test specimen prior to submerging the test specimen in the tap water. Each test specimen was then immediately sheared after it was completely submerged in the tap water.

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- *Test Series Number 3:* fresh specimens of the soil-bentonite admix soil were moisture -conditioned and compacted into the lower shear box by hand tamping to the reported dry unit weight for each normal stress condition, as specified by DELHUR. A fresh geocomposite specimen was cut from the bulk sample of geocomposite provided by DELHUR and attached to the lower shear box with mechanical compression clamps. Fresh specimens of the operations layer material at its as-received moisture content were compacted directly on top of the geocomposite specimen by light hand tamping to the reported dry unit weight for each normal stress condition. This set-up caused shearing to occur at the interface between operations layer material and geocomposite. For each test, the test specimen was saturated by pouring tap water on the top surface of the compacted operations layer material. The tap water flowed through the specimen and drained at the test interface. Pouring was continued until the test specimen was completely submerged in the tap water. The normal stress used for shearing was applied to the test specimen prior to submerging the test specimen in the tap water. Each test specimen was then immediately sheared after it was completely submerged in the tap water.

For each test series, the target dry unit weight and moisture content for the soil-bentonite admix soil were specified by DELHUR based on the project specifications. The target dry unit weight and moisture content for the admix soil were 97 lb/ft³ (15.3 kN/m³) and 21 to 22 percent. DELHUR did not specify any target dry unit weight and moisture content conditions for the operations layer material which was used in Test Series 2 and 3. The reported values of dry unit weight for each soil specimen were determined by measuring the as-placed volume of the soil and dividing this volume into the calculated total dry weight of the moist soil specimen.

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Other features of the testing procedure included the following:

- a freshly remolded 3-in. (75-mm) thick layer of concrete sand was used as a bedding layer below the test interface in Test Series 1; the concrete sand was compacted by hand tamping to a relatively dense state under dry conditions;
- each test specimen was sheared at a constant displacement rate immediately after application of the normal stress used for shearing;
- the direction of shear for each test was in the direction of manufacture (machine direction) of the geosynthetic samples;
- each test was performed using a constant effective sample area (i.e., the plan area of the geosynthetic specimens were larger than that of the upper shear box), therefore, no area correction was required when computing normal and shear stresses; and
- each test was sheared until a constant, residual shear load was recorded.

TEST RESULTS

The total-stress interface shearing resistance was evaluated for each applied normal stress. The test data were plotted on a graph of shear force versus horizontal displacement. The resulting plots are presented in Attachment 1 to this report. The peak value of shear force was used to calculate the peak shear strength. For this report, the residual shear strength was assumed to be equal to the stabilized, post-peak shear force measured at the end of each test.

The total-stress peak and residual shear strengths derived from the plotted test results are summarized in Table 3. These strengths were plotted on a graph of shear stress versus normal stress and the results

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were used to evaluate total-stress peak and residual strength envelopes. A best-fit straight line was drawn through the three data points from each test series to obtain total-stress peak and residual friction angles and adhesions. The coefficient of correlation (R^2), a standard statistical indicator of how well the best-fit line matches the test data, was obtained for each best-fit line. The plot of the shear stress versus normal stress for each test series is also presented in Attachment 1. The interface friction angles, adhesions, and R^2 values derived from the plotted test results are summarized in Table 4.

For each test series, it is noted that the reported adhesion is the shear stress axis intercept of the best-fit straight line drawn through the test data on the plot of shear stress versus normal stress. This value may not be the "true adhesion" of the interface and caution should be exercised in using this adhesion value for applications involving normal stresses outside the range of stresses covered by the test series.

The reported results apply only to the materials and test conditions used during the laboratory program. The results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analyses unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. This testing report is submitted for the exclusive use of DELHUR.

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CLOSURE

GeoSyntec appreciates the opportunity to conduct interface direct shear testing for DELHUR. If you have any questions about this report, or if you require additional information, please do not hesitate to contact any of the undersigned.

Sincerely,

Zehong Yuan, Ph.D.
Assistant Division Manager
Soil-Geosynthetic Interaction Testing

Robert H. Swan, Jr.
Division Manager
Soil-Geosynthetic Interaction Testing

Gary R. Schmertmann, Ph.D., P.E. (Georgia)
Project Engineer

Attachments

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TABLE 1

SUMMARY OF GENERAL TESTING CONDITIONS
INTERFACE DIRECT SHEAR TESTING
DELHUR INDUSTRIES, INC.
W-025 LANDFILL - HANFORD SITE, EASTERN WASHINGTON

Test Series Number	Interface Tested ⁽¹⁾	Target Dry Unit Weight and Moisture Content ⁽²⁾	Consolidation Stress (psf)	Time for Consolidation (hours)	Normal Stress During Shearing (psf)	Rate of Shear (in./min)
1	Soil-bentonite admix soil/60-mil SLT textured HDPE geomembrane	97.0 pcf at 21 to 22%	200, 400, and 600	0	200, 400, and 600	0.04
2	SLT double-sided geocomposite/60-mil SLT textured HDPE geomembrane (under saturated conditions)	N/A	200, 400, and 600	0	200, 400, and 600	0.04
3	Operations layer material/SLT double-sided geocomposite (under saturated conditions)	N/A	200, 400, and 600	0	200, 400, and 600	0.04

NOTE:

⁽¹⁾ For Test Series 1, the soil-bentonite admix soil was compacted away from the geomembrane specimen and then placed on it for testing; the specimens were tested under as-placed moisture conditions. For Test Series 2, the test specimens were tested under submerged conditions. For Test Series 3, the operation layer material was compacted directly on top of the geomembrane specimen and the test specimens were tested under submerged conditions.

⁽²⁾ N/A refers to test condition which is not applicable to the test.

TABLE 2

SUMMARY OF INTERFACE DIRECT SHEAR
TEST EQUIPMENT AND CONDITIONS
DELHUR INDUSTRIES, INC.
W-025 LANDFILL - HANFORD SITE, EASTERN WASHINGTON

Test Series Number	Shear Box Size	TEST CONDITIONS ⁽¹⁾								Normal Stress During Shearing (psf)	Displacement Rate (in./min)
		γ_{di} (pcf)		ω_{di} (%)		Consolidation Stress (psf)	Time for Consolidation (Hours)	ω_{di} (%)			
		Admix Soil	Operation Layer Material	Admix Soil	Operation Layer Material			Admix Soil	Operation Layer Material		
1	12" x 12"	97.8	N/A	21.6	N/A	200	0	20.8	N/A	200	0.04
		98.5	N/A	20.8	N/A	400	0	20.2	N/A	400	0.04
		97.6	N/A	21.2	N/A	600	0	20.8	N/A	600	0.04
2	12" x 12"	97.5	N/A	21.0	N/A	200	0	20.8	N/A	200	0.04
		97.7	N/A	21.0	N/A	400	0	20.5	N/A	400	0.04
		97.1	N/A	21.0	N/A	600	0	20.3	N/A	600	0.04
3	12" x 12"	98.1	101.2	20.3	22.5	200	0	27.9	28.2	200	0.04
		98.0	101.9	20.3	22.8	400	0	27.9	26.8	400	0.04
		97.8	101.5	20.3	22.6	600	0	27.9	28.1	600	0.04

Note: (1) γ_d refers to initial dry unit weight of soil specimen.
 ω_d refers to initial moisture content of soil specimen.
 ω_d refers to final moisture content of soil specimen.
N/A refers to test data which is not applicable to the test.

TABLE 3

INTERFACE DIRECT SHEAR TEST RESULTS
 MEASURED PEAK AND RESIDUAL TOTAL SHEAR STRENGTHS
 DELHUR INDUSTRIES, INC.
 W-025 LANDFILL-HANFORD SITE, EASTERN WASHINGTON

Test Series Number	Normal ⁽¹⁾ Stress (psf)	Measured Peak Shear Strength (psf)	Measured Residual Shear Strength (psf)	Reference Appendix Figure Number
1	200	225	205	1-1 and 1-2
	400	381	371	
	600	527	507	
2	200	297	168	1-3 and 1-4
	400	518	255	
	600	684	343	
3	200	172	142	1-5 and 1-6
	400	302	251	
	600	472	396	

Note: ⁽¹⁾ Test specimens were sheared immediately after application of normal stress used for shearing.

TABLE 4

INTERFACE DIRECT SHEAR TEST RESULTS
MEASURED TOTAL STRESS SHEAR STRENGTH PARAMETERS
DELHUR INDUSTRIES, INC.
W-025 LANDFILL - HANFORD SITE, EASTERN WASHINGTON

Test Series Number	Interface Tested ⁽¹⁾	Normal Stress Range (psf) ⁽²⁾	Peak Strength ⁽³⁾		R ²	Residual Strength ⁽³⁾		
			Friction Angle	Adhesion (psf)		Friction Angle	Adhesion (psf)	R ²
1	Soil-bentonite admix soil/60-mil SLT textured HDPE geomembrane	200 to 600	37°	75	1.000	37°	60	0.997
2	SLT double-sided geocomposite/60-mil SLT textured HDPE geomembrane (under saturated conditions)	200 to 600	44°	113	0.993	24°	80	1.000
3	Operations layer material/SLT double-sided geocomposite (under saturated conditions)	200 to 600	37°	15	0.994	32°	9	0.993

ii) For Test Series 1, the soil-bentonite admix soil was compacted away from the geomembrane specimen and then placed on it for testing; the specimens were tested under as-placed moisture conditions. For Test Series 2, the test specimens were tested under submerged conditions. For Test Series 3, the operation layer material was compacted directly on top of the geomembrane specimen and the test specimens were tested under submerged conditions.

(2) Test specimens were sheared immediately after application of the normal stress used for shearing.

(b) The reported value of adhesion may not be the "true adhesion" of the interface and caution should be exercised in using this adhesion value for applications involving normal stresses outside the range of stresses covered by the test. The value of R^2 , the coefficient of correlation, provides an indication of how well the best-fit shear strength parameters match the test data.

ATTACHMENT 1

INTERFACE DIRECT SHEAR TEST RESULTS

DELHUR INDUSTRIES, INC. INTERFACE DIRECT SHEAR TESTING

NOTE: The shear box size was 12 in. by 12 in.(300 mm by 300 mm), and the contact area remained constant throughout the entire test.

DATE TESTED: 4 NOVEMBER 1993

FIGURE NO.	1-1
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.	

DELHUR INDUSTRIES, INC. INTERFACE DIRECT SHEAR TESTING

NOTE: The reported value of adhesion may not be the true adhesion of the interface, and caution should be exercised in using this adhesion value for applications involving normal stresses outside the range of stresses covered by the test.

DATE TESTED: 4 NOVEMBER 1993

FIGURE NO.	1-2
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.	

DELHUR INDUSTRIES, INC. INTERFACE DIRECT SHEAR TESTING

NOTE: The shear box size was 12 in. by 12 in. (300 mm by 300 mm), and the contact area remained constant throughout the entire test.

DATE TESTED: 10 NOVEMBER 1993

GEOSYNTEC CONSULTANTS

GEOMECHANICS AND ENVIRONMENTAL LABORATORY

FIGURE NO.	1-3
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.	

DELHUR INDUSTRIES, INC.
INTERFACE DIRECT SHEAR TESTING

NOTE: The reported value of adhesion may not be the true adhesion of the interface, and caution should be exercised in using this adhesion value for applications involving normal stresses outside the range of stresses covered by the test.

DATE TESTED: 10 NOVEMBER 1993

FIGURE NO.	1-4
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.	

DELHUR INDUSTRIES, INC. INTERFACE DIRECT SHEAR TESTING

NOTE: The shear box size was 12 in. by 12 in. (300 mm by 300 mm), and the contact area remained constant throughout the entire test.

DATE TESTED: 9 NOVEMBER 1993

FIGURE NO.	1-5
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.	

DELHUR INDUSTRIES, INC.
INTERFACE DIRECT SHEAR TESTING

NOTE: The reported value of adhesion may not be the true adhesion of the interface, and caution should be exercised in using this adhesion value for applications involving normal stresses outside the range of stresses covered by the test.

DATE TESTED: 9 NOVEMBER 1993

GEOSYNTEC CONSULTANTS
GEOMECHANICS AND ENVIRONMENTAL LABORATORY

FIGURE NO.	1-6
PROJECT NO.	GL3479
DOCUMENT NO.	GEL93300
PAGE NO.

NORTH AMERICA, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

TEL: (714) 850-1818
SALES FAX: (408) 273-2298
ADMIN. FAX: (408) 273-3808

November 4, 1993

GeoPacific Lining, Inc.
1300 Dexter Ave. N. # 250
Seattle, Wash. 98109

Attn: El Hafuschak

RE: D.O.E Hanford Radioactive Waste
SLT Project No. 8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the SLT HyperFlex® manufactured for the above referenced project will meet or exceed the minimum specifications as listed on page 02275-4 of the customer specifications.

A handwritten signature in cursive script, reading "Melody A. Adams", is written over a horizontal line.

Melody A. Adams
Engineer

Cont1104.1

MAA/ma

For environmental lining solutions...the world comes to SLT.®

SLT

Roll Test Data Report

ROLL NO. AC-6893FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6893FF
 PROD DATE: 09/26/93
 SHEET AREA: 9994 sq.ft.
 929 sq. meters
 LENGTH: 426 feet
 130 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3740 pounds
 1696 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40681
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	149 lb/in	27 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		22	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	336 lb/in	60 kg/cm
MD -		243	44	352	63
1K ELONGATION	D638				
CD -		560 %		703 %	
MD -		560		746	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1200	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	104 lb	47 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.1 %	
MD -		+/- 2.00		0.4	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.57 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

LT

Roll Test Data Report

ROLL NO. AC-6894FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6894FF
 PROD DATE: 09/26/93
 SHEET AREA: 11847 sq.ft.
 1101 sq. meters
 LENGTH: 505 feet
 154 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3860 pounds
 1751 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40681
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	146 lb/in	26 kg/cm
MD -		130	24	145	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		22	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	351 lb/in	63 kg/cm
MD -		243	44	354	63
K ELONGATION	D638				
CD -		560 %		725 %	
MD -		560		754	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1285 ft-lb.in2	2700mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1300	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	104 lb	47 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.1 %	
MD -		+/- 2.00		0.4	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.60 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6895FF

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-6895FF		
PROD DATE:	09/26/93		
SHEET AREA:	11144	sq. ft.	
	1036	sq. meters	
LENGTH:	475	feet	
	145	meters	
WIDTH:	23.46	feet	
	7.1	meters	
WEIGHT:	3880	pounds	
	1760	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-40681		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	143 lb/in	26 kg/cm
MD -		130	24	143	26
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		22	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	357 lb/in	64 kg/cm
MD -		243	44	349	62
BREAK ELONGATION	D638				
CD -		560 %		731 %	
MD -		560		743	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb/in ²	2800 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1200%	
MD -		100		>1300	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	103 lb	47 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.1 %	
MD -		+/- 2.00		0.3	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.62 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS.

CUSTOMER:
 JOB NO.
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Roll Test Data Report

ROLL NO. AC-6896FF

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-6896FF		
PROD DATE:	09/26/93		
SHEET AREA:	9548	sq. ft.	
	887	sq. meters	
LENGTH:	407	feet	
	124	meters	
WIDTH:	23.46	feet	
	7.1	meters	
WEIGHT:	3160	pounds	
	1433	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-40681		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	140 lb/in	25 kg/cm
MD -		130	24	141	25
YIELD ELONGATION	D638				
CD -		13 %		22 %	
MD -		13		22	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	351 lb/in	63 kg/cm
MD -		243	44	341	61
BREAK ELONGATION	D638				
CD -		560 %		730 %	
MD -		560		722	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb/in ²	2800 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1200%	
MD -		100		>1300	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065	75 lb	34 kg	104 lb	47 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.1 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.65 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
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Roll Test Data Report

ROLL NO. AC-6898FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-6898FF	
PROD DATE:	09/26/93	
SHEET AREA:	10539	sq. ft.
	979	sq. meters
LENGTH:	450	feet
	137	meters
WIDTH:	23.42	feet
	7.1	meters
WEIGHT:	3520	pounds
	1597	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40681		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	142 lb/in	25 kg/cm
MD -		130	24	140	25
YIELD ELONGATION	D638				
CD -		13 %		22 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	347 lb/in	62 kg/cm
MD -		243	44	343	61
BREAK ELONGATION	D638				
CD -		560 %		723 %	
MD -		560		732	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb.in ²	2800mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1200	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	107 lb	48 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.70 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.52
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:

JOB NO.

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Roll Test Data Report

ROLL NO. AC-6899FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6899FF
 PROD DATE: 09/26/93
 SHEET AREA: 10539 sq.ft.
 979 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.42 feet
 7.1 meters
 WEIGHT: 3500 pounds
 1588 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40681
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	146 lb/in	26 kg/cm
MD -		130	24	142	25
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	341 lb/in	61 kg/cm
MD -		243	44	345	62
TEAR ELONGATION	D638				
CD -		560 %		710 %	
MD -		560		737	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	108 lb	49 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.0	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.73 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.52
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
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Roll Test Data Report

ROLL NO. AC-6904FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6904FF
 PROD DATE: 09/26/93
 SHEET AREA: 10557 sq.ft.
 981 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3720 pounds
 1687 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	150 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	344 lb/in	61 kg/cm
MD -		243	44	374	67
BREAK ELONGATION	D638				
CD -		560 %		713 %	
MD -		560		774	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb.in ²	2800 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	111 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.0 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.83 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
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Roll Test Data Report

ROLL NO. AC-6905FF

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-6905FF		
PROD DATE:	09/26/93		
SHEET AREA:	10557	sq. ft.	
	981	sq. meters	
LENGTH:	450	feet	
	137	meters	
WIDTH:	23.46	feet	
	7.1	meters	
WEIGHT:	3280	pounds	
	1488	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS ENGLISH	METRIC	ACTUAL TEST VALUES ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	151 lb/in	27 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	342 lb/in	61 kg/cm
MD -		243	44	374	67
BREAK ELONGATION	D638				
CD -		560 %		709 %	
MD -		560		768	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb.in ²	2800 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>900	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	112 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.0 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.85 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
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Roll Test Data Report

ROLL NO. AC-6906FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6906FF
 PROD DATE: 09/26/93
 SHEET AREA: 11144 sq.ft.
 1036 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3540 pounds
 1606 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLENESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	151 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	341 lb/in	61 kg/cm
MD -		243	44	371	66
BREAK ELONGATION	D638				
CD -		560 %		708 %	
MD -		560		762	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1332 ft-lb/in ²	2800 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>900	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	27 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065				
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.0 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.87 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6907FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6907FF
 PROD DATE: 09/26/93
 SHEET AREA: 9736 sq.ft.
 905 sq. meters
 LENGTH: 415 feet
 126 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3280 pounds
 1488 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
<hr/>					
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	151 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	356 lb/in	64 kg/cm
MD -		243	44	372	67
BREAK ELONGATION	D638				
CD -		560 %		742 %	
MD -		560		764	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1332 ft-lb.in2	2800mj/mm2
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>900	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.0 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.89 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
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Roll Test Data Report

ROLL NO. AC-6908FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-6908FF	
PROD DATE:	09/26/93	
SHEET AREA:	10566	sq.ft.
	982	sq. meters
LENGTH:	450	feet
	137	meters
WIDTH:	23.48	feet
	7.2	meters
WEIGHT:	3540	pounds
	1606	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	151 lb/in	27 kg/cm
MD -		130	24	148	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	368 lb/in	66 kg/cm
MD -		243	44	372	66
BREAK ELONGATION	D638				
CD -		560 %		770 %	
MD -		560		766	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1237 ft-lb.in ²	2600 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	57	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.91 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6909FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6909FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3560 pounds
 1615 kilograms

RESIN LOT INFORMATION

PROPERTY	UNITS	METHOD	RESULT
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	150 lb/in	27 kg/cm
MD -		130	24	147	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	366 lb/in	65 kg/cm
MD -		243	44	374	67
EAK ELONGATION	D638				
CD -		560 %		767 %	
MD -		560		775	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1189 ft-lb/in ²	2500 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.3 %	
MD -		+/-2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.93 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: _____ DATE SHIPPED _____
 JOB NO. _____
 COMMENTS _____

SLT

Roll Test Data Report

ROLL NO. AC-6910FF

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-6910FF		
PROD DATE:	09/26/93		
SHEET AREA:	10557	sq.ft.	
	981	sq. meters	
LENGTH:	450	feet	
	137	meters	
WIDTH:	23.46	feet	
	7.1	meters	
WEIGHT:	3740	pounds	
	1696	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	148 lb/in	26 kg/cm
MD -		130	24	147	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	356 lb/in	64 kg/cm
MD -		243	44	367	65
BREAK ELONGATION	D638				
CD -		560 %		750 %	
MD -		560		765	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1047 ft-lb/in ²	2200 mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>800 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	58	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.95 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6911FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6911FF
 PROD DATE: 09/26/93
 SHEET AREA: 10557 sq.ft.
 981 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3720 pounds
 1687 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	145	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	346 lb/in	62 kg/cm
MD -		243	44	357	64
TEAR ELONGATION	D638				
CD -		560 %		729 %	
MD -		560		745	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	952 ft-lb.in2	2000mj/mm2
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>800 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.94 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6912FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6912FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3520 pounds
 1597 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	144	26
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	343 lb/in	61 kg/cm
MD -		243	44	351	63
BREAK ELONGATION	D638				
CD -		560 %		726 %	
MD -		560		731	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	952 ft-lb/in ²	2000 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>800 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.4 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.92 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6913FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6913FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3540 pounds
 1606 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	148 lb/in	26 kg/cm
MD -		130	24	146	26
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		20	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	344 lb/in	61 kg/cm
MD -		243	44	347	62
BREAK ELONGATION	D638				
CD -		560 %		730 %	
MD -		560		718	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	999 ft-lb.in ²	2100mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>800 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	27 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SERINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.4 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.91 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 OB NO.
 COMMENTS

DATE SHIPPED

SLT**Roll Test Data Report**

ROLL NO. AC-6914FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-6914FF	
PROD DATE:	09/26/93	
SHEET AREA:	10566	sq.ft.
	982	sq. meters
LENGTH:	450	feet
	137	meters
WIDTH:	23.48	feet
	7.2	meters
WEIGHT:	3740	pounds
	1696	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	148	26
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		20	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	345 lb/in	62 kg/cm
MD -		243	44	330	59
BREAK ELONGATION	D638				
CD -		560 %		736 %	
MD -		560		682	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1047 ft-lb.in ²	2200 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	58 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.3	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.90 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

Roll Test Data Report

ROLL NO. AC-6915FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6915FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3200 pounds
 1452 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	148 lb/in	26 kg/cm
MD -		130	24	148	27
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	353 lb/in	63 kg/cm
MD -		243	44	322	58
TEAR ELONGATION	D638				
CD -		560 %		758 %	
MD -		560		666	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1142 ft-lb/in ²	2400 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.2 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.88 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6916FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-6916FF	
PROD DATE:	09/26/93	
SHEET AREA:	11623	sq.ft.
	1080	sq. meters
LENGTH:	495	feet
	151	meters
WIDTH:	23.48	feet
	7.2	meters
WEIGHT:	3660	pounds
	1660	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLENESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	148 lb/in	26 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	354 lb/in	63 kg/cm
MD -		243	44	329	59
BREAK ELONGATION	D638				
CD -		560 %		757 %	
MD -		560		686	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1142 ft-lb.in2	2400mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.3 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.87 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.53
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6917FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-6917FF	
PROD DATE:	09/26/93	
SHEET AREA:	8922	sq.ft.
	829	sq. meters
LENGTH:	380	feet
	116	meters
WIDTH:	23.48	feet
	7.2	meters
WEIGHT:	2840	pounds
	1288	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	146 lb/in	26 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		20 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	347 lb/in	62 kg/cm
MD -		243	44	333	59
TEAR ELONGATION	D638				
CD -		560 %		738 %	
MD -		560		700	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1047 ft-lb.in2	2200mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>800 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	56 lb	26 kg
MD -		45	20	58	26
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	113 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.2 %	
MD -		+/-2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.85 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.53
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

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Roll Test Data Report

ROLL NO. AC-6923FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6923FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3420 pounds
 1551 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	152 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	355 lb/in	63 kg/cm
MD -		243	44	338	60
BREAK ELONGATION	D638				
CD -		560 %		762 %	
MD -		560		702	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	56 lb	25 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.4 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.86 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6924FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6924FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3640 pounds
 1651 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	154 lb/in	28 kg/cm
MD -		130	24	151	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	349 lb/in	62 kg/cm
MD -		243	44	333	60
BREAK ELONGATION	D638				
CD -		560 %		744 %	
MD -		560		688	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	56 lb	25 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.87 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

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Roll Test Data Report

ROLL NO. AC-6925FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6925FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3780 pounds
 1715 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	153 lb/in	27 kg/cm
MD -		130	24	151	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	346 lb/in	62 kg/cm
MD -		243	44	335	60
BREAK ELONGATION	D638				
CD -		560 %		729 %	
MD -		560		691	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1285 ft-lb/in2	2700mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	56 lb	25 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.89 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6926FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6926FF
 PROD DATE: 09/26/93
 SHEET AREA: 10566 sq.ft.
 982 sq.-meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3780 pounds
 1715 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	151 lb/in	27 kg/cm
MD -		130	24	151	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	342 lb/in	61 kg/cm
MD -		243	44	336	60
BREAK ELONGATION	D638				
CD -		560 %		716 %	
MD -		560		690	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1285 ft-lb.in2	2700mj/mm2
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/-2.00 %		0.3 %	
MD -		+/-2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.91 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
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Roll Test Data Report

ROLL NO. AC-6927FF

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-6927FF		
PROD DATE:	09/26/93		
SHEET AREA:	10575	sq.ft.	
	983	sq. meters	
LENGTH:	450	feet	
	137	meters	
WIDTH:	23.50	feet	
	7.2	meters	
WEIGHT:	3260	pounds	
	1479	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-40682		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	150 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	338 lb/in	60 kg/cm
MD -		243	44	339	61
BREAK ELONGATION	D638				
CD -		560 %		703 %	
MD -		560		701	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.92 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.52
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6928FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6928FF
 PROD DATE: 09/27/93
 SHEET AREA: 10575 sq.ft.
 983 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3220 pounds
 1461 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS ENGLISH	METRIC	ACTUAL TEST VALUES ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	148 lb/in	26 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		18	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	339 lb/in	61 kg/cm
MD -		243	44	339	61
BREAK ELONGATION	D638				
CD -		560 %		706 %	
MD -		560		704	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.94 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.944 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.52
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6929FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6929FF
 PROD DATE: 09/27/93
 SHEET AREA: 10575 sq.ft.
 983 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3740 pounds
 1696 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	346 lb/in	62 kg/cm
MD -		243	44	344	62
BREAK ELONGATION	D638				
CD -		560 %		725 %	
MD -		560		722	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1285	2700
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1100%	
MD -		100		>1200	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.95 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6930FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6930FF
 PROD DATE: 09/27/93
 SHEET AREA: 10575 sq. ft.
 983 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3700 pounds
 1678 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	149	27
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	353 lb/in	63 kg/cm
MD -		243	44	354	63
REAK ELONGATION	D638				
CD -		560 %		741 %	
MD -		560		747	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1200	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	60	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	115 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.97 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-6931FF

ROLL DIMENSIONS = $\pm 1\%$

ROLL NUMBER: AC-6931FF
 PROD DATE: 09/27/93
 SHEET AREA: 10575 sq. ft.
 983 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3740 pounds
 1696 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS ENGLISH	METRIC	ACTUAL TEST VALUES ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	147 lb/in	26 kg/cm
MD -		130	24	148	26
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		19	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	350 lb/in	62 kg/cm
MD -		243	44	355	63
BREAK ELONGATION	D638				
CD -		560 %		740 %	
MD -		560		756	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1237 ft-lb.in ²	2600mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1200	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.97 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/01/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.53
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-6932FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-6932FF
 PROD DATE: 09/27/93
 SHEET AREA: 10575 sq.ft.
 983 sq. meters
 LENGTH: 450 feet
 137 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3220 pounds
 1461 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40682
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.556

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	149 lb/in	27 kg/cm
MD -		130	24	150	27
YIELD ELONGATION	D638				
CD -		13 %		18 %	
MD -		13		20	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	352 lb/in	63 kg/cm
MD -		243	44	357	64
BREAK ELONGATION	D638				
CD -		560 %		747 %	
MD -		560		761	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1237 ft-lb.in2	2600mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	57 lb	26 kg
MD -		45	20	59	27
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	114 lb	52 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.3 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.96 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours	Start 10/01/93		
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	60	1.53
AVG. THICKNESS				63	1.59

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-7680

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-7680
 PROD DATE: 10/16/93
 SHEET AREA: 11163 sq.ft.
 1037 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3548 pounds
 1609 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40687
 RESIN TYPE 005 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.934
MOISTURE	%	D570	< 0.09
BRITTLENESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.550

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		132 lb/in	24 kg/cm	143 lb/in	26 kg/cm
MD -		132	24	143	26
YIELD ELONGATION	D638				
CD -		12 %		22 %	
MD -		12		21	
TENSILE BREAK STRENGTH	D638				
CD -		228 lb/in	41 kg/cm	352 lb/in	63 kg/cm
MD -		228	41	356	64
BREAK ELONGATION	D638				
CD -		550 %		746 %	
MD -		550		767	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1285 ft-lb/in2	2700 mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		42 lb	19 kg	52 lb	24 kg
MD -		42	19	54	24
PUNCTURE STRENGTH	FTMS 101/2065	90 lb	41 kg	107 lb	49 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.1 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.89 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.946 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.51	61	1.54
AVG. THICKNESS				64	1.62

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD/GEOPACIFIC

JOB NO. 8491

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Roll Test Data Report

ROLL NO. AC-7681FF

ROLL DIMENSIONS $\approx \pm 1\%$		
ROLL NUMBER:	AC-7681FF	
PROD DATE:	10/16/93	
SHEET AREA:	11144	sq.ft.
	1036	sq. meters
LENGTH:	475	feet
	145	meters
WIDTH:	23.46	feet
	7.1	meters
WEIGHT:	3800	pounds
	1724	kilograms

RESIN LOT INFORMATION			
LOT NUMBER	S-40687		
RESIN TYPE	005 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.934
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.550

PROPERTY	ASTM METHOD	SLT MINIMUMS ENGLISH	METRIC	ACTUAL TEST VALUES ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	144 lb/in	26 kg/cm
MD -		130	24	146	26
YIELD ELONGATION	D638				
CD -		13 %		21 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	355 lb/in	63 kg/cm
MD -		243	44	364	65
BREAK ELONGATION	D638				
CD -		560 %		756 %	
MD -		560		775	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1285 ft-lb.in ²	2700mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	53 lb	24 kg
MD -		45	20	54	25
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	108 lb	49 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.87 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.54
AVG. THICKNESS				63	1.61

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-7682

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-7682
 PROD DATE: 10/16/93
 SHEET AREA: 11144 sq.ft.
 1036 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.46 feet
 7.1 meters
 WEIGHT: 3548 pounds
 1609 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40687
 RESIN TYPE 005 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.934
MOISTURE	%	D570	< 0.09
BRITTLENESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.550

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		132 lb/in	24 kg/cm	144 lb/in	26 kg/cm
MD -		132	24	147	26
YIELD ELONGATION	D638				
CD -		12 %		21 %	
MD -		12		21	
TENSILE BREAK STRENGTH	D638				
CD -		228 lb/in	41 kg/cm	350 lb/in	63 kg/cm
MD -		228	41	366	65
BREAK ELONGATION	D638				
CD -		550 %		748 %	
MD -		550		775	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1237 ft-lb/in ²	2600 mj/mm ²
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		42 lb	19 kg	53 lb	24 kg
MD -		42	19	53	24
PUNCTURE STRENGTH	FTMS 101/2065	90 lb	41 kg	110 lb	50 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.85 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.51	61	1.55
AVG. THICKNESS				64	1.61

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD/GEOPACIFIC

JOB NO. 8491

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Roll Test Data Report

ROLL NO. AC-7683FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-7683FF
 PROD DATE: 10/16/93
 SHEET AREA: 11153 sq.ft.
 1037 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.48 feet
 7.2 meters
 WEIGHT: 3780 pounds
 1715 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40687
 RESIN TYPE 005 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.934
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.550

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		130 lb/in	24 kg/cm	144 lb/in	26 kg/cm
MD -		130	24	144	26
YIELD ELONGATION	D638				
CD -		13 %		22 %	
MD -		13		21	
TENSILE BREAK STRENGTH	D638				
CD -		243 lb/in	44 kg/cm	348 lb/in	62 kg/cm
MD -		243	44	360	64
TEAR ELONGATION	D638				
CD -		560 %		736 %	
MD -		560		770	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1285 ft-lb.in2	2700mj/mm2
MD -		381	801	1332	2800
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>900	
INITIAL TEARING STRENGTH	D1004				
CD -		45 lb	20 kg	53 lb	24 kg
MD -		45	20	53	24
PUNCTURE STRENGTH	FTMS 101/2065	76 lb	34 kg	111 lb	50 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.83 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		54	1.37	61	1.55
AVG. THICKNESS				64	1.61

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

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Roll Test Data Report

ROLL NO. AC-7684

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-7684
 PROD DATE: 10/16/93
 SHEET AREA: 11163 sq.ft.
 1037 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.50 feet
 7.2 meters
 WEIGHT: 3552 pounds
 1611 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40687
 RESIN TYPE 005 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.934
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.550

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		132 lb/in	24 kg/cm	143 lb/in	26 kg/cm
MD -		132	24	144	26
YIELD ELONGATION	D638				
CD -		12 %		22 %	
MD -		12		21	
TENSILE BREAK STRENGTH	D638				
CD -		228 lb/in	41 kg/cm	340 lb/in	61 kg/cm
MD -		228	41	361	65
BREAK ELONGATION	D638				
CD -		550 %		724 %	
MD -		550		775	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1237 ft-lb/in ²	2600 mj/mm ²
MD -		381	801	1189	2500
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>900	
INITIAL TEARING STRENGTH	D1004				
CD -		42 lb	19 kg	53 lb	24 kg
MD -		42	19	53	24
PUNCTURE STRENGTH	FTMS 101/2065	90 lb	41 kg	112 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.2	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.81 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.945 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.51	61	1.56
AVG. THICKNESS				64	1.61

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD/GEOPACIFIC
 JOB NO. 8491
 COMMENTS _____

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Roll Test Data Report

ROLL NO. AC-7794

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-7794
 PROD DATE: 10/19/93
 SHEET AREA: 8410 sq.ft.
 782 sq. meters
 LENGTH: 355 feet
 108 meters
 WIDTH: 23.69 feet
 7.2 meters
 WEIGHT: 3424 pounds
 1553 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40680
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	<-70
MELT INDEX	g/10 min.	D1238	0.545

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		176 lb/in	32 kg/cm	202 lb/in	36 kg/cm
MD -		176	32	193	35
YIELD ELONGATION	D638				
CD -		12 %		17 %	
MD -		12		19	
TENSILE BREAK STRENGTH	D638				
CD -		304 lb/in	55 kg/cm	471 lb/in	84 kg/cm
MD -		304	55	442	79
BREAK ELONGATION	D638				
CD -		550 %		783 %	
MD -		550		739	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in2	801 mj/mm2	1047 ft-lb/in2	2200 mj/mm2
MD -		381	801	1047	2200
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		56 lb	25 kg	69 lb	31 kg
MD -		56	25	71	32
PUNCTURE STRENGTH	FTMS 101/2065	105 lb	48 kg	129 lb	59 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.1 %	
MD -		+/- 1.00		0.1	
CARBON BLACK DISPERSION	D3015	A1		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.18 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.942 g/cc
ESCR	D1693-B	1500 hours		Start 10/22/93	
THICKNESS	D1593/D751				
NOMINAL		80 mil	2.03 mm	80 mil	2.03 mm
MINIMUM		72	1.82	78	1.97
AVG. THICKNESS				81	2.05

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD/GEOPACIFIC

DATE SHIPPED

JOB NO. 8491

COMMENTS

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Roll Test Data Report

ROLL NO. AC-8309

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-8309
 PROD DATE: 10/31/93
 SHEET AREA: 8396 sq.ft.
 780 sq. meters
 LENGTH: 355 feet
 108 meters
 WIDTH: 23.65 feet
 7.2 meters
 WEIGHT: 3376 pounds
 1531 kilograms

RESIN LOT INFORMATION

LOT NUMBER --S-45726
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.932
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.551

PROPERTY	ASTM METHOD	SLT MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		173 lb/in	31 kg/cm	190 lb/in	34 kg/cm
MD -		173	31	187	33
YIELD ELONGATION	D638				
CD -		13 %		19 %	
MD -		13		20	
TENSILE BREAK STRENGTH	D638				
CD -		324 lb/in	59 kg/cm	424 lb/in	76 kg/cm
MD -		324	59	456	81
BREAK ELONGATION	D638				
CD -		560 %		761 %	
MD -		560		810	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	999 ft-lb/in ²	2100 mj/mm ²
MD -		381	801	1047	2200
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>1000	
INITIAL TEARING STRENGTH	D1004				
CD -		60 lb	27 kg	70 lb	32 kg
MD -		60	27	70	32
PUNCTURE STRENGTH	FTMS 101/2065	98 lb	44 kg	146 lb	66 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 2.00 %		0.2 %	
MD -		+/- 2.00		0.5	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.30 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.941 g/cc
ESCR	D1693-B	1500 hours		Start 11/05/93	
THICKNESS	D1593/D751				
NOMINAL		80 mil	2.03 mm	80 mil	2.03 mm
MINIMUM		72	1.83	78	1.98
AVG. THICKNESS				80	2.03

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER:
 JOB NO.
 COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-8388

ROLL DIMENSIONS $\approx \pm 1\%$			
ROLL NUMBER:	AC-8388		
PROD DATE:	11/03/93		
SHEET AREA:	8431	sq. ft.	
	784	sq. meters	
LENGTH:	355	feet	
	108	meters	
WIDTH:	23.75	feet	
	7.2	meters	
WEIGHT:	3464	pounds	
	1571	kilograms	

RESIN LOT INFORMATION			
LOT NUMBER	S-45727		
RESIN TYPE	600 SERIES		
PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.933
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.537

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		176 lb/in	32 kg/cm	193 lb/in	35 kg/cm
MD -		176	32	192	34
YIELD ELONGATION	D638				
CD -		12 %		19 %	
MD -		12		21	
TENSILE BREAK STRENGTH	D638				
CD -		304 lb/in	55 kg/cm	448 lb/in	80 kg/cm
MD -		304	55	444	79
BREAK ELONGATION	D638				
CD -		550 %		769 %	
MD -		550		763	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	801 mj/mm ²	1094 ft-lb/in ²	2300 mj/mm ²
MD -		381	801	1142	2400
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>1000%	
MD -		100		>1100	
INITIAL TEARING STRENGTH	D1004				
CD -		56 lb	25 kg	71 lb	32 kg
MD -		56	25	75	34
PUNCTURE STRENGTH	FTMS 101/2065	105 lb	48 kg	138 lb	63 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 1.00 %		0.3 %	
MD -		+/- 1.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.48 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.943 g/cc
ESCR	D1693-B	1500 hours		Start 11/05/93	
THICKNESS	D1593/D751				
NOMINAL		80 mil	2.03 mm	80 mil	2.03 mm
MINIMUM		72	1.82	78	1.99
AVG. THICKNESS				80	2.03

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD

JOB NO. 8491

COMMENTS

DATE SHIPPED

SLT

Roll Test Data Report

ROLL NO. AC-9604 FF

ROLL DIMENSIONS $\approx \pm 1\%$

ROLL NUMBER: AC-9604 FF
 PROD DATE: 12/04/93
 SHEET AREA: 11253 sq. ft.
 1046 sq. meters
 LENGTH: 475 feet
 145 meters
 WIDTH: 23.69 feet
 7.2 meters
 WEIGHT: 3540 pounds
 1606 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40031
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.935
MOISTURE	%	D570	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.591

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
ENSILE YIELD STRENGTH	D638				
CD -		132 lb/in	24 kg/cm	150 lb/in	27 kg/cm
MD -		132	24	150	27
TILD ELONGATION	D638				
CD -		12 %		18 %	
MD -		12		18	
ENSILE BREAK STRENGTH	D638				
CD -		228 lb/in	41 kg/cm	337 lb/in	60 kg/cm
MD -		228	41	343	61
BREAK ELONGATION	D638				
CD -		550 %		773 %	
MD -		550		775	
ENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/in ²	501 mj/mm ²	1142 ft-lb/in ²	2400 mj/mm ²
MD -		381	501	1047	2200
ENSILE IMPACT ELONGATION	D1822				
CD -		100 %		>900 %	
MD -		100		>900	
VITAL TEARING STRENGTH	D1004				
CD -		42 lb	19 kg	55 lb	25 kg
MD -		42	19	54	25
DUCTURE STRENGTH	FTMS 101/2063	90 lb	41 kg	112 lb	51 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100°C)	+/-1.00 %		0.2 %	
MD -		+/-1.00		0.1	
ARBON BLACK DISPERSION	D3015	A2		A2	
ARBON BLACK CONTENT	D1603	2.00 %		2.96 %	
MEMBRANE DENSITY	D792		0.940 g/cc		0.947 g/cc
SCR	D1693-B	1500 hours		Start 12/10/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.5 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD
 JOB NO. 8491
 COMMENTS

DATE SHIPPED

Roll Test Data Report

ROLL NO. AC-9605 FF

ROLL DIMENSIONS = $\pm 1\%$

ROLL NUMBER: AC-9605 FF
 PROD DATE: 12/04/93
 SHEET AREA: 11727 sq. ft.
 1090 sq. meters
 LENGTH: 495 feet
 151 meters
 WIDTH: 23.69 feet
 7.2 meters
 WEIGHT: 3540 pounds
 1606 kilograms

RESIN LOT INFORMATION

LOT NUMBER S-40031
 RESIN TYPE 600 SERIES

PROPERTY	UNITS	METHOD	RESULT
DENSITY	g/cc	D792	0.935
MOISTURE	%	D578	< 0.09
BRITTLINESS	°C	D746	< -70
MELT INDEX	g/10 min.	D1238	0.591

PROPERTY	ASTM METHOD	ORDER MINIMUMS		ACTUAL TEST VALUES	
		ENGLISH	METRIC	ENGLISH	METRIC
TENSILE YIELD STRENGTH	D638				
CD -		132 lb/in	24 kg/cm	149 lb/in	27 kg/cm
MD -		132	24	146	26
YIELD ELONGATION	D638				
CD -		12 %		18 %	
MD -		12		18	
TENSILE BREAK STRENGTH	D638				
CD -		228 lb/in	41 kg/cm	340 lb/in	61 kg/cm
MD -		228	41	337	60
ELONGATION	D638				
CD -		550 %		773 %	
MD -		550		764	
TENSILE IMPACT STRENGTH	D1822				
CD -		381 ft-lb/m ²	501 mj/mm ²	1142 ft-lb/m ²	2400 mj/mm ²
MD -		381	501	1094	2300
TENSILE IMPACT ELONGATION	D1822				
CD -		100 %		> 900 %	
MD -		100		> 1000	
INITIAL TEARING STRENGTH	D1004				
CD -		42 lb	19 kg	54 lb	25 kg
MD -		42	19	54	24
PUNCTURE STRENGTH	FTMS 101/2065	90 lb	41 kg	111 lb	50 kg
SHRINKAGE	D1204				
CD -	(1 HR @ 100C)	+/- 1.00 %		0.2 %	
MD -		+/- 1.00		0.1	
CARBON BLACK DISPERSION	D3015	A2		A2	
CARBON BLACK CONTENT	D1603	2.00 %		2.95 %	
GEOMEMBRANE DENSITY	D792		0.940 g/cc		0.947 g/cc
ESCR	D1693-B	1500 hours		Start 12/10/93	
THICKNESS	D1593/D751				
NOMINAL		60 mil	1.52 mm	60 mil	1.52 mm
MINIMUM		60	1.52	61	1.55
AVG. THICKNESS				63	1.60

TEST NOTES: MD=MACHINE DIRECTION CD=CROSS DIRECTION ESCR START DATE IS GIVEN
 -FOR TENSILE ELONGATION TEST GAUGE LENGTH=1.3 ON YIELD, 2.5 ON BREAK
 ALL STRENGTH VALUES BASED ON NOMINAL THICKNESS

CUSTOMER: HANFORD

JOB NO. 8491

COMMENTS

933-1354

DATE SHIPPED:

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Marc Vanover
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

August 17, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Resin Analysis	
		Test	Lot Data
Product Type	HDA-601	Melt Index (gms/10 min) I ₂	0.56
Lot Number	S-40680	Density (gms/cc)	0.934
Hopper Car Number	RUSX-8040		
Quantity Shipped	165,350		
Date of Manufacture	17-Aug-93		
P.O. Number			
Location Shipped to			
Aldine, TX			

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Bill Walling
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

September 22, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Test	Resin Analysis	Lot Data
Product Type	HDX-005	Melt Index (gms/10 min) I ₂		0.56
Lot Number	S-4068T	Density (gms/cc)		0.934
Hopper Car Number	ACFX-58999			
Quantity Shipped	171,900			
Date of Manufacture	17 Aug-93			
P.O. Number				
Location Shipped to				
Aldine, TX				

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Bill Walling
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

September 22, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Test	Resin Analysis	Lot Data
Product Type	HDX-005	Melt Index (gms/10 min) I ₂		0.56
Lot Number	S-40682	Density (gms/cc)		0.934
Hopper Car Number	MOBX-52368			
Quantity Shipped	171,750			
Date of Manufacture	17-Aug-93			
P.O. Number				
Location Shipped to				
Aldine, TX				

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Bill Walling
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

September 22, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Resin Analysis	
		Test	Lot Data
Product Type	HDX-005	Melt Index (gms/10 min) I ₂	0.55
Lot Number	S-40687	Density (gms/cc)	0.934
Hopper Car Number	ACFX-52401		
Quantity Shipped	175,550		
Date of Manufacture	18-Aug-93		
P.O. Number			
Location Shipped to Aldine, TX			

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Bill Walling
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

October 20, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Resin Analysis	
		Test	Lot Data
Product Type	HDA-601	Melt Index (gms/10 min) I ₂	0.54
Lot Number	S-45726	Density (gms/cc)	0.934
Hopper Car Number	MOBX-52233		
Quantity Shipped	174,350		
Date of Manufacture	13-Aug-93		
P.O. Number			
Location Shipped to Aldine, TX			

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Bill Walling
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

October 20, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Test	Resin Analysis	Lot Data
Product Type	HDA-601	Melt Index (gms/10 min) I:		0.54
Lot Number	S-45727	Density (gms/cc)		0.934
Hopper Car Number	ACFX-52300			
Quantity Shipped	173,550			
Date of Manufacture	13-Aug-93			
P.O. Number				
Location Shipped to				
Aldine, TX				

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

Safety Through Accountability and Recognition

Mobil Polyethylene

Certificate of Analysis

"QUALITY PEOPLE MAKING QUALITY PRODUCTS"

Marc Vanover
SLT North America Inc.
200 S. Trade Center Pkwy
Conroe, TX 77385

August 31, 1993

Mobil Chemical, a major supplier of quality polyethylene, has shipped a lot of Material to your facility. The lot identification and analysis are listed below. This data has been supplied by our Quality Control Laboratory located here in Beaumont. If you should need further information or another copy of this report please call your sales office in Irving, TX 214-580-1040.

Resin Identification		Test	Resin Analysis	Lot Data
Product Type	HDG-600	Melt Index (gms/10 min) I ₂		0.59
Lot Number	S-40031	Density (gms/cc)		0.935
Hopper Car Number	TLCX-38077			
Quantity Shipped	181,450			
Date of Manufacture	25-Jan-93			
P.O. Number				
Location Shipped to				
Aldine, TX				

Thank you for your business. If you need additional assistance, please do not hesitate to contact our Sales Representative in your area.

Sincerely,

W. H. Pintsch
Quality Assurance Coordinator

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-3813
SALES FAX: (409) 273-2206
ADMIN. FAX: (409) 273-3808

October 22, 1993

GeoPacific Lining Inc.
1300 Dexter Ave. N., Suite 250
Seattle, Washington 98109

Attn: El Hafuschak

RE: / DOE Hanford
Radioactive Waste Disposal Facility
SLT Project No. 8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the geomembrane for the above referenced project was manufactured from first quality resin which contains no reclaimed polymer and less than 2% of recycled trim.

A handwritten signature in cursive script that reads "Melody A. Adams".

Melody A. Adams
Engineer

MAA/ma

Cart 10/22/93

For environmental lining solutions...the world comes to SLT.™

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

January 31, 1994

GeoPacific Lining, Inc.
1300 Dexter Avenue #205
Seattle, WA 98109

Attn: El Haluschak

RE: D.O.E Hanford Radioactive Waste
SLT Project No. US/93-8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the SLT HyperFlex® liner manufactured and supplied to the above referenced project has passed the required 2000 hours for ASTM D 1693 Condition B, Environmental Stress Crack Resistance:

AC6895	AC6905	AC6910	AC6915	AC6925	AC6930	AC7682
AC6896	AC6906	AC6911	AC6916	AC6926	AC6931	AC7684
AC6898	AC6907	AC6912	AC6917	AC6927	AC6932	
AC6899	AC6908	AC6913	AC6923	AC6928	AC7680	
AC6904	AC6909	AC6914	AC6924	AC6929	AC7681	

A handwritten signature in cursive script that reads "Melody A. Adams".

Melody A. Adams
Engineer

MAA/ma

CERT0131.1

For environmental lining solutions...the world comes to SLT.®

NORTH AMERICA, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

TEL: (713) 350-1813
SALES FAX: (409) 273-2288
ADMIN. FAX: (409) 273-3808

March 14, 1994

GeoPacific Lining, Inc.
1300 Dexter Ave. N, Suite 250
Seattle, WA 98109

Attn: El Haluschak

RE: D.O.E Hanford Radioactive Waste
SLT Project No. US/93-8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the SLT HyperFlex® liner manufactured and supplied to the above referenced project has passed the required 2000 hours for ASTM D 1693 Condition B, Environmental Stress Crack Resistance:

AC6893
AC6894

AC7683
AC8309

AC8388
AC9604

AC9605

A handwritten signature in cursive script, reading "Melody A. Adams", is written over a horizontal line.

Melody A. Adams
Engineer

NORTH AMERICA, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

March 14, 1994

GeoPacific Lining Inc.
1300 Dexter Ave. N, Suite 250
Seattle, WA 98109

Attn: El Haluschak

RE: D.O.E. Hanford Radioactive Waste
SLT Project No. 8491

**Certification
(Revised)**

The undersigned, being qualified and authorized to do so, hereby certifies that the Hyperflex® liner for the above referenced project will meet the requirement of 90% strength retained for Resistance to Soil Burial, ASTM 3083.

A handwritten signature in cursive script, reading "Melody A. Adams", is written over a horizontal line.

Melody A. Adams
Engineer

CERT0014.2

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

November 3, 1993

GeoPacific Lining, Inc.
1300 Dexter Ave. N. # 250
Seattle, Wash. 98109

Attn: El Haluschak

RE: D.O.E Hanford Radioactive Waste
SLT Project No. 8491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the welding extrudate (rod and resin) manufactured by Blackwell Plastics for use by SLT and its customers, is made from the same base resin type and will exhibit similar physical characteristics as the membrane.

A handwritten signature in cursive script that reads "Melody A. Adams". The signature is written in dark ink and is positioned above a horizontal line.

Melody A. Adams
Engineer

Cen1103.2

MAA/ma

For environmental lining solutions...the world comes to SLT.®

933-1354

E-3-77

INSTALLATION CONTRACTOR FOR YOUR
GEO SYNTHETIC NEEDS

Dec. 2/93

File no.: 354/93

Delhur Industries, Inc.
Port Angeles, WA

RE: Cold weather seaming between 30 and 40 degrees.
Hanford Site - KEH-5346 (W-025)

Attention: Tony

In reply to the GCS's field data form dated: 11-20-93

Accept this letter as certification to the statements:

" the quality of the seams welded at temperatures below 40 degrees F. and above 30 degrees F. are of the same quality of seam as those welded at temperatures between 40 degrees F. and 104 degrees F.."

" For seams welded below 40 degrees F., a sample coupon shall be provided from each end of the seam. All other testing required by the specifications will be performed."

Sincerely,

A handwritten signature in dark ink, appearing to read "El Haluschak", is written over a faint, dotted rectangular box.

El Haluschak
President

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77385

TEL: (713) 350-1813
SALES FAX: (409) 273-2268
ADMIN. FAX: (409) 273-3803

16 August 1994

Scott Matthews
Golder and Associates
Re: SLT Job # 94-9538

Fax: 509/373-9484

Certification

The undersigned, being qualified and authorized to do so hereby certifies that SLT HyperFlex® is made of high quality, virgin polyethylene resin. The finished product is composed of 97-98 % polyethylene and 2-3 % carbon black for uv stability. SLT has adhered to this formulation for all material carrying the HyperFlex trade name.

Matthew W. Adams
Chemist

For environmental lining solutions...the world comes to SLT.®

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77345

TEL: (713) 350-1813
SALES FAX: (409) 273-2266
ADMIN. FAX: (409) 273-3808

16 August 1994

Scott Matthews
Golder and Associates
Re: SLT Job # 94-9538

Fax: 509/373-9484

Certification

The undersigned, being qualified and authorized to do so hereby certifies that SLT HyperFlex® is made of high quality, virgin polyethylene resin. The resin used for manufacturing all HyperFlex geomembranes was developed for the express purpose of geomembrane production and is supplied by a single resin manufacturer to one, consistent specification. All material referred to as SLT HyperFlex has been made with this resin.

Further, due to the consistency of raw materials used in the production of HyperFlex, all HyperFlex material exhibits similar physical properties and chemical resistance.

Matthew W. Adams
Chemist

DOCUMENT CERT001W_7

For environmental lining solutions...the world comes to SLT.®

APPENDIX F
GEONET CONFORMANCE TESTS

APPENDIX F-1
CQA CONFORMANCE TESTS

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES, INC.
GEONET INVENTORY CONTROL RECORD
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANDFORD NUCLEAR RESERVATION

933-1354
05/10/94
Page: 1

SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENSIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Weight (oz/SY)	Tested (Y/N)	Date Sent	Results Received	Test P/F
2	1824	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1833	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1836	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1837	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1838	FHY210	Tenax	10/13/93	180.	6.7	22.	Y	10/14/93	01/26/93	Pass
2	1839	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1840	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1847	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1848	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1856	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1911	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1923	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1924	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1925	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1926	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1927	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1928	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1929	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1930	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1931	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1932	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1933	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1934	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1935	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1936	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1937	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1938	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1939	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1952	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1953	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1954	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1955	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1956	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1957	FHY210	Tenax	10/13/93	180.	6.7	22.	Y	10/14/93	10/26/93	Pass
2	1958	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1959	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1960	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1964	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1965	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1970	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1971	FHY210	Tenax	10/13/93	180.	6.7	22.	N			
2	1972	FHY210	Tenax	10/13/93	180.	6.7	22.	N			

Square Feet Delivered = 50652.

OCTOBER 1993

SUMMARY OF GEONET CONFORMANCE TEST RESULTS

933-1354

DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON
--

ROLL NO.	1838	1957	-	-	-	-	-	-	-	-
THICKNESS (mils) ASTM D 1777	207.5	202.5	-	-	-	-	-	-	-	-
SPECIFIC GRAVITY ASTM D 1505	0.940	0.941	-	-	-	-	-	-	-	-
MASS PER UNIT AREA (oz/sq. yd) ASTM D 3776	22.6	22.1	-	-	-	-	-	-	-	-
TRANSMISSIVITY (m ² /sec) ASTM D 4716	2.86E-03	3.17E-03	-	-	-	-	-	-	-	-

October 1993

933-1354

GEONET TEST RESULTS

DOE/NDO CQA/WA

ROLL DESIGNATION: 1838

THICKNESS (mils)		SPECIFIC GRAVITY		MASS PER UNIT AREA (oz/yd ²)		TRANSMISSIVITY (m ² /sec)
1.	209.0	1.	0.940	1.	22.36	2.91E-03
2.	210.1	2.	0.940	2.	23.04	2.83E-03
3.	208.7	3.	0.940	3.	23.47	2.83E-03
4.	208.3			4.	23.84	
5.	207.3			5.	23.20	
6.	207.1			6.	22.62	
7.	206.5			7.	21.78	
8.	206.6			8.	21.63	
9.	207.4			9.	22.08	
10.	204.0			10.	21.99	
AVG 207.5		AVG 0.940		AVG 22.6		2.86E-03

ROLL DESIGNATION: 1957

THICKNESS (mils)		SPECIFIC GRAVITY		MASS PER UNIT AREA (oz/yd ²)		TRANSMISSIVITY (m ² /sec)
1.	200.8	1.	0.941	1.	22.50	3.22E-03
2.	201.3	2.	0.941	2.	22.15	3.11E-03
3.	202.5	3.	0.940	3.	21.68	3.19E-03
4.	205.1			4.	22.24	
5.	200.6			5.	21.62	
6.	201.2			6.	22.21	
7.	205.8			7.	22.71	
8.	203.7			8.	22.38	
9.	199.6			9.	21.64	
10.	204.0			10.	22.13	
AVG 202.5		AVG 0.941		AVG 22.1		3.17E-03

APPENDIX F-2
MANUFACTURER'S QC DOCUMENTATION

September 3, 1993

Mr. El Haluschak
Geo Pacific Lining, Inc.
106-1687 West Broadway
Vancouver, B.C. V6J 1X2

RE: Hanford Landfill Project

Dear Mr. Haluschak;

TENAX Corporation certifies that all the rolls of CE-2 Geonet and TNT-206064 Geocomposite to be delivered to the above referenced project will be in accordance with the attached specifications dated 9/3/93 and 7/20/93.

Sincerely,

Giovanni Capra
General Manager

Enclosures: TENAX CE-2 Series Geonet specifications dated 9/3/93
TENAX TNT-206064 Geocomposite specification dated
7/20/93

Performance in
Plastic TechnologySM

TENAX CE-2 Series GEONET			
090393			
PROPERTIES	TEST	UNIT	VALUES
PERFORMANCE			
TENSILE STRENGTH	ASTM D4595	lb/ft	450
HYDRAULIC TRANSMISSIVITY @ i = 1 and vertical stress	ASTM D4716	m ² /sec psf	0.001 @ 10,000
COMPOSITION			
POLYETHYLENE CONTENT	ASTM D1248	%	98
DENSITY	ASTM D1505	g/cm ³	.940
MELT FLOW INDEX	ASTM D1238	g/10 min	0.3
FOAMING AGENT	-	-	No
CARBON BLACK CONTENT	ASTM D1603	%	2
DIMENSIONS			
GEONET THICKNESS	ASTM D1777	in	.20
ROLL WIDTH	-	ft	6.7
ROLL LENGTH	-	ft	250
ROLL AREA	-	ft ²	1675
ROLL WEIGHT	-	lb	260

Geonet tensile strength and transmissivity are reported as representative typical (average) roll values.

All other reported properties are minimum average roll values in each principal direction.

TENAX CE GEONETS QUALITY CONTROL CRITERIA

GEONET TYPE: CE-2 Series
ROLL SIZE: 6.7 ft X 180 ft

PROJECT NAME: HANFORD LANDFILL #386-93
LOCATION: RICHLAND, WA
QUANTITY: 50,000 SQUARE FEET

CHARACTERISTICS	UNITS	FREQUENCY	NOMINAL	MINIMUM	MAXIMUM
<i>Roll</i>					
WIDTH	Inches	Every Roll	81.5	80.4	82
LENGTH	feet	Every 45 Rolls	180	180	183
NET WEIGHT	pounds	Every Roll	188	186	193
CIRCUMFERENCE	Inches	Every Roll	78	76	80
<i>Geonet</i>					
THICKNESS	mm	Every Roll	-	5.1	-
PITCH, MD	mm	Every Roll	18	17	19
UNIT WEIGHT	g/m ²	At Set-Up	750	750	770
TENSILE STRENGTH, MD	lbs/ft	Every 120 Rolls	450	450	-
ELONGATION, MD	%	Every Day	40	30	50
TRANSMISSIVITY (10,000 psf, l = 1.00)	m ² /sec	SEE BELOW	SEE BELOW	SEE BELOW	SEE BELOW
POLYMER DENSITY	g/cm ³	Every Lot	0.940	0.940	0.940
POLYMER CONTENT	%	Every Box	98	98	98
CARBON BLACK	%	Every Box	2	2	2
MELT FLOW INDEX	g/10 min	Every Lot	0.25	0.1	0.5
<i>Additional Requirements</i>					
TRANSMISSIVITY (ASTM D4716) @ 1000 psf l=0.31	m ² /sec	Every 120 Rolls	-	0.00248	-
@ 10000 psf l=0.01			-	0.00166	-
COMPRESSION @ 15000 psf	%	Every 120 Rolls	75	-	-
THICKNESS - see MQCS sheet	mm	Every 120 Rolls	-	5.1	-

MASS POLYMERS CORPORATION

198 WEST HIGH STREET
SOMERVILLE, NJ 08876

(908) 725-3133
FAX (908) 725-9677

June 3, 1993

Mr Mario Tonani
Tenax Corporation
8291 Patuxent Range Road
Jessup, MD 20794

Dear Mario,

As per your P.O. 2454, the specifications for Novacor FHY-210-A Lot 7-1-16217-2 32 are as follows:

Melt Index	0.23 g/10 min	Test Method ASTM D1238
Density	0.935 g/cc	Test Method ASTM D792
Ship Date	1/6/93	

Sincerely,

Stephen Dazzo

HANQC.XLS

PROJECT NAME:		HANFORD LF							
PROJECT #		386-93							
		TENAX QUALITY CONTROL PROGRAM							
		CERTIFICATION OF MINIMUM PROPERTY VALUES							
		CE GEONET PRODUCTION DATABASE							
EXTRUDER #:		4							
PRODUCT:		CE 2		CARBON BLACK:		2%			
POLYMER TYPE:		MDPE		ROLL LENGTH:		180 ft			
FOAMING AGENT:		N/A		ROLL WEIGHT:		188 lbs			
THICKNESS:		5.2 mm		ROLL WIDTH:		80.4 in			
LINE	DATE OF	ROLL #	THICK.	WIDTH	WEIGHT	CIRC.	PITCH		
	PROD.		[mm]	[in]	[lbs]	[in]	[mm]		
1	9/19/93	1824	5.2	81.5	194.3	75	16		
2	9/19/93	1833	5.3	80.5	193.2	76.5	16		
3	9/19/93	1836	5.28	80.5	192.1	76	16		
4	9/19/93	1837	5.26	80.5	192.1	76	16		
5	9/19/93	1838	5.23	81	193.4	75	16		
6	9/19/93	1839	5.25	81	193	74.75	16		
7	9/19/93	1840	5.3	80.75	192.9	74.75	16		
8	9/19/93	1847	5.3	80.625	194.1	74.75	16		
9	9/19/93	1848	5.28	80.75	192.6	74.75	16		
10	9/20/93	1856	5.2	81.33	193.6	76.25	16		
11	9/21/93	1911	5.32	81.25	189.7	74.5	17		
12	9/22/93	1923	5.2	81	189.6	74.75	16		
13	9/22/93	1924	5.1	81	188.7	75	16		
14	9/22/93	1925	5.1	81	189.7	74.5	16		
15	9/22/93	1926	5.1	81	189	75	16		
16	9/22/93	1927	5.3	81	189.3	75.5	16		
17	9/22/93	1928	5.1	80.5	188.5	74	16		
18	9/22/93	1929	5.2	80.75	188.9	74.5	17		
19	9/22/93	1930	5.21	80.75	190.6	74.75	17		
20	9/22/93	1931	5.24	80.75	189.6	74.5	17		
21	9/22/93	1932	5.21	80.75	189.8	74.5	17		
22	9/22/93	1933	5.17	80.75	190.4	74.5	16		
23	9/22/93	1934	5.18	80.75	190	74.625	16		
24	9/22/93	1935	5.24	80.75	189.9	74.5	16		
25	9/22/93	1936	5.22	80.875	192.1	74.75	16		
26	9/22/93	1937	5.27	81	202.1	75.5	16		
27	9/22/93	1938	5.3	81.125	202.2	75.75	16		
28	9/22/93	1939	5.25	81	200.3	75.5	16		
29	9/23/93	1952	5	80.5	189.6	74.5	17		
30	9/23/93	1953	5.2	80.5	189.8	75	17		
31	9/23/93	1954	5.3	80.5	190	75	17		
32	9/23/93	1955	5.2	80.5	191	75.5	17		
33	9/23/93	1956	5	80.75	189	75	17		
34	9/23/93	1957	5.2	80.5	188.9	75	16		

HANQC.XLS

35	9/23/93	1958	5.1	80.5	187.9	75	16
36	9/23/93	1959	5.1	80.75	187.6	74.5	16
37	9/23/93	1960	5.2	80.75	188.8	74.75	16
38	9/23/93	1964	5.17	81	190.2	75.25	17
39	9/23/93	1965	5.2	81	191.3	75	16
40	9/23/93	1970	5.2	81	187.3	75	17
41	9/23/93	1971	5.2	81	188.7	75	16
42	9/23/93	1972	5.25	81	183.3	74.5	16
TOTAL RECORDS PROCESSED:				42			

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

WIDE WIDTH TENSILE
ASTM D4595

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Wide Width Tensile	ASTM D4595	526	450	lb/ft
	1931	Wide Width Tensile	ASTM D4595	519	450	lb/ft
	2051	Wide Width Tensile	ASTM D4595	536	450	lb/ft

Notes:

MANUFACTURING QUALITY CONTROL RESULTS **for the** **HANFORD LANDFILL**

CARBON BLACK
 ASTM D4218

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Carbon Black	ASTM D4218	2.14	2.0	%
	1931	Carbon Black	ASTM D4218	2.15	2.0	%
	2051	Carbon Black	ASTM D4218	2.27	2.0	%

Notes:

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

COMPRESSION BEHAVIOR
ASTM D1621

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Compression	ASTM D1621	77	75	%
	1931	Compression	ASTM D1621	75	75	%
	2051	Compression	ASTM D1621	76	75	%

Notes: Compression values indicate % retained at 15,000 psf

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

MASS PER UNIT AREA
ASTM D3776

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Mass/Unit Area	ASTM D3776	24.4	N/A	oz/sy
	1931	Mass/Unit Area	ASTM D3776	24	N/A	oz/sy
	2051	Mass/Unit Area	ASTM D3776	24.1	N/A	oz/sy

Notes:

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

SPECIFIC GRAVITY
ASTM D1505

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Specific Gravity	ASTM D1505	0.946	0.935	
	1931	Specific Gravity	ASTM D1505	0.946	0.935	
	2051	Specific Gravity	ASTM D1505	0.946	0.935	

Notes:

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

MINIMUM THICKNESS
ASTM D751

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2 Geonet	1811	Thickness	ASTM D751	0.210	0.200	in
	1931	Thickness	ASTM D751	0.211	0.200	in
	2051	Thickness	ASTM D751	0.211	0.200	in

Notes:

MANUFACTURING QUALITY CONTROL RESULTS
for the
HANFORD LANDFILL

TRANSMISSIVITY TEST RESULTS
ASTM D4716

NORMAL LOAD: 1,000 psf
HYDRAULIC GRADIENT: 0.31

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax CE-2	1811	Transmissivity	ASTM D4716	2.528 E-03	2.484 E-03	m2/sec
Geonet	1931	Transmissivity	ASTM D4716	2.524 E-03	2.484 E-03	m2/sec
	2051	Transmissivity	ASTM D4716	2.545 E-03	2.484 E-03	m2/sec

Notes:

MANUFACTURING QUALITY CONTROL RESULTS

for the

HANFORD LANDFILL

TRANSMISSIVITY TEST RESULTS

ASTM D4716

NORMAL LOAD: 10,000 psf
HYDRAULIC GRADIENT: 0.01

Submittal Date: 10/26/93

Customer: GeoPacific Lining, Inc.

PRODUCT	ROLL NO.	PROPERTY	TEST METHOD	TEST RESULTS	SPECS	UNITS
Tenax	1811	Transmissivity	ASTM D4716	7.224 E-03	1.656 E-03	m2/sec
CE-2						
Geonet	1931	Transmissivity	ASTM D4716	7.188 E-03	1.656 E-03	m2/sec
	2051	Transmissivity	ASTM D4716	7.248 E-03	1.656 E-03	m2/sec

Notes:

Geotrax Corp.

4800 East Monument Street
Baltimore, Maryland 21205

Office: (410) 522-7000 Order Line: (800) 356-8495
Fax: (410) 522-7015 Waste Mgt: (800) US-GRIDS

November 22, 1993

Mr. Tony Sample
Dellur Industries, Inc.
4333 Tum Access Rd.
Port Angeles, WA 98362

RE: Hanford / TENAX CE-2 Geonet

Dear Mr. Sample:

This letter is to address the discrepancies between the results of the conformance tests performed by the quality assurance consultant for the above referenced project and product and the results provided from our internal quality control program.

It seems that the major concern is that the test results from our internal QC program indicate a specific gravity of 0.946 while the QA consultant's results indicate a specific gravity of 0.940 and 0.941. Since there are many possible causes for variations in a property like specific gravity, it is impossible to determine exactly what caused the discrepancies seen here. However, the most probable causes are inter-laboratory precision and the accuracy of the standard test method. Considering that there are many possible causes of variation, it is not unusual to see the small variation seen here (0.006 and 0.005) between two independent laboratories.

Additionally, there seems to be some concern about the CE-2 geonet's specific gravity relative to the geomembrane's specific gravity. Since two different testing laboratories performed the sensitive specific gravity tests on the CE-2 geonet, it would be most appropriate to consider only the test results produced by one of the laboratories when a comparison of the specific gravity of the geonet to the specific gravity of the geomembrane is necessary. Considering that inter-laboratory precision is a problem with a test like specific gravity, comparing laboratory "A's" geonet specific gravity with laboratory "B's" geomembrane specific gravity would not be the most logical approach. The QA consultant's tests confirm that the geonet's specific gravity (0.940 and 0.941) is less than the geomembrane's specific gravity (0.942 to 0.944). Therefore, there should be no cause for concern about the compatibility of the geonet and the geomembrane.

Mr. Sample, if you have any questions at all, please feel free to contact me. I will be glad to assist you in any way possible.

Sincerely,

Joseph Cavanaugh
Quality Control

APPENDIX G
GEOTEXTILE CONFORMANCE TESTS

APPENDIX G-1
CQA CONFORMANCE TESTS

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES, INC.
 GEOTEXTILE INVENTORY CONTROL RECORD
 DEPARTMENT OF ENERGY
 NON-DRAG OFF LANDFILL FACILITY
 HANDFORD NUCLEAR RESERVATION

933-1354
 05/10/94
 Page: 1

SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Weight (oz/SY)	Tested (Y/N)	Date Sent	Results Received	Test P/F
1	020593	S700	Nicolon	10/04/93	600.	15.0	7.	N			
11	020638	S700	Nicolon	01/12/94	600.	15.0	7.	Y	01/12/94	01/13/94	Fail
11	021889	S700	Nicolon	01/12/94	600.	15.0	7.	N			
11	021893	S700	Nicolon	01/12/94	600.	15.0	7.	N			
1	023507	S700	Nicolon	10/04/93	600.	15.0	7.	N			
1	023525	S700	Nicolon	10/04/93	600.	15.0	7.	N			
1	023526	S700	Nicolon	10/04/93	600.	15.0	7.	Y	10/05/93	10/21/93	Pass
1	023529	S700	Nicolon	10/04/93	600.	15.0	7.	N			
1	025600	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025601	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025603	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025604	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025613	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025615	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025616	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025617	S1600	Nicolon	10/04/93	300.	15.0	16.	Y	10/05/93	10/15/93	Pass
1	025618	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025619	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025620	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025621	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025622	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025623	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025626	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025627	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025628	S1600	Nicolon	10/04/93	300.	15.0	16.	Y	10/05/93	10/15/93	Pass
1	025629	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025630	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025631	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025634	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025636	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025638	S1600	Nicolon	10/04/93	300.	15.0	16.	N			
1	025643	S1600	Nicolon	10/04/93	300.	15.0	16.	Y	10/05/93	10/15/93	Pass
1	025644	S1600	Nicolon	10/04/93	300.	15.0	16.	N			

Square Feet Delivered = 184500.

WHC-SD-W025-RPT-001, Rev. 0

OCTOBER 1993

SUMMARY OF GEOTEXTILE CONFORMANCE TEST RESULTS
DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON

933-1354

ROLL DESIGNATION	3526	5617	5628	5643	0838	-	-	-	-	-
THICKNESS (mils)	101.3	175.4	175.0	185.4	86.1	-	-	-	-	-
ASTM D 1777										
MASS/UNIT AREA (oz/sq yd)	8.1	18.7	18.3	19.5	7.5	-	-	-	-	-
ASTM D 3776										
GRAB STRENGTH (lbs)	256.9	506.8	509.9	552.4	240.8	-	-	-	-	-
MD/TD (1)	245.7	657.0	584.9	744.7	246.6	-	-	-	-	-
ASTM D 4632										
TRAPEZOIDAL TEAR STRENGTH	89.8	145.9	146.3	166.6	83.5	-	-	-	-	-
(lbs) MD/TD (1)	102.4	207.2	196.9	232.1	90.6	-	-	-	-	-
ASTM D 4533										
BURST STRENGTH (psi)	390	916	850	906	405	-	-	-	-	-
ASTM D 3786										
PUNCTURE STRENGTH (lbs)	126.8	288.4	303.2	311.6	129.7	-	-	-	-	-
ASTM D 4833										
APPARENT OPENING SIZE (mm)	0.125	0.075	0.075	0.075	0.121	-	-	-	-	-
(U.S. SIEVE NO.)	120	200	200	200	120	-	-	-	-	-
ASTM D 4751										
PERMITTIVITY (sec-1)	1.25	0.44	0.52	0.50	1.53	-	-	-	-	-
PERMEABILITY (cm/sec) (2)	0.33	0.21	0.24	0.24	0.32	-	-	-	-	-
ASTM D 4491										

(1) MD/TD corresponds to Machine Direction / Transverse Direction.

(2) Permeability calculated by multiplying measured thickness by permittivity.

October 1993				933-1354			
GEOTEXTILE TEST RESULTS							
PROJECT NUMBER: 933-1354							
PROJECT NAME: DOE/NDQ CQA/WA							
ROLL DESIGNATION: 3526							
THICKNESS (mils)		APPARENT OPENING SIZE (mm)		PERMITTIVITY (sec-1)		MASS PER UNIT AREA (oz/sq yd)	
1.	119.4	1.	0.125	1.	1.29	1.	9.24
2.	94.5	2.	0.125	2.	1.39	2.	8.33
3.	124.0	3.	0.125	3.	1.25	3.	9.58
4.	107.3	4.	0.125	4.	1.07	4.	8.53
5.	94.0	5.	0.125			5.	7.52
6.	96.5			AVG	1.25	6.	7.58
7.	92.3	AVG	0.125			7.	6.93
8.	89.8			PERMEABILITY		8.	7.64
9.	95.5	EQUIVALENT		(cm/sec)		9.	7.53
10.	99.2	SIEVE SIZE				10.	8.00
					0.33		
AVG	101.3		120			AVG	8.1
GRAB STRENGTH (pounds)		TRAPEZOIDAL TEAR (pounds)		BURST STRENGTH (lb/sq in)		PUNCTURE STRENGTH (pounds)	
MD	TD	MD	TD				
1.	325.0	271.5	95.1	123.6	470	127.9	
2.	297.2	238.7	81.3	83.5	440	154.8	
3.	269.7	275.5	83.4	85.5	420	141.3	
4.	211.5	188.0	102.2	94.6	340	136.2	
5.	187.0	251.5	91.3	93.0	340	127.1	
6.	221.0	265.0	70.8	86.3	380	109.7	
7.	229.5	217.7	84.8	117.1	340	121.8	
8.	248.7	236.0	80.1	124.2	390	112.9	
9.	230.5	237.7	104.5	97.4	340	129.3	
10.	349.0	275.5	104.8	118.8	440	107.3	
AVG	256.9	245.7	89.8	102.4	390	126.8	

October 1993				933-1354			
GEOTEXTILE TEST RESULTS							
PROJECT NUMBER: 933-1354							
PROJECT NAME: DOE/NDO CQA/WA							
ROLL DESIGNATION: 5617							
THICKNESS (mils)		APPARENT OPENING SIZE (mm)		PERMITTIVITY (sec-1)		MASS PER UNIT AREA (oz/sq yd)	
1.	172.0	1.	0.075	1.	0.40	1.	20.27
2.	183.2	2.	0.075	2.	0.43	2.	18.32
3.	166.0	3.	0.075	3.	0.47	3.	18.24
4.	178.6	4.	0.075	4.	0.44	4.	18.05
5.	169.5	5.	0.075			5.	17.69
6.	163.2	AVG		0.44		6.	15.91
7.	165.5	AVG	0.075	PERMEABILITY		7.	17.99
8.	161.9	EQUIVALENT SIEVE SIZE		(cm/sec)		8.	18.94
9.	199.3					9.	20.53
10.	194.3			0.21		10.	21.24
AVG 175.4		200				AVG 18.7	
GRAB STRENGTH (pounds)		TRAPEZOIDAL TEAR (pounds)		BURST STRENGTH (lb/sq in)		PUNCTURE STRENGTH (pounds)	
MD	TD	MD	TD				
1.	526.5	550.2	150.7	200.6	1040	341.3	
2.	504.2	630.7	156.5	203.8	880	276.6	
3.	584.0	698.5	160.3	190.6	840	280.5	
4.	470.0	663.5	131.0	185.1	840	255.6	
5.	494.5	682.7	106.3	219.1	860	250.2	
6.	389.0	657.7	154.6	210.5	760	221.6	
7.	474.5	713.0	130.0	246.0	850	233.7	
8.	514.7	713.0	155.1	229.8	1120	380.9	
9.	503.2	613.0	165.0	200.1	970	329.7	
10.	607.5	647.2	149.5	186.5	1000	313.7	
AVG 506.8		657.0	145.9		207.2	916	288.4

October 1993		933-1354		
GEOTEXTILE TEST RESULTS				
PROJECT NUMBER: 933-1354				
PROJECT NAME: DOE/NDO CQA/WA				
ROLL DESIGNATION: 5628				
THICKNESS (mils)		APPARENT OPENING SIZE (mm)	PERMITTIVITY (sec-1)	MASS PER UNIT AREA (oz/sq yd)
1.	192.3	1. 0.075	1. 0.48	1. 20.17
2.	176.0	2. 0.075	2. 0.51	2. 18.13
3.	185.8	3. 0.075	3. 0.52	3. 18.59
4.	169.0	4. 0.075	4. 0.56	4. 17.31
5.	160.0	5. 0.075		5. 16.91
6.	184.5		AVG 0.52	6. 19.55
7.	159.2	AVG 0.075		7. 17.25
8.	159.0		PERMEABILITY	8. 17.79
9.	179.0	EQUIVALENT	(cm/sec)	9. 17.79
10.	185.4	SIEVE SIZE	0.24	10. 19.75
AVG	175.0	200		AVG 18.3
GRAB STRENGTH (pounds)		TRAPEZOIDAL TEAR (pounds)		PUNCTURE STRENGTH (pounds)
MD	TD	MD	TD	
1.	593.7 623.5	161.1	189.0	900 317.2
2.	541.7 572.5	142.7	190.0	840 304.2
3.	516.2 531.0	166.5	220.0	850 366.2
4.	491.0 607.0	111.0	183.7	860 308.7
5.	480.2 568.7	133.6	237.5	760 262.5
6.	490.0 624.2	135.7	163.6	880 303.8
7.	456.5 593.2	132.5	224.1	920 285.2
8.	441.2 560.2	150.5	201.3	840 305.2
9.	483.7 566.5	146.2	184.1	800 277.2
10.	605.2 602.2	183.2	175.3	850 302.1
AVG	509.9 584.9	146.3	196.9	850 303.2

October 1993

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: 5643

THICKNESS (mils)	APPARENT OPENING SIZE (mm)	PERMITTIVITY (sec-1)	MASS PER UNIT AREA (oz/sq yd)
1. 193.0	1. 0.075	1. 0.50	1. 20.59
2. 170.3	2. 0.075	2. 0.49	2. 18.70
3. 171.3	3. 0.075	3. 0.47	3. 17.59
4. 178.4	4. 0.075	4. 0.54	4. 17.64
5. 184.8	5. 0.075		5. 20.35
6. 178.9		AVG 0.50	6. 18.73
7. 185.3	AVG 0.075		7. 19.43
8. 191.0		PERMEABILITY	8. 22.11
9. 196.5	EQUIVALENT	(cm/sec)	9. 19.12
10. 204.2	SIEVE SIZE		10. 20.42
		0.24	
AVG 185.4	200		AVG 19.5

GRAB STRENGTH (pounds)	TRAPEZOIDAL TEAR (pounds)	BURST STRENGTH (lb/sq in)	PUNCTURE STRENGTH (pounds)
MD TD	MD TD		
1. 641.2 760.0	192.6 222.1	840	318.0
2. 541.5 792.5	151.5 241.1	920	305.2
3. 491.2 822.5	157.2 201.6	840	289.4
4. 498.5 834.2	139.6 235.8	760	297.6
5. 551.2 764.0	175.0 260.0	1020	317.7
6. 511.0 708.0	143.0 240.0	960	338.8
7. 506.7 670.2	159.2 206.6	960	306.7
8. 579.0 683.0	168.6 247.1	980	311.0
9. 585.5 737.0	190.1 249.0	980	303.1
10. 618.2 675.7	189.6 217.7	800	328.3
AVG 552.4 744.7	166.6 232.1	906	311.6

January 1994

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: 0638

THICKNESS (mils)		APPARENT OPENING SIZE (mm)		PERMITTIVITY (sec-1)		MASS PER UNIT AREA (oz/sq yd)	
1.	89.9	1.	0.125	1.	1.72	1.	7.58
2.	80.0	2.	0.125	2.	1.65	2.	6.69
3.	76.1	3.	0.125	3.	1.59	3.	6.75
4.	83.9	4.	0.125	4.	1.17	4.	6.88
5.	72.5	5.	0.106			5.	6.66
6.	100.0			AVG	1.53	6.	8.35
7.	82.8	AVG	0.121			7.	8.09
8.	90.0			PERMEABILITY		8.	8.04
9.	86.8	EQUIVALENT		(cm/sec)		9.	8.10
10.	99.0	SIEVE SIZE				10.	8.13
					0.32		
AVG	86.1		120			AVG	7.5

GRAB STRENGTH (pounds)		TRAPEZOIDAL TEAR (pounds)		BURST STRENGT (lb/sq in)		PUNCTURE STRENGTH (pounds)	
MD	TD	MD	TD				
1.	244.0	194.5	115.7	72.7	440	94.8	
2.	212.5	289.3	60.5	74.4	280	102.0	
3.	244.5	235.5	66.0	80.1	380	131.9	
4.	208.3	275.5	69.7	89.7	350	127.6	
5.	228.6	194.5	74.7	102.8	370	131.8	
6.	196.7	222.8	78.2	83.3	430	130.3	
7.	235.3	255.5	111.8	116.7	420	134.6	
8.	300.2	262.2	72.8	108.3	490	147.1	
9.	231.1	289.2	76.9	86.4	470	156.8	
10.	306.8	247.0	108.3	91.6	420	139.7	
AVG	240.8	246.6	83.46	90.6	405	129.7	

APPENDIX G-2
MANUFACTURER'S QC DOCUMENTATION

September 14, 1993

Mr. Don Hilderbrand
SLT North America
200 S. Trade Ctr. Pky
Conroe, TX

RE: S700

Project Name : North Hanover D.O.T.

Dear Don:

This is to certify that Nicolon S700 is a 100% polypropylene nonwoven needlepunched fabric. Nicolon S700 is resistant to degradation due to ultraviolet exposure and resists commonly encountered soil chemicals, insects, mildew and is non-biodegradable. Polypropylene is stable within a pH range of 2 to 13. Nicolon S700 conforms to the physical properties listed in the following table.

<u>Fabric Property</u>	<u>Test Method</u>	<u>Units</u>	<u>M.A.R.V.</u>
Weight	ASTM D3776	oz/sq.yd.	7.0
Thickness	ASTM D1777	mls	110
Grab Tensile	ASTM D4632	lbs.	200
Grab Elongation	ASTM D4632	%	50
Trapezoid Tear	ASTM D4533	lbs.	80
Puncture	ASTM D4833	lbs.	115
Mullen Burst	ASTM D3786	psi	400
AOS	ASTM D4751	US Sieve(mm)	70
Permittivity	ASTM D4491	1/sec	1.2
Water Flow Rate	ASTM D4491	gpm/sq.ft.	95
Permeability	ASTM D4491	cm/sec	.38
U.V. Resistance	ASTM D4355	%	70

Note: MARV - Minimum Average Roll Values. These are defined as two (2) standard deviations below the mean and represent a 95% confidence level.

Sincerely,

 A handwritten signature in dark ink, appearing to read "Greg Stales". Below the signature, the name "Greg Stales" and title "Sales Engineer" are printed. At the bottom of the signature block, the initials "/kal" are handwritten.

Greg Stales
Sales Engineer
/kal

September 14, 1993

Mr. Don Hilderbrand
SLT North America
200 S. Trade Cir. Pky
Conroe, TX

RE: S700

Project Name : North Hanover D.O.T.

Dear Don:

This is to certify that Nicolon S1600 is a 100% polypropylene nonwoven needlepunched fabric. Nicolon S1600 is resistant to degradation due to ultraviolet exposure and resists commonly encountered soil chemicals, insects, mildew and is non-biodegradable. Polypropylene is stable within a pH range of 2 to 13. Nicolon S1600 conforms to the physical properties listed in the following table.

<u>Fabric Property</u>	<u>Test Method</u>	<u>Units</u>	<u>M.A.R.V.</u>
Weight	ASTM D3776	oz/sq.yd.	16.0
Thickness	ASTM D1777	mils	183
Grab Tensile	ASTM D4632	lbs.	500
Grab Elongation	ASTM D4632	%	60
Trap Tear Strength	ASTM D4533	lbs.	160
Puncture	ASTM D4833	lbs.	245
Mullen Burst	ASTM D3786	psi	780
Water Flow Rate	ASTM D4491	gal/min/ft ²	35
Permeability	ASTM D4491	cm/sec	.20
Permittivity	ASTM D4491	sec. ⁻¹	.45
U.V. Resistance	ASTM D4355	%	70
	(@ 150 hrs)		
A.O.S.	ASTM D4751	US Sieve	100

Note: MARV: Minimum Average Roll Values. These are defined as two (2) standard deviations below the mean and represent a 95% confidence level.

Sincerely,

A handwritten signature in dark ink, appearing to read "Greg Seales", is written over the printed name.

Greg Seales
Sales Engineer - Environmental

/s/

ATLANTIC THREAD AND SUPPLY CO., INC.

P.O. BOX 11395 • BALTIMORE, MARYLAND 21239

PHONE NO: 410-488-4040

FAX NO: 410-483-4068

October 20, 1993

Mr. Al Haluchek
GEO PACIFIC LINING, INC.
Suite 250
1300 Dexter Avenue, North
Seattle, WA 98109

CERTIFICATION

Dear Mr. Haluchek,

ITEM: POLYPRO, POLYPROPYLENE SEWING THREAD

SIZE: TEX 210

QUANTITY: 14 LBS.

We hereby certify this thread is made of 100% polypropylene fiber and demonstrates the same chemical resistance as the polypropylene fabric being used for this geotextile project.

Very truly yours,

Vincent Diaz
President

VD/pab

THE COMPANY BUILT ON RELIABILITY TECHNOLOGY AND SERVICE

September 30, 1993

RE: NICOLON Style S700
 ORDER # 3005
 QUANTITY: 5000 Sq.Yd.
 SHIP DATE: September 30, 1993
 PROJECT NAME : Handford Waste
 Disposal
 CUSTOMER ORDER #: HT-31938
 JOB #: 8491

Ms. Colleen Murphy
 SLT North America
 200 S. Trade Ctr. Pkwy
 Conroe, TX 77385

Dear Ms. Murphy,

This is to certify that NICOLON S700 is a 100% polypropylene nonwoven needle-punched fabric. NICOLON S700 is resistant to degradation due to ultraviolet exposure and resists commonly encountered soil chemicals, insects, mildew and is non-biodegradable. Polypropylene is stable within a pH range of 2 to 13. NICOLON style S700 conforms to the physical properties listed in the following table:

FABRIC PROPERTY	TEST METHOD	UNITS	M.A.R.V.
Weight	ASTM D3776	oz./sq.yd.	7.0
Thickness	ASTM D1777	mils	110
Grab Tensile	ASTM D4632	lbs.	
- MD			200
- XMD			200
Grab Elongation	ASTM D4632	%	
- MD			50
- XMD			50
Trap Tear	ASTM D4533	lbs.	
- MD			80
- XMD			80
Puncture	ASTM D4833	lbs.	115
Mullen Burst	ASTM D3786	PSI	400
AOS	ASTM D4751	US Std Sieve	70
Permittivity	ASTM D4491	1/sec	1.2
Permeability	ASTM D4491	cm/sec	.38
Flow Rate	ASTM D4491	gpm/sq.ft.	95

Attached are actual test values of rolls in shipment.

Sincerely,

Victor Orr
 Victor Orr
 Quality Control

Sworn and subscribed to before me this 30th day of September, 1993.

Vicki Benfield
 Notary Public Signature

My Commission Expires Aug. 8, 1994

Nicolon Corporation, P.O. Box 1979 - Cleveland Road, Cornelia, Georgia 30531 (706) 778-9794 FAX. (706) 778-2043

933-1354

G-2-4

PAGE 1

10:28:06 30 SEP 1993

ROLL...	STYLE.	ACTUAL THICK	GRAB...	GRAB...	GRAB.	GRAB.	TRAP	TRAP.	PUNC	BURST	AOS	PERMIT	PERMEA	FLOW.
		WEIGHT	HES	TENSILE	TENSILE	ELONG	ELONG	TEAR	TEAR	TURE		TIVITY	BILITY	RATE
				MACH	XMACH	MACH	XMACH	MACH	XMACH					
				DIR	DIR	DIR	DIR	DIR	DIR					

020593	S700	7.8	131	225	245	61	69	94	112	144	481	120	1.648	.568	128
023507	S700	9.1	144	252	264	89	99	107	162	132	430	100	1.730	.633	134
023525	S700	8.2	136	250	235	77	64	145	145	135	451	100	1.768	.651	137
023526	S700	8.1	136	250	235	77	64	145	145	135	451	100	1.768	.651	137
023529	S700	7.8	136	250	235	77	64	145	145	135	451	100	1.768	.651	137

5 Rows Processed

September 30, 1993

RE: NICOLON Style S1600
 ORDER # 3005
 QUANTITY: 12500 Sq.Yd.
 SHIP DATE: September 30, 1993
 PROJECT NAME : Handford Waste
 Disposal
 CUSTOMER ORDER #: HT-31938
 JOB #: 8491

Ms. Colleen Murphy
 SLT North America
 200 S. Trade Ctr. Pkwy.
 Conroe, TX 77385

Dear Ms. Murphy,

This is to certify that NICOLON S1600 is a 100% polypropylene nonwoven needle-punched fabric. NICOLON S1600 is resistant to degradation due to ultraviolet exposure and resists commonly encountered soil chemicals, insects, mildew and is non-biodegradable. Polypropylene is stable within a pH range of 2 to 13. NICOLON style S1600 conforms to the physical properties listed in the following table:

FABRIC PROPERTY	TEST METHOD	UNITS	M.A.R.V.
Weight	ASTM D3776	oz./sq.yd.	16.0
Thickness	ASTM D1777	mils	185
Grab Tensile	ASTM D4632	lbs.	
- MD			500
- XMD			500
Grab Elongation	ASTM D4632	%	
- MD			60
- XMD			60
Trap Tear	ASTM D4533	lbs.	
- MD			160
- XMD			160
Puncture	ASTM D4833	lbs.	245
Mullen Burst	ASTM D3786	PSI	780
AOS	ASTM D4751	US Std Sieve	100
Permittivity	ASTM D4491	1/sec	.45
Permeability	ASTM D4491	cm/sec	.20
Flow Rate	ASTM D4491	gpm/sq.ft.	35

Attached are actual test values of rolls in shipment.

Sincerely,

Marshall O. Gaddy
 Quality Control Manager

Sworn and subscribed to before me this 30th day of September, 1993.

Notary Public Signature

My Commission Expires Aug. 8, 1994

Nicolon Corporation, P.O. Box 1979 - Cleveland Road, Cornelia, Georgia 30531 (706) 778-9794 FAX. (706) 778-2048

933-1354

G-2-6

WHC-SD-W025-RPT-001, Rev. 0

PAGE 1

10:39:55 30 SEP 1993

RM	STYLE	ACTUAL THICK	GRAB...	GRAB...	GRAB...	GRAB...	TRAP	TRAP...	PUNC	BURST	AOS	PERMIT	PERMEA	FLOW...
		WEIGHT	NESS	TENSILE	TENSILE	ELONG	ELONG	TEAR	TEAR	TURE		TIVITY	BILITY	RATE
				MACH	XMACH	MACH	XMACH	MACH	XMACH					
				DIR	DIR	DIR	DIR	DIR	DIR					

025600	S1600	17.1	194	515	658	97	102	205	281	261	783	200	.664	.327	52
025601	S1600	17.9	194	515	658	97	102	205	281	261	783	200	.664	.327	52
025603	S1600	21.5	194	515	658	97	102	205	281	261	783	200	.664	.327	52
025604	S1600	17.0	194	515	658	97	102	205	281	261	783	200	.664	.327	52
025613	S1600	19.9	195	515	658	97	102	256	269	251	824	200	.664	.327	52
025615	S1600	19.0	195	515	658	97	102	256	269	251	824	200	.664	.327	52
025616	S1600	20.8	195	515	658	97	102	256	269	251	824	200	.664	.327	52
025617	S1600	20.8	195	515	658	97	102	256	269	251	824	200	.664	.327	52
025618	S1600	17.3	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025619	S1600	17.3	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025620	S1600	20.8	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025621	S1600	20.8	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025622	S1600	16.7	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025623	S1600	16.7	198	523	700	97	117	166	248	275	863	200	.562	.283	44
025626	S1600	17.5	198	523	700	97	117	169	260	275	854	200	.562	.283	44
025627	S1600	17.5	198	523	700	97	117	169	260	275	854	200	.562	.283	44
025628	S1600	18.0	198	523	700	97	117	169	260	275	854	200	.562	.283	44
025629	S1600	18.0	198	523	700	97	117	169	260	275	854	200	.562	.283	44
025630	S1600	17.2	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025631	S1600	17.2	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025634	S1600	16.4	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025636	S1600	16.9	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025638	S1600	16.9	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025643	S1600	16.8	212	507	675	102	114	186	271	262	847	200	.654	.352	51
025644	S1600	17.2	212	507	675	102	114	186	271	262	847	200	.654	.352	51

is Processed

February 10, 1994

RE: NICOLON Style S700
 QUANTITY: 3,000 Sq. Yds.

Ms. Erin Huitt
 SLT North America
 200 S. Trade Ctr. Pkwy.
 Conroe, TX 77385

Dear Ms. Huitt,

This is to certify that Nicolon S700 is a 100% polypropylene nonwoven needle-punched fabric. Nicolon S700 is resistant to degradation due to ultraviolet exposure and resists commonly encountered soil chemicals, insects, mildew and is non-bio-degradable. Polypropylene is stable within a pH range of 2 to 13. Nicolon style S700 conforms to the physical properties listed in the following table:

FABRIC PROPERTY	TEST METHOD	UNITS	M.A.R.V.
Weight	ASTM D3776	oz./sq.yd.	7.0
Thickness	ASTM D1777	mils	110
Grab Tensile	ASTM D4632	lbs.	
- MD			200
- XMD			200
Grab Elongation	ASTM D4632		
- MD			50
- XMD			50
Trap Tear	ASTM D4533	lbs.	
- MD			80
- XMD			80
Puncture	ASTM D4833	lbs.	115
Burst	ASTM D3736	PSI	400
AOS	ASTM D4751	US Std Sieve	70
Permittivity	ASTM D4491	1/sec	1.2
Permeability	ASTM D4491	cm/sec	.38
Flow Rate	ASTM D4491	gpm/sq.ft.	95

Attached are actual test values of rolls in shipments.

Sincerely,

Marshall Gaddy
 Marshall Gaddy
 Quality Control Manager

Sworn and subscribed to before me this 10th day of February, 1994.

James W. Perry
 Notary Public Signature

My Commission Expires Sept. 26, 1996

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ROLL NO	STYLE	ACTUAL..	THICK	GRAB...	GRAB...	GRAB.	GRAB.	TRAP	TRAP.	PUNC	BURST	AOS	PERMIT	PERMEA	FLOW.
		WEIGHT	NESS	TENSILE	TENSILE	ELONG	ELONG	TEAR	TEAR	TURE			TIVITY	BILITY	RATE
				MACH	XMACH	MACH	XMACH	MACH	XMACH						
				DIR	DIR	DIR	DIR	DIR	DIR						
020638	S700	7.7	137	245	276	69	76	105	96	141	453	120	1.747	.489	136
021889	S700	9.1	141	274	344	72	73	99	99	148	424	100	1.592	.570	122
021893	S700	8.4	136	237	281	74	76	99	99	132	424	100	1.726	.596	133

3 Rows Processed

APPENDIX H
GEOCOMPOSITE CONFORMANCE TESTS

APPENDIX H-1
CQA CONFORMANCE TESTS

OCTOBER 1993

**GEOCOMPOSITE
PRE-MANUFACTURING TEST
SUMMARY OF GEOTEXTILE
CONFORMANCE TEST RESULTS**

933-1354

**DEPARTMENT OF ENERGY
NON DRAG-OFF CQA
WASHINGTON**

ROLL DESIGNATION	S-700	-	-	-	-	-	-	-	-	-	-
APPARENT OPENING SIZE (mm)	0.140	-	-	-	-	-	-	-	-	-	-
(U.S. SIEVE NO.)	100	-	-	-	-	-	-	-	-	-	-
ASTM D 4751											

(1) MD/TD corresponds to Machine Direction / Transverse Direction.

(2) Permeability calculated by multiplying measured thickness by permittivity.

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GOLDER CONSTRUCTION SERVICES, INC.
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HANDFORD NUCLEAR RESERVATION

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SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Thick (mil)	Tested (Y/N)	Date Sent	Results Received	Test P/F (1)
11	31832AB	GS228	SLT	01/12/94	289.	7.5	220.	N			
11	38742AB	GS228	SLT	01/12/94	299.	7.5	220.	N			
11	40382AB	GS228	SLT	01/12/94	211.	7.5	220.	N			
11	46892ABA	GS228	SLT	01/12/94	290.	7.5	220.	N			
11	51642ABA	GS228	SLT	01/12/94	294.	7.5	220.	Y	01/12/94	01/18/94	Pass
11	62122AB	GS228	SLT	01/12/94	291.	7.5	220.	N			
8	64742ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	64742ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			
11	68302AB	GS228	SLT	01/12/94	143.	7.5	220.	N			
6	68372ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68372ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68372ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68372ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68372ABE	GS228	SLT	11/08/93	271.	7.5	220.	N			
6	68442ABA	GS228	SLT	11/08/93	250.	7.5	220.	N			
6	68442ABB	GS228	SLT	11/08/93	300.	7.5	220.	Y	11/09/93	11/15/93	Pass
6	68442ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68442ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	68442ABE	GS228	SLT	11/08/93	363.	7.5	220.	N			
11	68842AB	GS228	SLT	01/12/94	287.	7.5	220.	N			
11	68902AB	GS228	SLT	01/12/94	296.	7.5	220.	N			
11	68922AB	GS228	SLT	01/12/94	164.	7.5	220.	N			
11	68942AB	GS228	SLT	01/12/94	290.	7.5	220.	N			
11	68972AB	GS228	SLT	01/12/94	345.	7.5	220.	N			
6	70142ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70142ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70142ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70142ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70142ABE	GS228	SLT	11/08/93	296.	7.5	220.	N			
8	70172ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			
6	70172ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70172ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70172ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	70172ABE	GS228	SLT	11/08/93	280.	7.5	220.	N			
8	70242ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70242ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70242ABC	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70242ABD	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70242ABE	GS228	SLT	11/10/93	270.	7.5	220.	N			
8	70602ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70602ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	70602ABC	GS228	SLT	11/10/93	120.	7.5	220.	N			
9	70732AB	GS228	SLT	11/12/93	287.	7.6	220.	N			REJ

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SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Thick (mil)	Tested (Y/N)	Date Sent	Results Received	Test P/F (1)
8	71252ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			REJ
8	71252ABB	GS228	SLT	11/10/93	229.	7.5	220.	N			
8	71512AB	GS228	SLT	11/10/93	280.	7.5	220.	N			
6	72222ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	72222ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
8	72222ABC	GS228	SLT	11/10/93	300.	7.5	220.	N			
6	72222ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	72222ABE	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	72352ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	72352ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	72352ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	72352ABD	GS228	SLT	11/08/93	300.	7.5	220.	Y	11/09/93	11/16/93	Pass
7	72352ABE	GS228	SLT	11/08/93	115.	7.5	220.	N			
7	72352ABF	GS228	SLT	11/08/93	135.	7.5	220.	N			
9	72522AB	GS228	SLT	11/12/93	290.	7.5	220.	N			
8	72572AB	GS228	SLT	11/10/93	293.	7.5	220.	N			
9	72682AB	GS228	SLT	11/12/93	288.	7.5	220.	N			
8	72852ABA	GS228	SLT	11/10/93	280.	7.5	220.	N			
8	72892AB	GS228	SLT	11/10/93	185.	7.5	220.	N			
8	72932ABA	GS228	SLT	11/10/93	276.	7.5	220.	N			
8	73402AB	GS228	SLT	11/10/93	275.	7.5	220.	N			
8	73412AB	GS228	SLT	11/10/93	273.	7.5	220.	N			
8	73422ABB	GS228	SLT	11/10/93	200.	7.5	220.	N			
9	73452AB	GS228	SLT	11/12/93	302.	7.6	220.	N			
8	73512ABB	GS228	SLT	11/10/93	275.	7.5	220.	N			
6	73802ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	73802ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	73802ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	73822ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	73822ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	73822ABC	GS228	SLT	11/08/93	335.	7.5	220.	N			
9	73832ABB	GS228	SLT	11/12/93	300.	7.5	220.	Y	11/13/93	11/17/93	Pass
9	73832ABC	GS228	SLT	11/12/93	300.	7.5	220.	N			
8	73832ABD	GS228	SLT	11/10/93	147.	7.5	220.	N			
7	74272ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74272ABB	GS228	SLT	11/08/93	240.	7.5	220.	N			
7	74282ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74282ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74282ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74282ABD	GS228	SLT	11/08/93	370.	7.5	220.	N			
7	74292ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
8	74292ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	74292ABC	GS228	SLT	11/10/93	300.	7.5	220.	N			
6	74292ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			

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SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Thick (mil)	Tested (Y/N)	Date Sent	Results Received	Test P/F (1)
7	74292ABE	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74302ABA	GS228	SLT	11/08/93	250.	7.5	220.	N			
7	74302ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74302ABC	GS228	SLT	11/08/93	300.	7.5	220.	F	11/09/93	11/16/93	Pass
7	74302ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74302ABE	GS228	SLT	11/08/93	294.	7.5	220.	N			
6	74312ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74312ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74312ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	74312ABD	GS228	SLT	11/08/93	300.	7.5	220.	F	11/09/93	11/16/93	Pass
6	74312ABE	GS228	SLT	11/08/93	287.	7.5	220.	N			
7	74322ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74322ABB	GS228	SLT	11/08/93	300.	7.5	220.	Y	11/09/93	11/16/93	Pass
7	74322ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74322ABD	GS228	SLT	11/08/93	270.	7.5	220.	N			
7	74322ABE	GS228	SLT	11/08/93	350.	7.5	220.	N			
7	74332ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74332ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74332ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74332ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74332ABE	GS228	SLT	11/08/93	324.	7.5	220.	N			
9	74342ABA	GS228	SLT	11/12/93	300.	7.5	220.	N			
6	74342ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74342ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74342ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	74352ABA	GS228	SLT	11/08/93	300.	7.5	220.	Y	11/09/93	11/16/93	Pass
6	74352ABB	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74352ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	74352ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
9	74352ABE	GS228	SLT	11/12/93	335.	7.5	220.	N			
9	74362ABA	GS228	SLT	11/12/93	300.	7.5	220.	N			
9	74362ABB	GS228	SLT	11/12/93	300.	7.5	220.	N			
9	74362ABC	GS228	SLT	11/12/93	300.	7.5	220.	N			
6	74362ABD	GS228	SLT	11/08/93	300.	7.5	220.	N			
6	74362ABE	GS228	SLT	11/08/93	334.	7.5	220.	N			
8	74832ABA	GS228	SLT	11/10/93	115.	7.5	220.	N			
9	74832ABB	GS228	SLT	11/12/93	300.	7.5	220.	N			
6	74832ABC	GS228	SLT	11/08/93	300.	7.5	220.	N			
9	74832ABD	GS228	SLT	11/12/93	300.	7.5	220.	N			
8	74832ABE	GS228	SLT	11/10/93	300.	7.5	220.	N			
7	74832ABF	GS228	SLT	11/08/93	220.	7.5	220.	N			
7	74852ABA	GS228	SLT	11/08/93	300.	7.5	220.	N			
7	74852ABB	GS228	SLT	11/08/93	235.	7.5	220.	N			
8	74862ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			

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SHIPMENT NUMBER	ROLL NUMBER	BATCH NUMBER	MANUFACTURER	DATE OF INVENTORY	ROLL DIMENTIONS			CONFORMANCE TEST INFORMATION			
					Length (ft)	Width (ft)	Thick (mil)	Tested (Y/N)	Date Sent	Results Received	Test P/F (1)
8	74862ABB	GS228	SLT	11/10/93	352.	7.5	220.	N			REJ
8	74872ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			REJ
8	74872ABC	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	74872ABD	GS228	SLT	11/10/93	215.	7.5	220.	N			
9	74882ABA	GS228	SLT	11/12/93	300.	7.5	220.	N			
8	74882ABB	GS228	SLT	11/10/93	62.	7.5	220.	N			
8	74892ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	74892ABB	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	74892ABC	GS228	SLT	11/10/93	300.	7.5	220.	N			
8	74892ABD	GS228	SLT	11/10/93	371.	7.5	220.	N			REJ
8	74902ABC	GS228	SLT	11/10/93	280.	7.5	220.	N			REJ
8	74902ABD	GS228	SLT	11/10/93	100.	7.5	220.	N			REJ
8	74912ABA	GS228	SLT	11/10/93	300.	7.5	220.	N			REJ
8	74912ABB	GS228	SLT	11/10/93	140.	7.5	220.	Y	11/13/93	11/17/93	Pass
8	74912ABC	GS228	SLT	11/10/93	50.	7.5	220.	N			
8	74912ABD	GS228	SLT	11/10/93	233.	7.5	220.	N			
9	74922ABA	GS228	SLT	11/12/93	300.	7.5	220.	N			
9	74922ABB	GS228	SLT	11/12/93	304.	7.5	220.	N			
11	77782ABA	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	77782ABB	GS228	SLT	01/12/94	210.	7.5	220.	N			
11	77782ABC	GS228	SLT	01/12/94	93.	7.5	220.	N			
11	80082ABA	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	80082ABB	GS228	SLT	01/12/94	197.	7.5	220.	N			
11	80082ABC	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	80082ABD	GS228	SLT	01/12/94	300.	7.5	220.	Y	01/12/94	01/18/94	Pass
11	80082ABE	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	80082ABF	GS228	SLT	01/12/94	127.	7.5	220.	N			
11	80132ABA	GS228	SLT	01/12/94	285.	7.5	220.	N			
11	80132ABB	GS228	SLT	01/12/94	379.	7.5	220.	N			
11	82572ABA	GS228	SLT	01/12/94	289.	7.5	220.	N			
11	82822AB	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	83532AB	GS228	SLT	01/12/94	192.	7.5	220.	N			
11	83632AB	GS228	SLT	01/12/94	283.	7.5	220.	N			
11	83652AB	GS228	SLT	01/12/94	290.	7.5	220.	N			
11	83972AB	GS228	SLT	01/12/94	287.	7.5	220.	N			
11	83982AB	GS228	SLT	01/12/94	344.	7.5	220.	N			
11	83982ABB	GS228	SLT	01/12/94	300.	7.5	220.	N			
11	83982ABD	GS228	SLT	01/12/94	400.	7.5	220.	N			

Square Feet Delivered = 355686.9

NOTES

- =====
- (1) TEST P/F note of "REJ" indicates a roll of material which was rejected and removed from the site because the Manufacturer's QC test data indicated that the material did not meet the manufacturer's specifications.

NOVEMBER 1993

933-1354

<p align="center"> GEOCOMPOSITE SUMMARY OF GEOTEXTILE CONFORMANCE TEST RESULTS DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON </p>

ROLL DESIGNATION	6844B Top	6844B Bottom	7235D Top	7235D Bottom	7432B Top	7432B Bottom	7435A Top	7435A Bottom	7383B Top	7383B Bottom	7491B Top	7491B Bottom
APPARENT OPENING SIZE (mm)	0.130	0.125	0.157	0.150	0.140	0.117	0.140	0.125	0.156	0.125	0.140	0.125
(U.S. SIEVE NO.)	100	120	80	100	100	120	100	120	80	120	100	120
ASTM D 4751												

JANUARY 1994

933-1354

<p>GEOCOMPOSITE SUMMARY OF GEOTEXTILE CONFORMANCE TEST RESULTS</p>
<p>DEPARTMENT OF ENERGY NON DRAG-OFF CQA WASHINGTON</p>

ROLL	5164	5164	8008	8008	-	-	-	-	-	-	-	-
DESIGNATION	Top	Bottom	Top	Bottom	-	-	-	-	-	-	-	-
APPARENT OPENING SIZE (mm)	0.106	0.117	0.117	0.106	-	-	-	-	-	-	-	-
(U.S. SIEVE NO.)	140	120	120	140	-	-	-	-	-	-	-	-
ASTM D 4751												

October 1993

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NAME: DOE/NDO CQA/WA

PROJECT NUMBER: 933-1354

ROLL DESIGNATION: S-700

APPARENT
OPENING

SIZE

(mm)

1.	0.150
2.	0.150
3.	0.125
4.	0.150
5.	0.125

AVG 0.140

EQUIVALENT
SIEVE SIZE

100

ROLL DESIGNATION:

APPARENT
OPENING

SIZE

(mm)

1.	-
2.	-
3.	-
4.	-
5.	-

AVG 0.000

EQUIVALENT
SIEVE SIZE

-

November 1993

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: 6844B TOP

APPARENT
OPENING
SIZE
(MM)

1.	0.150
2.	0.125
3.	0.125
4.	0.125
5.	0.125

AVG 0.130EQUIVALENT
SIEVE SIZE100

ROLL DESIGNATION: 6844B BOTTOM

APPARENT
OPENING
SIZE
(MM)

1.	0.125
2.	0.125
3.	0.125
4.	0.125
5.	0.125

AVG 0.125EQUIVALENT
SIEVE SIZE120

ROLL DESIGNATION: 7235D TOP

APPARENT
OPENING
SIZE
(MM)

1.	0.150
2.	0.125
3.	0.150
4.	0.180
5.	0.180

AVG 0.157EQUIVALENT
SIEVE SIZE80

ROLL DESIGNATION: 7235D BOTTOM

APPARENT
OPENING
SIZE
(MM)

1.	0.150
2.	0.150
3.	0.150
4.	0.150
5.	0.150

AVG 0.150EQUIVALENT
SIEVE SIZE100

November 1993

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: 7432B TOP

APPARENT
OPENING
SIZE
(MM)

1. 0.125
2. 0.150
3. 0.125
4. 0.150
5. 0.150

AVG 0.140

EQUIVALENT
SIEVE SIZE

100

ROLL DESIGNATION: 7432B BOTTOM

APPARENT
OPENING
SIZE
(MM)

1. 0.125
2. 0.125
3. 0.106
4. 0.125
5. 0.106

AVG 0.117

EQUIVALENT
SIEVE SIZE

120

ROLL DESIGNATION: 7435A TOP

APPARENT
OPENING
SIZE
(MM)

1. 0.150
2. 0.125
3. 0.150
4. 0.125
5. 0.150

AVG 0.140

EQUIVALENT
SIEVE SIZE

100

ROLL DESIGNATION: 7435A BOTTOM

APPARENT
OPENING
SIZE
(MM)

1. 0.125
2. 0.125
3. 0.125
4. 0.125
5. 0.125

AVG 0.125

EQUIVALENT
SIEVE SIZE

120

November 1993

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDO CQA/WA

ROLL DESIGNATION: 7383B TOP

APPARENT
OPENING
SIZE
(MM)

1. 0.150
2. 0.180
3. 0.150
4. 0.150
5. 0.150

AVG 0.156

EQUIVALENT
SIEVE SIZE

80

ROLL DESIGNATION: 7383B BOTTOM

APPARENT
OPENING
SIZE
(MM)

1. 0.125
2. 0.125
3. 0.125
4. 0.125
5. 0.125

AVG 0.125

EQUIVALENT
SIEVE SIZE

120

ROLL DESIGNATION: 7491B TOP

APPARENT
OPENING
SIZE
(MM)

1. ~~0.150~~
2. 0.150
3. 0.150
4. 0.125
5. 0.125

AVG 0.140

EQUIVALENT
SIEVE SIZE

100

ROLL DESIGNATION: 7491B BOTTOM

APPARENT
OPENING
SIZE
(MM)

1. 0.125
2. 0.125
3. 0.125
4. 0.125
5. 0.125

AVG 0.125

EQUIVALENT
SIEVE SIZE

120

January 1994

933-1354

GEOTEXTILE TEST RESULTS

PROJECT NUMBER: 933-1354

PROJECT NAME: DOE/NDQ CQA/WA

ROLL DESIGNATION: 5164 TOP

APPARENT
OPENING
SIZE
(MM)

1.	0.106
2.	0.106
3.	0.106
4.	0.106
5.	0.106

AVG 0.106

EQUIVALENT
SIEVE SIZE

140

ROLL DESIGNATION: 5164 BOTTOM

APPARENT
OPENING
SIZE
(MM)

1.	0.106
2.	0.125
3.	0.106
4.	0.125
5.	0.125

AVG 0.117

EQUIVALENT
SIEVE SIZE

120

ROLL DESIGNATION: 8008 TOP

APPARENT
OPENING
SIZE
(MM)

1.	0.125
2.	0.125
3.	0.106
4.	0.125
5.	0.106

AVG 0.117

EQUIVALENT
SIEVE SIZE

120

ROLL DESIGNATION: 8008 BOTTOM

APPARENT
OPENING
SIZE
(MM)

1.	0.106
2.	0.106
3.	0.106
4.	0.106
5.	0.106

AVG 0.106

EQUIVALENT
SIEVE SIZE

140

7017 Farrell Road S.E.
Calgary, Alberta, T2H-0T3
Telephone: 1-(403)-259-4280
Facsimile: 1-(403)-253-1715

FAX TRANSMITTAL

November 16, 1993 Ref. No. 932-2610

To: Cliff Knitter fax no. 1 (206) 882-5498

Fr: Gord Guest / Dave Horsfield / Thanh Lam

RE: TEST RESULTS TO DATE

MESSAGE:

Attached please find the results of the geocomposite roll 7431D - textured HDPE roll 6916 and geocomposite roll 7430C - textured HDPE roll 6898 interface friction tests completed to date. Detailed stress - deformation plots for each of the groups of 3 tests is provided along with peak and residual shear strength envelope summary.

In each of the series the test results are in good agreement with one-another. All tests showed an initial peak in the shear stress, occurring at within 0.4 inches of displacement. Post peak softening was rapid with all three results in each series tending toward a stable large strain (or residual) shear strength beyond horizontal displacements of 1.5 inches. The peak and residual shear strength envelopes are defined as follows:

geocomposite 7430C / HDPE 6898

- peak friction angle 40°, cohesion 0.6 psi
- residual friction angle 18°, cohesion 0.6 psi

geocomposite 7431D / HDPE 6916

- peak friction angle 34°, cohesion 1.2 psi
- residual friction angle 18°, cohesion 0.7 psi

We have completed both of the soil - geocomposites series of tests and expect to have the results to you this afternoon.

If you have any questions or further requirements please give us a call.

Regards,

TRANSMITTED
Date: _____
Time: _____
Pages: _____ Page 1
H-1-14

GEOCOMPOSITE ROLL 7431D/
TEXTURED HDPE ROLL 6916

Figure

PROJECT No. 932-2610 DRAWN GTS/LL REVIEWED DATE 16 NOV 1993

Golder Associates

Figure

Direct Shear Test

Test Number	: GC6916-2
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.43 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.36 in
Normal Stress	: 1.39 psi
Dry Density	: 0 pcf
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6916/
	: GEODCOMPOSITE ROLL 7431D
Test Description	: FRICTION INTERFACE
	: ac

Golder Associates

Figure

Direct Shear Test

Test Number	: GC6916-4
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.48 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.36 in
Normal Stress	: 2.78 psi
Dry Density	: 0 pct
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6916/
	: GEOCOMPOSITE ROLL 7431D
Test Description	: FRICTION INTERFACE
	: ac

Golder Associates

Figure

Direct Shear Test

Test Number	: GC6916-6
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.25 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.35 in
Normal Stress	: 4.17 psi
Dry Density	: 0 pcf
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6916/ : GEOCOMPOSITE ROLL 7431D
Test Description	: FRICTION INTERFACE : ac

Goldier Associates

GEOCOMPOSITE ROLL 7430C/
TEXTURED HDPE ROLL 6898

Figure

Golder Associates

Figure

Direct Shear Test

Test Number	: GC6896-2
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.34 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.38 in
Normal Stress	: 1.39 psi
Dry Density	: 0 pcf
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6888/ : GEOCOMPOSITE ROLL 7430C
Test Description	: FRICTION INTERFACE : ac

Goldier Associates

Figure

Direct Shear Test

Test Number	: GC6898-4
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.4 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.36 in
Normal Stress	: 2.78 psi
Dry Density	: 0 pcf
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6898/
	: GEOCOMPOSITE ROLL 7430C
Test Description	: FRICTION INTERFACE
	: ac

Goldor Associates

Figure

Direct Shear Test

Test Number	: GC6898-6
Test Date	: 12 NOV 93
Shear Disp. Rate	: 2.45 in/hr
Sample Area	: 144 sq in
Sample Height	: 0.36 in
Normal Stress	: 4.17 psf
Dry Density	: 0 pcf
Moisture Content	: 0 %
Sample Description	: GEOMEMBRANE ROLL AC6898/ : GEOCOMPOSITE ROLL 7430C
Test Description	: FRICTION INTERFACE : SC

Golder Associates

GRANULAR SOIL/GEOCOMPOSITE ROLL 7431D

Figure 6

CHECK PRINT

PROJECT No. 932-261D DRAWN GTC/TL REVIEWED DATE 18 NOV 1993

Golder Associates

Figure

Direct Shear Test

Test Number	: 807431D-2
Test Date	: 13 NOV 93
Shear Disp. Rate	: 2.22 in/hr
Sample Area	: 144 sq in
Sample Height	: 8 in
Normal Stress	: 1.28 psi
Dry Density	: 100 pcf
Moisture Content	: 0 %
Sample Description	: GRANULAR FILL SOIL/ BEDCOMPOSITE ROLL 7431D
Test Description	: INTERFACE FRICTION SAMPLE SUBMERGED

Golder Associates

Figure

Direct Shear Test

Test Number	: 8C74310-4
Test Date	: 13 NOV 93
Shear Disp. Rate	: 2.24 in/hr
Sample Area	: 144 sq in
Sample Height	: 6 in
Normal Stress	: 2.78 psi
Dry Density	: 100 pcf
Moisture Content	: 0 %
Sample Description	: GRANULAR FILL SOIL/ : GEOCOMPOSITE ROLL 74310
Test Description	: INTERFACE FRICTION : SAMPLE SUBMERGED

Golder Associates

Figure

Direct Shear Test

Test Number	: GC74310-BA
Test Date	: 17 NOV 93
Shear Disp. Rate	: 2.45 in/hr
Sample Area	: 144 sq in
Sample Height	: 8 in
Normal Stress	: 4.17 psi
Dry Density	: 100 pcf
Moisture Content	: 0 %
Sample Description	: GRANULAR FILL/ : GEOCOMPOSITE ROLL 74310
Test Description	: INTERFACE FRICTION : SAMPLE SUBMERGED

Golden Associates

GRANULAR SOIL/GEOCOMPOSITE ROLL 7430C

Figure 7

PROJECT No. 932-2810 DRAWN GTD/TL REVIEWED DATE 16 NOV 1993

Golder Associates

APPENDIX H-2
MANUFACTURER'S QC DOCUMENTATION

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

Doe Hanford
Radioactive Waste WHC-S-045 Rev 2
Specification Review
Section 02275
Geosynthetic Transmission Media

B. Specific Geosynthetic Transmission Media Properties

1. SLT's GS-228 will meet or exceed the properties shown on pp. 33.
2. Type A Fabric, Nicolon S-700 has been approved.
3. The individual product properties which make up the geocomposite will meet the values specified or previously approved as separate products.
4. SLT will provide material for direct shear testing. However, a frictional value of 27.5° cannot be certified without the tests being performed.
- 5 & 6. SLT will provide test results and or certification to the specified or previously approved materials.
7. Yes.

All other items, as spelled out in this section, as related to the geonet, geotextile and geocomposite are acceptable.

The properties of the net as a single product and the properties of the fabric as a single product make up the geocomposite. The only additional property used for geocomposite performance is Fly Adhesion. The SLT 7 oz. composite will exhibit a Fly Adhesion in accordance with ASTM F904, 2" x 8" @ 2 ipm of 1.0 pounds/inch average.

For environmental lining solutions...the world comes to SLT.™

NORTH AMERICA, INC.

A SUBSIDIARY OF
SLT ENVIRONMENTAL, INC.

250 SOUTH TRADE CENTER PARKWAY
CORRAL, TEXAS 77025

TEL: (713) 315-1611
SALES FAX: (800) 278-2206
ADMIN. FAX: (409) 278-2474

December 6, 1993

GeoPacific Lining, Inc.
1300 Dexter Ave. N. # 250
Seattle, Wash. 98109

Attn: ☒ Haluschak

RE: D.O.E Hanford Radioactive Waste
SLT Project No. 2491

Certification

The undersigned, being qualified and authorized to do so, hereby certifies that the SLT HyperNet® GS228 for the above referenced project will meet or exceed the minimum specifications as listed on page 02275-11 of the customer specifications, with the exception of the footnote (1). The specific gravity of the resin used to manufacture SLT HyperNet® will sometimes exceed that of the resin used to manufacture SLT HyperFlex® geomembrane.

Melody A. Adams
Engineer

001231

MAA:ma

For environmental lining solutions...the world comes to SLT.®

Geotrax Corp.

4800 East Monument Street
Baltimore, Maryland 21205

Office: (410) 522-7000 Order Line: (800) 356-8495
Fax: (410) 522-7015 Waste Mgt: (800) US-GRIDS

November 22, 1993

Mr. Tony Sample
Delhur Industries, Inc.
4333 Tum Access Rd.
Port Angeles, WA 98362

RE: Hanford / TENAX CE-2 Geonet

Dear Mr. Sample:

This letter is to address the discrepancies between the results of the conformance tests performed by the quality assurance consultant for the above referenced project and product and the results provided from our internal quality control program.

It seems that the major concern is that the test results from our internal QC program indicate a specific gravity of 0.946 while the QA consultant's results indicate a specific gravity of 0.940 and 0.941. Since there are many possible causes for variations in a property like specific gravity, it is impossible to determine exactly what caused the discrepancies seen here. However, the most probable causes are inter-laboratory precision and the accuracy of the standard test method. Considering that there are many possible causes of variation, it is not unusual to see the small variation seen here (0.006 and 0.005) between two independent laboratories.

Additionally, there seems to be some concern about the CE-2 geonet's specific gravity relative to the geomembrane's specific gravity. Since two different testing laboratories performed the sensitive specific gravity tests on the CE-2 geonet, it would be most appropriate to consider only the test results produced by one of the laboratories when a comparison of the specific gravity of the geonet to the specific gravity of the geomembrane is necessary. Considering that inter-laboratory precision is a problem with a test like specific gravity, comparing laboratory "A's" geonet specific gravity with laboratory "B's" geomembrane specific gravity would not be the most logical approach. The QA consultant's tests confirm that the geonet's specific gravity (0.940 and 0.941) is less than the geomembrane's specific gravity (0.942 to 0.944). Therefore, there should be no cause for concern about the compatibility of the geonet and the geomembrane.

Mr. Sample, if you have any questions at all, please feel free to contact me. I will be glad to assist you in any way possible.

Sincerely,

A handwritten signature in black ink, appearing to read "Joseph Cavanaugh".

Joseph Cavanaugh
Quality Control

ENVIRONMENTAL, INC.

200 SOUTH TRADE CENTER PARKWAY
CONROE, TEXAS 77345
FAC: (713) 273-3804

TOL: (409) 271-3065 (CORPUS CHRISTI)
(713) 350-1813 (HOUSTON)
TELEX: 732745

El Haluschak
GeoPacific Lining Inc.
1300 Dexter Avenue # 205
Seattle, Washington 98109

RE: Test Results and Certification
for Geocomposite and Hypernet
D.O.E. Hanford Radioactive Waste
SLT Project # 8491

Dear Mr. Haluschak:

As requested to follow is the above referenced information outlined in our response to Section 02275, Geosynthetic Transmission Media, item 5 and 6. You will notice the geocomposite information is the actual test results based on data for every other roll. The Hypernet reflects a letter of certification.

Please call me should you have any questions or need additional information.

Best Regards,

A handwritten signature in dark ink, appearing to read "Don C. Hildebrandt", with a large, looping flourish at the end.

Don C. Hildebrandt
Manager/Dealer Network

NORTH AMERICA, INC.

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 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 GONNAGE, TEXAS 77345

 TEL: (713) 350-3873
 SALES FAX: (409) 873-2548
 ADMIN FAX: (409) 273-3808

01-Nov-93

Hanford Composite Test Results
Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1 Avg Peel [lb/in]	Side 2 Avg Peel [lb/in]	STATUS
	Avg Min	Avg Max	Avg Min	Avg Max			
7235-2AB-A	5.4	37.7	5.3	28.3	21.6	16.8	Pass
7235-2AB-C	4.0	19.3	5.3	27.4	11.6	16.3	Pass
7235-2AB-E	5.2	14.3	5.3	23.2	9.7	14.3	Pass
7383-2AB-C	3.2	5.1	1.5	3.7	4.2	2.6	Pass
7428-2AB-A	5.6	49.0	5.3	40.9	27.3	23.1	Pass
7428-2AB-C	5.3	27.3	5.3	49.9	16.3	27.6	Pass
7429-2AB-A	5.2	5.2	5.4	42.3	5.2	23.8	Pass
7429-2AB-C	5.3	29.4	5.2	33.2	17.3	19.2	Pass
7429-2AB-E	5.2	26.4	5.4	21.7	15.8	13.5	Pass
7430-2AB-A	5.4	25.8	5.2	38.7	15.6	22.0	Pass
7430-2AB-C	5.3	24.9	5.1	37.0	15.1	21.1	Pass
7430-2AB-E	5.3	24.5	5.2	39.5	14.9	22.3	Pass
7431-2AB-A	5.4	29.5	5.2	46.9	17.5	26.1	Pass
7431-2AB-C	5.4	31.6	5.3	16.9	18.5	11.1	Pass
7431-2AB-E	5.2	26.6	5.1	13.2	15.9	9.1	Pass
7432-2AB-A	5.4	36.8	5.3	34.4	21.1	19.9	Pass
7432-2AB-C	5.2	24.8	5.3	25.5	15.0	15.4	Pass
7432-2AB-E	5.3	50.2	5.4	26.8	27.7	16.1	Pass
7433-2AB-A	5.3	41.3	5.3	30.6	23.3	17.9	Pass
7433-2AB-C	5.2	22.6	5.1	27.7	13.9	16.4	Pass
7433-2AB-E	5.6	21.5	5.2	34.2	13.5	19.7	Pass
7434-2AB-A	5.3	30.5	5.4	35.4	17.9	20.4	Pass
7434-2AB-C	5.1	31.0	5.4	36.7	18.0	21.1	Pass
7435-2AB-A	1.3	4.5	2.7	5.8	2.9	4.2	Pass
7435-2AB-C	1.0	4.4	1.5	4.4	2.7	2.9	Pass
7435-2AB-E	5.2	19.1	5.2	24.0	12.1	14.6	Pass
7436-2AB-A	2.2	3.5	2.7	6.2	2.8	4.5	Pass
7436-2AB-C	1.9	4.2	2.5	6.3	3.1	4.4	Pass
7436-2AB-E	1.6	3.7	2.0	4.5	2.6	3.2	Pass
7483-2AB-A	5.2	35.7	5.2	17.5	20.4	11.3	Pass
7483-2AB-C	5.2	32.4	5.3	36.2	18.8	20.8	Pass
7483-2AB-E	5.4	24.1	5.2	30.0	14.8	17.6	Pass

NOTE: The following rolls have PASSED the required minimum average of 1.0 lb/in peel value:

7235-2AB-A,B,C,D,E,& F

7383-2AB-C

(Only received a sample for 7383-2AB-C)

7428-2AB-A,B,C,& D

7429-2AB-A,B,C,D,& E

7430-2AB-A,B,C,D,& E

7431-2AB-A,B,C,D,& E

7432-2AB-A,B,C,D,& E

7433-2AB-A,B,C,D,& E

7434-2AB-A,B,C,& D

7435-2AB-A,B,C,D,& E

7436-2AB-A,B,C,D,& E

7483-2AB-A,B,C,D,E,& F

For environmental lining solutions...the world comes to SLT.®

PEEL 1041

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 TEL: (713) 380-4853
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 ADMIN. FAX: (409) 273-2408

02-Nov-93

Hanford Composite Test Results

Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		Side 2		STATUS
	Avg	Min	Avg	Min	Avg	Min	Avg	Min	
		(lb/in)		(lb/in)		(lb/in)		(lb/in)	
6837-2AB-A	1.7	4.5	2.5	5.9	3.1	4.2	Pass		
6837-2AB-C	1.7	3.6	2.6	4.9	2.6	3.7	Pass		
6837-2AB-E	0.8	2.3	1.4	4.1	1.5	2.7	Pass		
7017-2AB-A	1.2	4.1	2.1	5.6	2.7	3.1	Pass		
7017-2AB-C	0.8	2.7	2.0	5.0	1.8	3.5	Pass		
7380-2AB-A	0.9	3.4	2.3	6.1	2.2	4.2	Pass		
7380-2AB-C	1.0	2.5	1.2	4.2	1.8	2.7	Pass		
7382-2AB-A	1.3	4.2	2.8	6.8	2.8	4.8	Pass		
7382-2AB-C	1.6	4.4	2.6	5.1	3.0	3.8	Pass		
7427-2AB-A	1.0	2.5	2.8	6.2	1.7	4.5	Pass		
7485-2AB-A	1.8	3.3	2.7	5.7	2.5	4.2	Pass		

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

6837-2AB-A,B,C,D,& E

7017-2AB-A,B,& C

7380-2AB-A,B,& C

7382-2AB-A,B,& C

7427-2AB-A & B

7485-2AB-A & B

(We received sample for E November 2, 1993 AM)

There are 18 good rolls in this group that can be shipped.

For environmental lining solutions...the world comes to SLT.®

77212 11/93

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 CONROE, TEXAS 77385

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 SALES FAX: (409) 273-2268
 ADMIN. FAX: (409) 273-3508

03-Nov-93

Hanford Composite Test Results
Peel - 2"x9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		Side 2		STATUS
	Avg Min	Avg Max	Avg Min	Avg Max	Avg Peel	Avg Peel	Avg Peel	Avg Peel	
	[lb/in]		[lb/in]		[lb/in]	[lb/in]	[lb/in]	[lb/in]	
6844-2AB-A	1.3	4.1	2.1	5.5	2.7	3.8			Pass
6844-2AB-C	2.4	4.5	2.7	5.7	3.4	4.2			Pass
6844-2AB-E	1.4	3.7	2.5	7.4	2.6	5.0			Pass
7014-2AB-A	1.3	3.8	2.3	5.8	2.6	3.1			Pass
7014-2AB-C	2.1	4.3	1.7	3.7	3.2	2.7			Pass
7014-2AB-E	1.2	2.8	2.4	5.3	2.0	3.8			Pass
7017-2AB-E	1.2	2.8	2.4	5.3	2.0	3.8			Pass
7024-2AB-A	1.9	3.2	3.5	6.7	2.6	5.1			Pass
7024-2AB-C	1.6	4.4	2.6	5.1	3.0	3.8			Pass
7024-2AB-E	1.4	2.8	2.0	4.2	2.1	3.1			Pass
7222-2AB-A	1.5	3.3	2.5	6.3	2.4	4.4			Pass
7222-2AB-C	1.7	3.3	2.9	4.9	2.5	3.9			Pass
7222-2AB-E	2.1	3.3	2.9	5.8	2.7	4.3			Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

 6844-2AB-A,B,C,D,& E
 7014-2AB-A,B,C,D,& E
 7017-2AB-D,& E
 7024-2AB-A,B,C,D,& E
 7222-2AB-A,B,C,D,& E

There are 22 good rolls in this group that can be shipped.

For environmental lining solutions...the world comes to SLT.®

PCL 11/93

NORTH AMERICA, INC.

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 TEL: (713) 580-1818
 SALES FAX: (409) 379-3386
 ADMIN. FAX: (409) 273-3558

04-Nov-93

Hanford Composite Test Results
Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		Side 2		STATUS
	Avg Min	Avg Max	Avg Min	Avg Max	Avg Peel	Avg Peel	Avg Peel	Avg Peel	
	(lb/in)		(lb/in)		(lb/in)	(lb/in)	(lb/in)	(lb/in)	
7060-2AB-A	1.3	4.0	2.6	5.3	2.6	3.3			Pass
7060-2AB-C	1.1	2.6	2.6	5.1	1.9	3.9			Pass
7342-2AB	1.3	3.4	2.8	5.7	2.3	4.2			Pass
7486-2AB-A	1.9	3.5	2.6	5.2	2.7	3.9			Pass
7487-2AB-B	1.2	3.2	2.3	5.9	2.2	4.1			Pass
7487-2AB-C	1.3	3.6	2.9	5.6	2.4	4.2			Pass
7488-2AB-A	1.6	3.4	1.7	5.0	2.5	3.3			Pass
7489-2AB-A	1.0	2.4	2.2	6.2	1.7	4.2			Pass
7489-2AB-C	1.8	3.0	1.9	4.7	2.4	3.3			Pass
7490-2AB-A	1.0	2.8	1.0	3.5	1.9	2.2			Fail *
7490-2AB-C									Fail *

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

 7060-2AB-A, B, & C
 7342-2AB
 7486-2AB-A & B
 7487-2AB-B, C, & D
 7488-2AB-A & B
 7489-2AB-A, B, C, & D

NOTE: The following rolls have FAILED:

 7487-2AB-A
 7490-2AB-A, B, C, & D

 (The sample had signs of the net melting through the textile)
 (The roll of net used to make this composite had inconsistent
 diamonds and weight per area that did not meet SLT
 requirements. A net sample was not provided to the lab for testing)

There are 15 good rolls in this group that can be shipped.

For environmental lining solutions...the world comes to SLT.®

PG24 11/93

NORTH AMERICA, INC.

 300 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 TEL: (713) 360-1813
 SALES FAX: (409) 273-2253
 ADMIN. FAX: (409) 273-3608

04-Nov-93

Hanford Composite Test Results
Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		Side 2		STATUS
	Avg	Min	Avg	Max	Avg	Min	Avg	Max	
		[lb/in]				[lb/in]			
7491-2AB - A	1.3		4.0		2.6		5.3		Pass
7491-2AB - C	1.1		2.6		2.6		5.1		Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:
 7491-2AB-A, B, C, & D

There are 4 good rolls in this group that can be shipped.

For environmental lining solutions...the world comes to SLT.®

PERLS 111A3

NORTH AMERICA, INC.

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 TEL: (713) 550-1813
 SALES FAX: (409) 273-2256
 ADMIN. FAX: (409) 273-3608

08-Nov-93

Hanford Composite Test Results
Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		Side 2	STATUS
	Avg	Min	Avg	Max	Avg	Min		
	(lb/in)		(lb/in)		(lb/in)	(lb/in)		
6474-2AB-A	2.0	5.6	2.3	4.8	3.8	3.9		Pass
7125-2AB-A	3.1	6.3	1.7	3.5	4.7	4.0		Pass
7151-2AB	1.0	3.4	0.6	2.4	2.2	2.0		Pass
7257-2AB	1.2	3.6	1.2	3.3	2.4	2.4		Pass
7260-2AB	0.8	3.3	1.0	2.9	2.0	2.0		Pass
7285-2AB-A	1.1	3.5	1.0	4.5	2.3	2.3		Pass
7289-2AB	1.6	4.2	1.1	5.0	2.9	2.7		Pass
7293-2AB-A	1.3	3.5	0.8	5.0	2.4	2.1		Pass
7340-2AB	1.4	3.9	2.2	4.7	2.6	3.0		Pass
7341-2AB	1.2	4.1	3.4	5.1	2.7	3.8		Pass
7345-2AB	1.5	3.7	2.6	6.1	2.6	3.1		Pass
7351-2AB	1.6	3.6	1.3	3.9	2.6	2.4		Pass
7492-2AB-B	1.8	3.7	2.0	5.9	2.8	2.9		Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

 6474-2AB-A & B
 7125-2AB-A & B
 7151-2AB
 7257-2AB
 7260-2AB
 7285-2AB-A & B
 7289-2AB
 7293-2AB-A & B
 7340-2AB
 7341-2AB
 7345-2AB
 7351-2AB
 7492-2AB-A & B

There are 18 good rolls in this group that can be shipped.

For environmental lining solutions...the world comes to SLT.®

PEEL 11A3

NORTH AMERICA, INC.

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 TEL: (713) 350-1613
 SALES FAX: (409) 273-2286
 ADMIN. FAX: (409) 273-3808

08-Nov-93

Hanford Composite Test Results
Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		STATUS
	Avg Min	Avg Max	Avg Min	Avg Max	Avg Peel	Avg Peel	
	[lb/in]		[lb/in]		[lb/in]	[lb/in]	
6952-2AB	1.6	4.4	1.4	4.1	3.0	2.9	Pass
7073-2AB							Fail
7146-2AB	1.0	3.7	0.9	3.8	2.3	2.3	Pass
7152-2AB	1.1	3.4	3.3	6.1	2.3	3.4	Pass
7252-2AB	1.7	4.9	0.9	3.2	3.3	2.1	Pass
7268-2AB	2.0	4.1	0.9	3.1	3.1	2.5	Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

 6952-2AB
 7146-2AB
 7152-2AB
 7252-2AB
 7268-2AB

There are 5 good rolls in this group that can be shipped.

NOTE: The following rolls have FAILED:

7073-2AB (Failure due to melting of textile)

For environmental lining solutions...the world comes to SLT.®

PEEL 711/93

NORTH AMERICA, INC.

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 TEL: (713) 350-1813
 SALES FAX: (409) 273-2266
 ADMIN. FAX: (409) 273-3808

18-Jan-94

Hanford Composite Test Results

Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1		STATUS
	Avg Min	Avg Max	Avg Min	Avg Max	Avg Peel	Avg Peel	
	[lb/in]	[lb/in]	[lb/in]	[lb/in]	[lb/in]	[lb/in]	
3874 -2AB	2.1	5.4	2.8	5.2	3.8	4.1	Pass
4038 -2AB	2.4	5.4	2.3	4.2	3.9	3.8	Pass
5177 -2AB	1.2	2.5	2.5	5.2	1.8	2.5	Fail
6884 -2AB	2.6	5.2	0.7	1.8	3.9	2.9	Pass
6894 -2AB	2.5	4.8	0.9	2.0	3.7	2.9	Pass
8008 -2AB - A	3.7	6.1	1.3	2.1	4.9	3.7	Pass
8008 -2AB - C	4.6	3.4	3.4	5.7	4.0	3.4	Pass
8008 -2AB - E	1.9	4.3	2.6	5.2	3.1	3.4	Pass
8257 -2AB - A	0.8	2.0	2.5	4.6	1.4	2.3	Pass
8398 -2AB - A	2.2	5.3	1.6	3.7	3.8	3.5	Pass
8398 -2AB - C	2.7	5.1	1.8	4.3	3.9	3.4	Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value:

3183-2AB
 3874-2AB
 4038-2AB
 5164-2AB
 6884-2AB
 6890-2AB
 6892-2AB
 6894-2AB
 6897-2AB
 8008-2AB-A,B,C,D,E & F
 8257-2AB-A
 8398-2AB-A,B,C & D

There are 20 good rolls that can be shipped.

NORTH AMERICA, INC.

 A SUBSIDIARY OF
 SLT ENVIRONMENTAL, INC.

 200 SOUTH TRADE CENTER PARKWAY
 CONROE, TEXAS 77385

 TEL: (713) 350-1813
 SALES FAX: (409) 273-2266
 ADMIN. FAX: (409) 273-3808

18-Jan-94

Hanford Composite Test Results

Peel - 2"X9" Sample ASTM D413/F904

Roll No.	Side 1		Side 2		Side 1 Avg Peel [lb/in]	Side 2 Avg Peel [lb/in]	STATUS
	Avg Min [lb/in]	Avg Max	Avg Min [lb/in]	Avg Max			
7778-2AB - A	1.0	3.7	1.1	2.9	2.3	2.4	Pass
7778-2AB - C	1.3	4.0	1.0	4.3	2.7	2.5	Pass
8013-2AB - A	0.6	2.8	0.7	2.2	1.7	1.8	Pass
8353-2AB	0.7	1.9	2.9	6.8	1.3	2.4	Pass
8363-2AB	0.7	2.3	3.1	8.2	1.5	2.7	Pass
8365-2AB	0.9	3.1	3.6	7.4	2.0	3.3	Pass
8379-2AB	0.6	2.4	3.5	6.8	1.5	2.9	Pass

NOTE: The following rolls have PASSED the required average of 1.0 lb/in peel value based on above test results:

4689-2AB
 6212-2AB
 6830-2AB
 7778-2AB-A, B, & C
 8013-2AB-A & B
 8353-2AB
 8363-2AB
 8365-2AB
 8379-2AB
 8382-2AB

There are 13 good rolls that can be shipped.

APPENDIX I
PIPE MANUFACTURER'S QC DOCUMENTATION

APPENDIX I-1

HDPE PIPE

:

INDUSTRIAL PLASTICS, INC.

740 S. 28th Street — Washougal, WA 98671-2597
 Phone (206) 835-2129 or (503) 227-5588
 1-800-634-5082 FAX (206) 835-3521

SUBMITTAL AND CERTIFICATION OF MATERIAL SPECIFICATION

CUSTOMER NAME DELHUR INDUSTRIES
 ORDER NUMBER PER QUOTATION DATED 7/23/93
 PROJECT IDENTIFICATION HANFORD RMWD FACILITY - 200 WEST AREA
KEH 5346
 PROJECT LOCATION HANFORD, WASHINGTON

PIPE SIZES INCLUDING SDR OR WALL THICKNESS:

SECTION 02725 HDPE PIPE & FITTINGS

SOLID & PERFORATED PER SPECIFICATIONS

4.5" OD X 3.68" ID X .409" WALL, SDR 11, 160 PSI

8.625" OD X 7.05" ID X .784" WALL, SDR 11, 160 PSI

2.375" OD X 1.93" ID X .216" WALL, SDR 11, 160 PSI

3.500" OD X 2.86" ID X .318" WALL, SDR 11, 160 PSI

1.90" OD X 1.55" ID X .173" WALL, SDR 11, 160 PSI

FITTINGS TO BE OF LIKE MATERIAL.

The above listed material for this project is certified to be manufactured from a PE 3408 Polyethylene compound as defined in ASTM D-1248 and is identified as:

TYPE	<u>III</u>	CLASS	<u>C</u>
CATEGORY	<u>5</u>	GRADE	<u>P 34</u>

This pipe compound has a cell classification according to ASTM D-3350 of 345434C.

Special Listings FULL PPI & SPI MEMBERSHIP & LISTING.

CERTIFICATION PREPARED BY

Susan McCullough

Susan McCullough

Sales

Date: August 31, 1993

b:specs/ro

Familian INDUSTRIAL PLASTICS, INC.

740 S. 28th Street - Washougal, WA 98671-2597

Phone (206) 835-2129 or (503) 227-5588

1-800-634-5082 FAX (206) 835-3521

SUBMITTAL AND CERTIFICATION OF MATERIAL SPECIFICATION

CUSTOMER NAME DELHUR INDUSTRIES
ORDER NUMBER S.O. 27307, P.O. 25817
PROJECT IDENTIFICATION HANFORD RMWD FACILITY - 200 WEST AREA
PROJECT LOCATION HANFORD, WA

PIPE SIZES INCLUDING SDR OR WALL THICKNESS:

LEACHATE COLLECTION WELL;

30" O.D. X 26.01" I.D. X 1.935" WALL SDR 15.5, 110 PSI

PER ATTACHED DRAWING

6.625" O.D. X 5.61" I.D. X .491" WALL, SDR 13.5, 130 PSI

HDPE FLATSTOCK PER ATTACHED SPEC SHEET

The above listed material for this project is certified to be manufactured from a PE 3408 Polyethylene compound as defined in ASTM D-1248 and is identified as:

TYPE III

CLASS C

CATEGORY 5

GRADE P 34

This pipe compound has a cell classification according to ASTM D-3350 of 345434C.

Special Listings SEE ATTACHED

CERTIFICATION PREPARED BY

Susan McCullough

Sales

Date: October 8, 1993

b:specs/ro

Polaris Pipe

Manufacturers of Plastic Pipe Co.

16360 Roscoe Blvd., Suite 120
Van Nuys, California 91406
(818) 893-1112
Wats California Only (800) 252-7473
Facsimile (818) 892-0696

October 12, 1993

FAMILIAN INDUSTRIAL PLASTICS
740 South 28th Street
Washougal, WA 98671-2597

Re: Delhur Industries
Your P.O. #4716

	<u>Date/Mat'l</u>	<u>R/C #</u>	<u>MFR</u>	<u>Lot#</u>
2800' 4" x 40' SDR11	10893NB	CCBX55207	U.C.	537865
160' 3" x 40' SDR11	91293YB	ELTX1338	Solvay	C30816L06A
400' 8" x 40' SDR11	82793YB	ELTX605	Solvay	C30424D11A
800' 2" x 40' SDR11	61993YB	ELTX1550	Solvay	C30224L07A
300' 1 1/2" x 300' SDR11	31093YB	ELTX647	Solvay	C30118L13A

NSF coil

Dear Sir:

This letter is to certify that the DURATUFF® HDPE pipe produced by Polaris Pipe Co. for the above project conforms to ASTM material specification D1248, Type III, Class C, Category 5, Grade P34. The pipe made from this material also conforms to cell classification PE345434C per ASTM specification D3350.

All resin/pellets were used from sources of HDPE material that are listed both with the National Sanitation Foundation (NSF) and the Plastics Pipe Institute (PPI).

Sincerely,

POLARIS PIPE CO.

Jay L. Grossman
President

JLG:amp\L930029.jlg

Polaris Pipe

Manufacturers of Plastic Pipe Co.

16380 Roscoe Blvd., Suite 120
Van Nuys, California 91406
(818) 893-
Wats California Only (800) 252-
Facsimile (818) 892-0

VIA FACSIMILE TO (206) 835-3521

November 30, 1993

David Schlegel
FAMILIAN INDUSTRIAL PLASTICS
740 South 28th Street
Washougal, WA 98671-2597

Re: Delhur Industries
Your PO # 2121 06/02/92
SO # 13834

	<u>Date/Mat'l</u>	<u>Manufacturer</u>
25' 6" x 25' SDR 13.5 HDPE Pipe	C3UU6291	Union Carbide

Dear Dave:

This letter is to certify that the DURATUFF® HDPE pipe produced by Polaris Pipe Co. for the above project conforms to ASTM material specification D1248, Type III, Class C, Category 8, Grade P34. The pipe made from this material also conforms to cell classification PE345434C per ASTM specification D3350.

All resin/pellets were used from sources of HDPE material that are listed both with the National Sanitation Foundation (NSF) and the Plastics Pipe Institute (PPI).

Sincerely,

POLARIS PIPE CO.

Ray L. Grossman
President

cc: Barbra Hellwig

JLQ:sdp\L930062.jlg

TYPICAL PHYSICAL PROPERTIES

Property (Determined on compression, molded specimen)	Test Method	Typical Value
Mechanical Properties		
Tensile Strength (break), psi	D 838	4500
Ultimate Elongation, %	D 638	850
Flexural Modulus, psi	D 790	120,000
Tensile Strength (yield), psi	D 638	3,200
Thermal Properties		
Brittleness Temperature, °C	D 746	<-100
Melt Index, g/10 minutes	D 1238 (cond. E)	0.10
High Load Melt Index, g/10 minutes	D 1238 (cond. F)	12
OSC Induction Temperature, °C	D 3350	>250
OSC Induction Time, minutes at 210°C (100% Oxygen)	UNION CARBIDE	25
Melting Point, °C ^(a)	UNION CARBIDE	127
Crystallization Point, °C ^(a)	UNION CARBIDE	113
Vicat Softening Temperature, °C	D 1525	121
Miscellaneous Properties		
Density, g/cm ³ (base resin)	D 1505	0.944
Density, g/cm ³ (compound)	D 1505	0.954
Environmental Stress Crack Resistance, P, Hours	D 1693 (cond. C)	>2000
Thermally Aged Environmental Stress Crack Resistance, ^(a) P, Hours	D 1693 (cond. C)	>2500
Durometer Hardness, Shore "D"	D 2240	58
Linear Thermal Coefficient of Expansion, in/in/°C (-30°C to +30°C)	D 658	1.4 × 10 ⁻⁴
Izod Impact, ft.-lbs./in notch at 23°C	D 256	3.0

(a) Heating and cooling rate at 10°C/min

(b) Plaque first aged 10,000 hours in water at 80°C

TEST METHODS

Designated tests are made in accordance with current issues of ASTM Standard Testing Methods. Copies of these are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, on request. The Union Carbide methods are available upon request.

PROCESSING

DGDB-2480 Black 4365 can be readily processed by any of the current pipe extrusion methods in all pipe sizes at rates considered commercially acceptable. However, to ensure proper plastication and performance of the product we recommend the following key points be adhered to closely. The extruder should be equipped with a high quality high density polyethylene screw (preferably a barrier type to insure complete melting), as well as a melt thermocouple and pressure gauge for control.

DuraTuff®

Polyethylene Pipe HDPE
PHYSICAL PROPERTIES DATA 989

DuraTuff®

polyethylene pipe

Polaris Pipe
Manufacturers of Plastic Pipe Co.

STRAIGHT LENGTHS

		SDR 7.3			SDR 9			SDR 11			SDR 13.5		
		255 P.S.I.			200 P.S.I.			160 P.S.I.			130 P.S.I.		
Nominal Pipe Size (Inches)	Actual Outside Diameter	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)
1½"	1.90	1.38	.260	.59	1.48	.211	.49	1.55	.173	.41	1.62	.141	.34
2"	2.375	1.71	.325	.91	1.83	.264	.77	1.93	.216	.64	2.01	.176	.53
3"	3.500	2.51	.479	1.97	2.70	.389	1.65	2.86	.318	1.38	2.97	.259	1.15
4"	4.500	3.23	.616	3.27	3.47	.500	2.73	3.68	.409	2.28	3.81	.333	1.89
5.375"	5.375	3.86	.736	4.72	4.18	.597	4.00	4.39	.489	3.26	4.55	.398	2.75
5"	5.563	3.99	.762	4.99	4.29	.618	4.16	4.55	.506	3.49	4.71	.412	2.89
6"	6.625	4.76	.908	7.08	5.11	.736	5.92	5.42	.602	4.95	5.61	.491	4.10
7.125"	7.125	5.11	.976	8.30	5.49	.792	6.90	5.82	.648	5.78	6.04	.528	4.82
8"	8.625	6.19	1.182	11.99	6.65	.958	10.03	7.05	.784	8.39	7.31	.639	6.96
10"	10.750	7.72	1.473	18.63	8.29	1.194	15.57	8.79	.977	13.03	9.11	.796	10.81
12"	12.750	9.15	1.747	26.21	9.83	1.417	21.90	10.43	1.159	18.33	10.81	.944	15.21
13.38"	13.380	9.58	1.832	29.27	10.32	1.486	24.45	10.87	1.216	20.40	11.34	.991	16.99
14"	14.000	10.05	1.918	32.00	10.80	1.556	26.40	11.38	1.273	22.09	11.86	1.037	18.34
16"	16.000	11.48	2.192	41.80	12.34	1.778	34.48	13.00	1.455	28.95	13.56	1.183	23.95
18"	18.000	12.92	2.466	53.00	13.88	2.000	44.28	14.63	1.636	37.05	15.25	1.333	30.30
20"	20.000	14.35	2.740	65.45	15.42	2.222	54.66	16.26	1.818	45.75	16.95	1.481	37.32
22"	22.000	—	—	—	16.96	2.444	66.15	17.88	2.000	55.35	18.64	1.630	45.18
24"	24.000	—	—	—	18.50	2.668	78.70	19.50	2.182	65.87	20.33	1.778	54.67
26"	26.000	—	—	—	20.05	2.888	92.36	21.13	2.364	77.32	22.03	1.926	64.20
28"	28.000	—	—	—	—	—	—	22.75	2.545	89.64	23.72	2.074	74.40
30"	30.000	—	—	—	—	—	—	24.38	2.727	102.91	25.42	2.222	85.41
800mm	31.496	—	—	—	—	—	—	—	—	—	26.67	2.34	94.50
32"	32.000	—	—	—	—	—	—	—	—	—	27.11	2.370	97.20

ALL WEIGHTS ARE CALCULATED IN ACCORDANCE WITH PPI-TR-7.
Reference ASTM Standard F714 / D3035 for Pipe Specifications & Dimensions.

Polaris Pipe
Manufacturers of Plastic Pipe Co.

	SDR 15.5			SDR 17			SDR 21			SDR 26			SDR 32.5		
	110 P.S.I.			100 P.S.I.			80 P.S.I.			65 P.S.I.			50 P.S.I.		
Nominal Size (Inches)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)	Average Inside Diameter	Minimum Wall Thickness	Weight (lb./ft.)
1½"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2"	2.06	.153	.47	2.10	.139	.43	—	—	—	—	—	—	—	—	—
3"	3.03	.226	1.01	3.08	.206	.93	3.16	.167	.76	3.22	.135	.63	3.28	.108	.50
4"	3.90	.290	1.67	3.97	.265	1.53	4.07	.214	1.25	4.15	.173	1.02	4.22	.138	.81
5.375"	4.66	.347	2.42	4.72	.316	2.18	4.85	.256	1.79	4.95	.207	1.45	5.04	.165	1.17
5"	4.82	.359	2.54	4.89	.327	2.34	5.02	.265	1.91	5.12	.214	1.56	5.22	.171	1.26
6"	5.75	.427	3.61	5.84	.390	3.32	5.99	.316	2.72	6.11	.255	2.22	6.21	.204	1.79
7.125"	6.17	.462	4.26	6.26	.419	3.83	6.43	.339	3.14	6.56	.274	2.57	6.67	.219	2.07
8"	7.48	.556	6.13	7.61	.507	5.62	7.80	.411	4.61	7.96	.332	3.76	8.09	.265	3.02
10"	9.32	.694	9.51	9.48	.632	8.73	9.72	.512	7.15	9.92	.414	5.84	10.08	.331	4.71
12"	11.06	.823	13.38	11.25	.750	12.28	11.53	.607	10.06	11.76	.491	8.20	11.96	.392	6.61
13.38"	11.60	.863	14.95	11.76	.787	13.52	12.07	.637	11.08	12.32	.515	9.03	12.53	.412	7.28
14"	12.14	.903	16.14	12.35	.824	14.81	12.66	.667	12.13	12.92	.539	9.90	13.13	.431	7.98
16"	13.87	1.032	21.07	14.06	.941	19.33	14.43	.762	15.83	14.73	.615	12.91	14.99	.492	10.41
18"	15.61	1.161	26.67	15.82	1.059	24.46	16.24	.857	20.03	16.57	.692	16.34	16.86	.554	13.17
20"	17.34	1.290	32.92	17.58	1.176	30.20	18.04	.952	24.74	18.42	.769	20.18	18.73	.615	16.27
22"	19.08	1.419	39.74	19.33	1.294	36.55	19.84	1.048	29.94	20.26	.846	24.41	20.61	.677	19.69
24"	20.81	1.548	48.09	21.09	1.412	43.49	21.65	1.143	35.63	22.10	.923	29.05	22.48	.738	23.42
26"	22.54	1.677	56.44	22.94	1.529	52.08	23.52	1.238	42.74	24.00	1.000	34.88	24.40	.800	28.25
28"	24.28	1.806	65.46	24.71	1.647	59.80	25.33	1.333	49.05	25.84	1.077	40.08	26.27	.862	32.32
30"	26.01	1.935	75.15	26.47	1.765	68.68	27.14	1.429	56.34	27.69	1.154	46.05	28.15	.923	37.11
800mm	27.31	2.032	83.20	27.78	1.858	76.24	28.48	1.505	62.62	29.06	1.215	51.12	29.55	.970	41.10
32"	27.80	2.038	84.50	28.23	1.882	78.28	28.85	1.524	64.10	29.53	1.231	52.38	30.03	.985	42.18

ALL WEIGHTS ARE CALCULATED IN ACCORDANCE WITH PPI-TR-7.
Reference ASTM Standard F714 / D3035 for Pipe Specifications & Dimensions.

POLYETHYLENE FEATURES AND BENEFITS

Polyethylene pipe is specifically designed to fulfill the needs of industry. The following are proven, cost effective applications for HDPE piping;

■ Acid Lines	■ Gas Lines
■ Aeration	■ Irrigation Lines
■ Caustic Lines	■ Extractive Metallurgy
■ Chilled Water Lines	■ Mud Lines
■ Cooling Water Lines	■ Oil Patch
■ Corrosive Wastes	■ Sewer Lines
■ Dewatering Lines	■ Sludge Lines
■ Drainage Lines	■ Slurry Lines
■ Dredging Lines	■ Tailing Lines
■ Electrical Conduit	■ Water Lines
■ Fly Ash Lines	

Polaris polyethylene pipe is 10% to 30% lighter in weight than most other piping materials of the same size. The physical properties of Polaris polyethylene pipe make it a natural for systems in difficult terrain where conditions of harsh environment, caustic soil conditions and extremes of temperature make other piping materials impractical and at best short lived.

The flexibility of Polaris polyethylene pipe allows for installation without the use of many fittings and assembly can be done at a more suitable area for fusion. Pipe can then be pulled to installation site and dropped into trench or, if conditions are impossible for trenching, pipe can be installed above ground without fear of damage from ultraviolet attack, corrosion, rot or rust.

PHYSICAL PROPERTIES DATA FOR POLARIS HIGH DENSITY, HIGH MOLECULAR WEIGHT PE 3408 POLYETHYLENE PRODUCTS.

The material used by Polaris Pipe Co. in the manufacturing of high density polyethylene pipe products conforms to ASTM D-1248 is Type III, Class C, Category 5, Grade P34. The following represents standard test values achieved at 73.4°F according to standard industry practice.

D-1505	Density (Black Resin)	0.955 g/cm ³
D-1505	Density (natural resin)	0.944 g/cm ³
D-1238	Melt Index (Condition E)	0.14 g/10 min
D-1238	Melt Index (Condition F)	11.0 g/10 min
D-1525	Melting Point (Vicat softening point)	257° Fahrenheit
D-746	Brittleness Temperature	-180° Fahrenheit
D-698	Thermal Expansion	0.8x10 ⁻⁴ in/in/°F
C-177	Thermal Conductivity	3.5 Btu-in/(ft ² -hr-°F)
D-638	Tensile Strength, Yield (2 in/min)	>3300 psi
D-638	Elongation at Break	800 percent
D-638	Modulus of Elasticity	120,000 psi
D-790	Flexural Modulus	140,000 psi
D-3350	Cell Classification	345434 C
D-2837	Hydrostatic Design Basis (HDB) 73°/100,000 hrs	1600 psi
D-2837	Hydrostatic Design Stress (HDS) 73°/100,000 hrs	800 psi
D-2240	Hardness - Shore D	63 —
D-1693	Environmental Stress Crack Resistance (ESCR), Condition C	>5000 F ₂₀ hrs
D-1603	Carbon Black	2% min

The information herein contained is based upon data to be thoroughly reliable, but no guaranty or warranty with respect to accuracy, completeness, or product result is implied and no liability is assumed. Users should verify suitability for their particular use or purpose of any information contained herein. In view of the many uses of this material, and the different equipment and techniques used, we cannot guarantee results in specific instances. No statement contained herein should be construed as a recommendation or license to use our products in a manner that would constitute infringement of any patent.

Polaris Pipe
Manufacturers of Plastic Pipe Co.

933-1354

8002 N.E. Hwy. #99, Suite 258/Vancouver, WA 98665
(206) 695-0655
16340 Roscoe Boulevard, Suite 210 / Van Nuys, CA 91406
(818) 893-1112 In California (800) 252-7473
FAX (818) 892-0696

INDUSTRIAL PLASTICS, INC.

740 S. 28th Street — Washougal, WA 98671-2597
Phone (206) 835-2129 or (503) 227-5588
1-800-634-5082 FAX (206) 835-3521

HANFORD MIXED-WASTE DISPOSAL FACILITY 200- WEST AREA, HANFORD SITE, RICHLAND, WA

QUALIFIED FUSION OPERATORS LIST

TO: DOUG CRABTREE

FROM: JIM JACOBS

LISTED BELOW ARE THE TEST RESULTS ON FUSIONS ON PIPE SAMPLES
SUBMITTED BY INDUSTRIAL PLASTICS, INC.

4" SDR 21 PE3408 BUTT FUSION SAMPLES

PIPE MARKING	BURST TEST ONE SPECIMEN	ELONGATION TEST TWO SPECIMENS	"BEND BACK" TEST THREE SPECIMENS
STEVE HAMRICK	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
DAN NOLAN	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RANDY SALSBERY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
BRIAN MURRAY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RY BOYLE	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
ED SALSBERY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RALPH FORD	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	

LAB TIME: 5 HRS

DATE TESTED: 20 DEC 90

TESTED BY: JIM JACOBS

Certificate of Recognition

Awarded to

LARRY BOYLE

In recognition of

SUCCESSFUL COMPLETION OF THE McELROY FUSION/MAINTENANCE SEMINAR

Dated this 22ND day of AUGUST, 1985

Presented by:

E. H. McElroy

J. H. Stetson

CERTIFICATE OF FAMILIARIZATION

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN
TITLE 49 OF THE CODE OF FEDERAL REGULATIONS 192.285

BE IT KNOWN THAT:

LARRY BOYLE

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 8th DAY OF JANUARY NINETEEN HUNDRED AND 93

INDUSTRIAL PLASTICS, INC. BY:

David J. Shelden

CERTIFICATE OF TRAINING

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN

Title 49 of the Code of Federal Regulations
#192.285 as it applies to Heat Fusion

BE IT KNOWN THAT:

DAN NOLAN

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 24 DAY OF JULY NINETEEN HUNDRED AND 92

INDUSTRIAL PLASTICS, INC. BY:

CERTIFICATE OF FAMILIARIZATION

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN
TITLE 49 OF THE CODE OF FEDERAL REGULATIONS 192.285

BE IT KNOWN THAT:

RANDLE SALSBERY

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 8th DAY OF JANUARY NINETEEN HUNDRED AND 93

BY: *David J. Schler*
INDUSTRIAL PLASTICS, INC.

INDUSTRIAL PLASTICS, INC.

740 S. 28th Street — Washougal, WA 98671-2597
Phone (206) 835-2129 or (503) 227-5588
1-800-634-5082 FAX (206) 835-3521

HANFORD MIXED-WASTE DISPOSAL FACILITY 200- WEST AREA, HANFORD SITE, RICHLAND, WA

QUALIFIED FUSION OPERATORS LIST

TO: DOUG CRABTREE

FROM: JIM JACOBS

LISTED BELOW ARE THE TEST RESULTS ON FUSIONS ON PIPE SAMPLES
SUBMITTED BY INDUSTRIAL PLASTICS, INC.

4" SDR 21 PE3408 BUTT FUSION SAMPLES

PIPE MARKING	BURST TEST ONE SPECIMEN	ELONGATION TEST TWO SPECIMENS	"BEND BACK" TEST THREE SPECIMENS
STEVE HAMRICK	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
DAN NOLAN	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RANDY SALSBERY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
BRIAN MURRAY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RRY BOYLE	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
ED SALSBERY	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	
RALPH FORD	PASSED	PASSED	PASSED
	PIPE FAILED	ELONGATION >100%	

LAB TIME: 5 HRS

DATE TESTED: 20 DEC 90

TESTED BY: JIM JACOBS

CERTIFICATE OF FAMILIARIZATION

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN
TITLE 49 OF THE CODE OF FEDERAL REGULATIONS 192.285

BE IT KNOWN THAT:

LARRY BOYLE

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 8th DAY OF JANUARY NINETEEN HUNDRED AND 93

BY: *Carol J. Schlarb*

INDUSTRIAL PLASTICS, INC.

CERTIFICATE OF TRAINING

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN

Title 49 of the Code of Federal Regulations
#192.285 as it applies to Heat Fusion

BE IT KNOWN THAT:

DAN NOLAN

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 24 DAY OF JULY NINETEEN HUNDRED AND 92

INDUSTRIAL PLASTICS, INC. BY: [Signature]

Certificate of Recognition

Awarded to

RANDY SALSBERY

In recognition of

SUCCESSFUL COMPLETION OF THE McELROY FUSION/MAINTENANCE SEMINAR

Dated this 19TH day of JULY, 19 84

Presented by:

J. H. Stricklin

R. S. McElroy

Certificate of Recognition

Awarded to

RANDY SALSBERY

In recognition of

SUCCESSFUL COMPLETION OF

THE McELROY LARGE DIAMETER FUSION/MAINTENANCE SEMINAR

Dated this 25TH day of OCTOBER, 1985

Presented by:

D. H. McElroy

J. H. Stripling

CERTIFICATE OF FAMILIARIZATION

RECOGNIZING THE COMPLETION OF ALL REQUIREMENTS IN
TITLE 49 OF THE CODE OF FEDERAL REGULATIONS 192.285

BE IT KNOWN THAT:

RANDLE SALSBERY

IS HEREBY AWARDED THIS CERTIFICATE OF FAMILIARIZATION
WHICH ATTESTS TO THIS ACHIEVEMENT.

GIVEN THIS 8th DAY OF JANUARY NINETEEN HUNDRED AND 93

BY: Andrew J. Schley
INDUSTRIAL PLASTICS, INC.

Date: AUGUST 1993

McELROY FUSION MACHINE TRAINING TO JOIN PHILLIPS DRISCOPIPE

This Letter of Accreditation serves to attest that on the above date, Maskell-Robbins, Inc. performed complete hands-on McElroy fusion unit training for:

JOHN ELLINGWOOD

Name

DELHUR INDUSTRIES

Company Name (if applicable)

Training was given using a McElroy # 1236 Unit on 20" SDR 21 Phillips Driscopipe 1000
(Pipe size/SDR)

Training was given using a McElroy # _____ Unit on _____ Phillips Driscopipe _____
(Pipe size/SDR)

Training was given using a McElroy # _____ Unit on _____ Phillips Driscopipe _____
(Pipe size/SDR)

Training consisted of:

1. Procedures required to butt fuse High Density Polyethylene (HDPE) pipe and fittings manufactured by Phillips Driscopipe only. No other brands of pipe were included.
2. Actual hands-on fusion by trainees until it was deemed by the Maskell-Robbins technician that the trainee is proficient in performing proper butt fusion.
3. Fusing polyethylene pipe in accordance with Phillips Driscopipe recommendations and Title 49 of the Code of Federal Regulations 192.283, 192.285 and 192.287
4. Safety features were explained and emphasized.

This qualification will be in effect for a one year period from date of issue. At that time a refresher course will be required. This Letter of Accreditation is not a warrantee of the workmanship of the individual named above or any of the products worked upon by said individual.

Attest:

Charles Robbins, Vice-President

Date: AUGUST 1993

McELROY FUSION MACHINE TRAINING TO JOIN PHILLIPS DRISCOPIPE

This Letter of Accreditation serves to attest that on the above date, Maskell-Robbins, Inc. performed complete hands-on McElroy fusion unit training for:

JOHN ELLINGWOOD

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Training was given using a McElroy # 1236 Unit on 20" SDR 21 Phillips Driscopipe 1000
(Pipe size/SDR)

Training was given using a McElroy # _____ Unit on _____ Phillips Driscopipe _____
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3. Fusing polyethylene pipe in accordance with Phillips Driscopipe recommendations and Title 49 of the Code of Federal Regulations 192.283, 192.285 and 192.287
4. Safety features were explained and emphasized.

This qualification will be in effect for a one year period from date of issue. At that time a refresher course will be required. This Letter of Accreditation is not a warrantee of the workmanship of the individual named above or any of the products worked upon by said individual.

Attest:

Charles Robbins
Charles Robbins, Vice-President

CORPORATE OFFICE: 24113 56th AVENUE W., MOUNTLAKE TERRACE, WA 98043-5503 (206) 775-8600 FAX (206) 775-5458 1-800-624-1100
REMITTANCE ADDRESS: P.O. BOX 12590, SEATTLE, WA 98111-4590
REGIONAL OFFICES: 6 HANGAR WAY #F, WATSONVILLE, CA 95076 • 12450 GALVESTON ROAD, WEBSTER, TX 77598
9541 S. BAGLEY PARK RD., SALT LAKE CITY, UT 84088 • 524 W. INT'L AIRPORT RD., #200, ANCHORAGE, AK 99518
2120 S. GRAND, SANTA ANA, CA 92705 • 3433 E. PENNSYLVANIA ST., TUCSON, AZ 85714 • 1125 MEREDITH WAY, SPARKS, NV 89431
933-1354

APPENDIX I-2
STAINLESS STEEL PIPE

P.O. BOX 834 • DQVER, N.J. 07801
PHONE (201) 361-4014 • FAX (201) 361-3104

CERTIFICATE OF QUALITY CONTROL

SIZE: 2" SCH 40 TYPE: 316/316L HEAT: 915333

SPECIFICATION: ASTM A312-92A ASME SA312-92A

CHEMICAL ANALYSIS %

C	Mn	P	S	Si	Ni	Cr	Mo
.018	1.75	.028	.012	.38	11.22	16.36	2.06

MECHANICAL PROPERTIES

HARDNESS, RB	YIELD STRENGTH, PSI	ULTIMATE STRENGTH, PSI	%ELONG
84	48800	85500	53

TESTS

HYDRO, PSI	FLATTEN	REV. FLATTEN	FLARE	FLANGE	EDDY CURRENT
1900	ok	ok	ok	ok	ok

DATE OCT 22 1993

SIGNED George B. Palmer

MILL TEST REPORT

COMMODITY : STAINLESS STEEL WELDED PIPE
 SPECIFICATION: ASTM A312 / ASME SA312
 GRADE : 316L
 CUST. ORDER #: A - 1/1

CUSTOMER : TA CHEN INT'L CORP.
 SKIPPER : TA CHEN STAINLESS PIPE CO., LTD
 DESTINATION: LOS ANGELES
 DATE : 03/10/94

No	Heat No.	SIZE	Chemical Composition in %							
			C	SI	Mn	P	S	NI	Cr	Mo
1	Y4001	4" WELDED PIPE S/40 316L	0.022	0.300	1.620	0.030	0.005	11.32	17.17	2.0

No	Tensile Test				Hardness Test HRB	Bend Test	Flattening Test	Heat Treatment Temp F	Dimension And Surface Condition	Hydrostat- ic Test PSI
	0.2% Yield Strength PSI	1% Yield Strength PSI	Tensile Strength PSI	Elong- ation %						
1	40300		80700	53.30	79.00		OK	1300	OK	1900

We hereby certify above statement to be true and correct every detail.
 TA CHEN STAINLESS PIPE CO., LTD.

[Signature]
 Manager of Inspection Section

APPENDIX J

SUBGRADE AND GENERAL FILL MOISTURE-DENSITY TESTS

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF SUBGRADE MOISTURE-DENSITY TESTS
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANFORD NUCLEAR RESERVATION
SUBGRADE

933-1354
05/04/94
Page 1

TEST NUMBER (1,2)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES			PASS or FAIL	NOTES
		NORTH	WEST	LIFT	DRY	FIELD	DRY	LAB	PERCENT		
		COORDINATE	COORDINATE	No.	DENS. (pcf)	MOIST (%)	DENSITY (pcf)	MOIST (%)	COMPACTION		
SG-001	10/01/93	44111.8	78792.0	N/A	99.4	10.4	97.0	13.1	89.0	Fail	N/A
SG-001A	10/21/93	44111.8	78792.0	N/A	104.0	5.8	102.8	7.1	94.3	Pass	N/A
SG-002	10/01/93	44127.1	78738.4	N/A	122.9	3.4	122.6	3.7	96.5	Pass	N/A
SG-003	10/01/93	44187.1	78717.6	N/A	100.8	6.2	100.6	6.5	92.3	Pass	N/A
SG-004	10/01/93	44239.4	78735.9	N/A	98.2	6.6	96.2	8.8	88.3	Fail	N/A
SG-004A	10/21/93	44239.4	78735.9	N/A	105.2	4.6	103.2	6.6	94.7	Pass	N/A
SG-004ARB	10/21/93	44239.4	78735.9	N/A	N/A	N/A	100.4	6.6	92.1	Pass	N/A
SG-005	10/01/93	44289.8	78792.6	N/A	105.1	10.9	102.5	13.8	94.0	Pass	N/A
SG-006	10/01/93	44197.3	78801.2	N/A	104.7	8.4	102.7	10.5	94.2	Pass	N/A
SG-007	10/01/93	44059.6	78486.4	N/A	98.2	13.9	96.3	16.2	88.3	Fail	N/A
SG-007A	10/21/93	44059.6	78486.4	N/A	102.0	5.6	100.4	7.3	92.1	Pass	N/A
SG-008	10/01/93	44042.2	78621.1	N/A	104.5	11.1	103.8	11.8	95.2	Pass	N/A
SG-009	10/01/93	44053.1	78695.4	N/A	102.9	7.6	98.1	13.0	90.0	Pass	N/A
SG-010	10/01/93	44028.8	78749.1	N/A	99.8	9.6	97.9	11.8	89.8	Fail	N/A
SG-010A	10/21/93	44028.8	78749.1	N/A	102.9	5.0	100.9	7.0	92.6	Pass	N/A
SG-011	10/01/93	44107.3	78665.5	N/A	101.1	4.9	97.6	8.7	89.5	Fail	N/A
SG-011A	10/21/93	44107.3	78665.5	N/A	98.3	4.1	99.3	3.0	91.1	Pass	N/A
SG-012	10/01/93	44142.4	78604.3	N/A	114.9	3.9	114.8	4.1	90.4	Pass	N/A
SG-013	10/01/93	44128.9	78527.6	N/A	115.5	4.8	116.3	4.1	91.6	Pass	N/A
SG-014	10/01/93	44132.1	78468.9	N/A	119.6	5.2	120.3	4.6	94.7	Pass	N/A
SG-015	10/01/93	44086.2	78418.7	N/A	98.3	5.1	96.4	7.2	88.4	Fail	N/A
SG-015A	10/21/93	44089.3	78416.5	N/A	100.2	4.7	99.5	5.4	91.3	Pass	N/A
SG-016	10/01/93	44031.0	78426.7	N/A	102.6	5.2	100.7	7.1	92.4	Pass	N/A
SG-016A	10/01/93	44031.0	78426.7	N/A	105.0	5.9	103.7	7.2	95.2	Pass	N/A
SG-016ARB	10/01/93	44031.0	78426.7	N/A	N/A	N/A	102.1	7.2	93.7	Pass	N/A
SG-016RB	10/01/93	44031.0	78426.7	N/A	N/A	N/A	94.9	7.1	87.0	Fail	N/A
SG-017	10/15/93	44170.2	78640.6	N/A	123.9	4.9	121.8	6.7	95.9	Pass	N/A
SG-017RB	10/15/93	44170.2	78640.6	N/A	N/A	N/A	123.8	6.7	97.5	Pass	N/A
SG-018	10/15/93	44219.3	78647.0	N/A	126.4	4.5	125.0	5.7	98.4	Pass	N/A
SG-019	10/15/93	44216.2	78532.6	N/A	116.1	7.5	115.2	8.3	90.7	Pass	N/A
SG-020	10/15/93	44165.0	78500.1	N/A	124.3	3.9	122.6	5.3	96.5	Pass	N/A
SG-021	10/15/93	44230.7	78469.7	N/A	123.7	5.2	122.3	6.4	96.3	Pass	N/A
SG-022	10/15/93	44250.6	78376.1	N/A	105.2	4.6	103.1	6.7	94.6	Pass	N/A
SG-023	10/15/93	44201.5	78383.1	N/A	104.0	5.9	101.8	8.2	93.4	Pass	N/A
SG-024	10/15/93	44115.6	78370.7	N/A	106.6	5.5	105.3	6.8	96.6	Pass	N/A
SG-025	10/15/93	44169.5	78423.0	N/A	117.8	2.5	117.3	2.9	94.2	Pass	N/A
SG-026	10/15/93	44230.5	78438.8	N/A	114.0	3.5	114.6	2.9	92.0	Pass	N/A

GOLDER CONSTRUCTION SERVICES INC.
 SUMMARY OF SUBGRADE MOISTURE-DENSITY TESTS
 DEPARTMENT OF ENERGY
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 HANFORD NUCLEAR RESERVATION
 SUBGRADE

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TEST NUMBER (1,2)	DATE	TEST LOCATION INFORMATION			TROLER		LABORATORY CALCULATED TEST VALUES					PASS or FAIL	NOTES
		NORTH	WEST	LIFT	DRY	FIELD	DRY	LAB	PERCENT				
		COORDINATE	COORDINATE	No.	DENS.	MOIST	DENSITY	MOIST	COMPACTION				
					(pcf)	(%)	(pcf)	(%)					
SG-027	10/15/93	44263.6	78491.8	N/A	114.4	4.4	111.4	7.3	89.5	Fail	N/A		
SG-027A	10/21/93	44263.6	78491.8	N/A	100.8	6.1	100.3	6.6	92.0	Pass	N/A		
SG-028	10/15/93	44270.4	78570.5	N/A	115.5	2.8	115.3	3.0	92.6	Pass	N/A		
SG-029	10/15/93	44274.9	78666.3	N/A	114.3	2.6	113.0	3.8	90.8	Pass	N/A		
SG-030	10/15/93	44309.6	78740.4	N/A	106.2	5.7	105.2	6.7	96.5	Pass	N/A		
SG-031	10/15/93	44314.4	78623.4	N/A	107.9	5.3	106.9	6.3	98.0	Pass	N/A		
SG-032	10/15/93	44322.4	78457.9	N/A	100.7	5.7	100.0	6.4	91.7	Pass	N/A		

NOTES

- (1) Test numbers with a suffix of "A" indicate retests of failing moisture-density tests.
 (2) Test numbers with a suffix of "RB" indicate rubber balloon tests.

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF SUBGRADE MOISTURE-DENSITY TESTS
DEPARTMENT OF ENERGY
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GENERAL FILL SUBGRADE

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TEST NUMBER (1,2)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES				PASS or FAIL	NOTES (3)
		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
GFSG-001	10/08/93	43929.4	78357.6	N/A	112.8	4.0	107.5	9.1	98.6		Pass	N/A
GFSG-002	10/08/93	43948.1	78220.1	N/A	108.8	4.1	106.0	6.9	97.2		Pass	N/A
GFSG-003	10/08/93	44012.6	78308.2	N/A	104.2	5.7	102.1	7.8	93.7		Pass	N/A
GFSG-004	10/08/93	44051.3	78314.1	N/A	110.4	4.6	108.5	6.5	99.6		Pass	N/A
GFSG-005	10/08/93	43984.6	78391.2	N/A	106.8	5.7	104.4	8.1	95.8		Pass	N/A
GFSG-006	10/13/93	44112.1	78286.3	N/A	106.5	9.4	104.2	11.8	95.6		Pass	N/A
GFSG-007	10/13/93	44178.0	78291.1	N/A	106.4	7.0	103.3	10.2	94.7		Pass	N/A
GFSG-008	10/13/93	44253.2	78295.6	N/A	105.6	7.7	102.6	10.4	94.2		Pass	N/A
GFSG-009	10/13/93	44391.3	78733.8	N/A	103.4	11.3	101.1	13.9	92.7		Pass	N/A
GFSG-010	10/13/93	44388.5	78632.2	N/A	108.5	8.1	106.2	10.5	97.4		Pass	N/A
GFSG-011	10/13/93	44382.6	78427.1	N/A	105.2	9.0	103.1	11.3	94.5		Pass	N/A
GFSG-012	10/13/93	44007.9	78467.2	N/A	104.7	6.0	102.3	8.5	93.9		Pass	N/A
GFSG-012RB	10/13/93	44007.9	78467.2	N/A	N/A	N/A	100.5	8.5	92.2		Pass	N/A
GFSG-013	10/13/93	43982.3	78616.6	N/A	109.6	9.8	107.8	11.6	98.9		Pass	N/A
GFSG-014	10/13/93	44032.5	78798.1	N/A	109.4	6.6	107.4	8.6	98.5		Pass	N/A

NOTES

- (1) Test numbers with suffixes of RB indicate rubber balloon tests.
(2) See General Fill test no. GF-009RB for the rubber balloon test performed on 10/08/93.

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF GENERAL FILL MOISTURE-DENSITY TESTS
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TEST NUMBER (1,2,3,4)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED			PASS or FAIL	NOTES (5)
		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	TEST VALUES				
							DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION		
GF-002	10/08/93	43964.7	78211.7	1	116.0	7.8	116.2	7.6	91.5	Pass	N/A
GF-003	10/08/93	43963.9	78275.0	1	120.0	6.9	121.6	5.5	95.8	Pass	N/A
GF-004	10/08/93	44020.6	78284.5	1	124.2	5.3	122.5	6.7	96.5	Pass	N/A
GF-005	10/08/93	44025.9	78315.9	2	119.6	6.1	118.9	6.7	93.6	Pass	N/A
GF-006	10/08/93	43947.8	78287.1	2	120.2	7.3	119.2	8.2	93.9	Pass	N/A
GF-007	10/08/93	44095.1	78297.1	3	120.0	7.7	118.2	9.3	93.1	Pass	N/A
GF-008	10/08/93	44023.7	78316.1	3	115.8	7.1	113.8	9.0	89.6	Fail	N/A
GF-008A	10/11/93	44023.7	78316.1	N/A	118.0	6.5	116.4	7.9	91.7	Pass	N/A
GF-009	10/08/93	43950.7	78222.1	4	121.8	4.3	120.0	5.8	94.5	Pass	N/A
GF-009RB	10/08/93	43950.7	78222.1	4	N/A	N/A	121.4	5.8	95.6	Pass	N/A
GF-010	10/11/93	43984.7	78304.6	N/A	116.4	4.8	114.5	6.5	90.1	Pass	N/A
GF-011	10/11/93	43997.8	78329.6	N/A	120.2	7.1	119.8	7.4	94.4	Pass	N/A
GF-012	10/11/93	44087.4	78319.4	N/A	116.7	7.5	115.1	9.0	90.7	Pass	N/A
GF-013	10/11/93	44010.0	78271.8	N/A	119.6	5.7	118.1	7.0	93.0	Pass	N/A
GF-014	10/11/93	43964.4	78256.3	N/A	120.7	5.7	120.0	6.3	94.5	Pass	N/A
GF-015	10/11/93	43923.6	78339.2	N/A	116.2	7.9	116.0	8.0	91.4	Pass	N/A
GF-016	10/11/93	43924.7	78410.4	N/A	120.2	5.1	118.3	6.8	93.1	Pass	N/A
GF-017	10/11/93	43969.5	78413.7	N/A	117.8	6.2	117.9	6.1	92.8	Pass	N/A
GF-018	10/11/93	44023.5	78305.0	N/A	119.5	6.5	117.6	8.2	92.6	Pass	N/A
GF-019	10/11/93	43926.4	78413.9	N/A	133.0	4.2	132.4	4.7	104.2	Pass	N/A
GF-020	10/11/93	43940.1	78323.9	N/A	123.2	5.8	122.2	6.7	96.2	Pass	N/A
GF-021	10/11/93	43929.6	78278.9	N/A	120.6	5.9	120.1	6.4	94.6	Pass	N/A
GF-022	10/11/93	44041.9	78375.4	N/A	119.0	7.5	116.9	9.5	92.0	Pass	N/A
GF-023	10/11/93	43922.1	78368.2	N/A	118.9	7.4	118.2	8.0	93.1	Pass	N/A
GF-024	10/11/93	43931.2	78297.8	N/A	120.5	6.4	118.6	8.1	93.4	Pass	N/A
GF-025	10/11/93	43939.9	78280.4	N/A	118.2	6.6	116.5	8.1	91.7	Pass	N/A
GF-026	10/11/93	43945.9	78202.0	N/A	120.8	6.5	118.8	7.5	93.5	Pass	N/A
GF-027	10/11/93	44022.8	78284.6	N/A	124.8	6.0	124.3	6.4	97.9	Pass	N/A
GF-027RB	10/11/93	44022.8	78284.6	N/A	N/A	N/A	125.2	6.4	98.6	Pass	N/A
GF-028	10/12/93	43997.8	78373.8	N/A	122.2	9.4	120.8	10.7	95.1	Pass	N/A
GF-029	10/12/93	44038.2	78325.7	N/A	118.1	6.9	116.5	8.3	91.8	Pass	N/A
GF-030	10/12/93	43957.0	78302.0	N/A	120.1	5.1	118.8	6.2	93.6	Pass	N/A
GF-031	10/12/93	43975.5	78352.3	N/A	120.1	8.3	118.9	9.3	93.7	Pass	N/A
GF-031RB	10/12/93	43975.5	78352.3	N/A	N/A	N/A	120.8	9.3	95.1	Pass	N/A
GF-033	10/13/93	44056.5	78301.1	N/A	122.0	5.0	120.1	6.7	94.6	Pass	N/A
GF-034	10/13/93	43947.5	78254.2	N/A	117.3	5.2	116.6	5.8	91.8	Pass	N/A
GF-035	10/13/93	43931.4	78392.4	N/A	124.8	3.3	123.3	4.6	97.1	Pass	N/A

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SUMMARY OF GENERAL FILL MOISTURE-DENSITY TESTS
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TEST NUMBER (1,2,3,4)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES					PASS or FAIL	NOTES (5)
		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION				
GF-036	10/13/93	44161.8	78276.0	N/A	123.1	5.4	121.8	6.6	95.9	Pass	N/A		
GF-037	10/13/93	44255.0	78272.5	N/A	123.9	6.5	123.2	7.1	97.0	Pass	N/A		
GF-038	10/13/93	44377.9	78367.9	N/A	122.4	6.1	119.9	8.3	94.4	Pass	N/A		
GF-039	10/13/93	44393.3	78738.6	N/A	122.6	3.1	122.1	3.4	96.2	Pass	N/A		
GF-040	10/13/93	44388.6	78621.4	N/A	121.8	4.0	120.9	4.8	95.2	Pass	N/A		
GF-041	10/13/93	44222.2	78309.2	N/A	125.1	4.4	124.5	4.9	98.0	Pass	N/A		
GF-042	10/13/93	44377.8	78623.3	N/A	107.5	4.0	104.9	6.7	96.2	Pass	N/A		
GF-043	10/13/93	44360.5	78446.2	N/A	107.8	7.6	106.4	9.0	97.6	Pass	N/A		
GF-044	10/14/93	44071.6	78746.3	N/A	110.6	4.3	108.6	6.3	99.6	Pass	N/A		
GF-045	10/14/93	43980.0	78597.5	N/A	104.3	3.6	102.5	5.5	94.0	Pass	N/A		
GF-046	10/14/93	43993.9	78584.5	N/A	116.0	3.3	114.5	4.7	90.2	Pass	N/A		
GF-047	10/14/93	43973.3	78785.5	N/A	106.5	3.5	104.9	5.1	96.3	Pass	N/A		
GF-048	10/14/93	43996.7	78861.7	N/A	105.2	4.1	103.9	5.4	95.3	Pass	N/A		
GF-048RB	10/14/93	43996.7	78861.7	N/A	N/A	N/A	101.0	5.4	92.7	Pass	N/A		
GF-049	01/31/94	44044.9	78355.6	1	104.1	4.3	103.0	5.4	94.5	Pass	N/A		
GF-050	01/31/94	43984.7	78357.2	2	108.1	4.8	105.6	7.3	96.9	Pass	N/A		
GF-051	01/31/94	44025.7	78405.9	3	106.4	6.2	106.8	5.8	98.0	Pass	N/A		
GF-052	01/31/94	44052.0	78390.5	4	104.3	4.2	102.8	5.7	94.3	Pass	N/A		
GF-052RB	01/31/94	44052.0	78390.5	4	N/A	N/A	101.4	5.7	93.0	Pass	N/A		
GF-053	02/09/94	44200.9	78354.1	N/A	100.3	3.5	98.8	5.1	90.6	Pass	N/A		
GF-054	02/09/94	44211.5	78348.5	N/A	102.4	2.7	99.8	5.4	91.6	Pass	N/A		
GF-054RB	02/09/94	44211.5	78348.5	N/A	98.3	N/A	98.3	5.4	90.2	Pass	N/A		
GF-055	03/02/94	43982.2	78325.1	N/A	114.5	5.0	112.7	6.7	90.5	Pass	5		
GF-055RB	03/02/94	43982.2	78325.1	N/A	112.0	N/A	112.3	6.7	90.2	Pass	5		
GF-056	03/07/94	44060.1	78323.2	1	104.9	6.4	111.6	N/A	102.4	Pass	5		
GF-056RB	03/07/94	44060.1	78323.2	1	N/A	N/A	108.4	N/A	99.4	Pass	5		
GF-057	03/11/94	44247.4	78355.0	1	100.7	1.5	99.3	2.9	91.1	Pass	5		
GF-057RB	03/11/94	44247.4	78355.0	1	99.0	N/A	98.9	2.9	90.8	Pass	5		
GF-058	03/23/94	44022.4	78434.3	1	106.2	3.3	105.6	3.8	96.9	Pass	5		
GF-058RB	03/23/94	44022.4	78434.3	1	N/A	N/A	107.6	3.8	98.7	Pass	5		

NOTES

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- (1) Test numbers with a suffix of "A" indicate retests of failing moisture-density tests.
- (2) Test numbers with suffixes of RB indicate rubber balloon tests.
- (3) See General Fill Subgrade test no. GFSG-012RB for rubber balloon test performed on 10/13/93.
- (4) Test numbers GF-001 and GF-032 were assigned to laboratory tested samples of general fill materials.
- (5) Rubber balloon verification tests were performed on general fill materials on days during which moisture-density tests were performed on Top Course material.

APPENDIX K
SOIL LINER MOISTURE-DENSITY TESTS

APPENDIX K-1
SECONDARY SOIL LINER

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF SOIL LINER MOISTURE-DENSITY TESTS
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TEST NUMBER (1,2,3)	DATE	TEST LOCATION INFORMATION			Troxler		LABORATORY CALCULATED TEST VALUES				PASS or FAIL	NOTES (4)
		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
SL-001	10/30/93	44308.0	78739.2	1	98.7	20.2	99.3	19.4	91.8	Pass	N/A	
SL-002	10/30/93	44262.3	78707.2	1	101.1	20.6	100.7	21.1	93.0	Pass	N/A	
SL-003	10/30/93	44280.1	78615.3	1	99.8	22.0	100.7	21.0	93.0	Pass	N/A	
SL-004	10/30/93	44241.5	78601.4	1	105.7	18.9	103.9	21.0	96.0	Pass	N/A	
SL-004RB	10/30/93	44241.5	78601.4	1	N/A	N/A	104.1	21.0	96.2	Pass	N/A	
SL-005	10/31/93	44328.9	78640.5	1	105.4	19.3	104.3	20.5	96.4	Pass	N/A	
SL-006	10/31/93	44325.3	78705.7	1	103.7	20.0	103.3	20.3	95.5	Pass	N/A	
SL-007	10/31/93	44326.7	78402.2	1	99.8	21.4	101.8	19.0	94.1	Pass	N/A	
SL-008	10/31/93	44312.7	78462.3	1	102.4	21.2	104.0	19.2	96.1	Pass	N/A	
SL-009	10/31/93	44291.5	78548.0	1	101.9	19.9	102.1	19.6	94.4	Pass	N/A	
SL-010	10/31/93	44240.7	78448.0	1	105.7	19.5	105.9	19.3	97.8	Pass	N/A	
SL-011	10/31/93	44222.1	78418.8	1	101.1	21.5	103.3	19.0	95.5	Pass	N/A	
SL-012	10/31/93	44262.0	78555.9	1	102.9	21.0	103.8	19.9	95.9	Pass	Shelby	
SL-013	10/31/93	44198.6	78415.4	1	105.1	19.2	104.9	19.3	97.0	Pass	N/A	
SL-014	10/31/93	44121.2	78385.6	1	102.6	20.1	103.5	19.1	95.7	Pass	N/A	
SL-015	10/31/93	44067.1	78479.3	1	101.0	20.1	101.9	19.1	94.2	Pass	N/A	
SL-016	10/31/93	44224.3	78568.1	1	102.9	20.5	103.1	20.3	95.3	Pass	N/A	
SL-016RB	10/31/93	44224.3	78568.1	1	N/A	N/A	104.8	20.3	96.9	Pass	N/A	
SL-017	10/31/93	44103.3	78658.1	1	102.5	20.2	103.0	19.6	95.2	Pass	N/A	
SL-018	10/31/93	44088.1	78621.9	1	102.5	19.4	102.3	19.6	94.6	Pass	N/A	
SL-019	10/31/93	44123.2	78787.9	1	98.7	20.7	99.0	20.3	91.5	Pass	N/A	
SL-020	10/31/93	44280.7	78757.6	1	98.3	23.4	100.4	20.8	92.8	Pass	N/A	
SL-021	11/01/93	44268.2	78801.5	1	100.9	21.1	102.2	19.7	94.4	Pass	N/A	
SL-022	11/01/93	44047.4	78757.8	1	103.3	19.9	102.2	21.1	94.5	Pass	N/A	
SL-023	11/01/93	44321.9	78750.9	2	106.4	19.7	106.5	19.6	98.4	Pass	N/A	
SL-024	11/01/93	44294.9	78650.2	2	104.1	21.2	105.4	19.7	97.4	Pass	N/A	
SL-025	11/01/93	44260.8	78572.5	2	101.1	20.9	102.2	19.7	94.4	Pass	N/A	
SL-026	11/01/93	44292.6	78509.4	2	103.0	19.8	104.0	18.6	96.1	Fail	N/A	
SL-026A	11/01/93	44292.6	78509.4	2	102.9	20.0	103.9	19.0	96.0	Pass	N/A	
SL-027	11/01/93	44297.1	78475.8	2	102.4	19.9	104.4	17.6	96.5	Fail	N/A	
SL-027A	11/01/93	44277.0	78472.2	2	100.4	21.6	102.3	19.3	94.6	Pass	N/A	
SL-028	11/01/93	44314.1	78391.5	2	105.2	19.9	107.2	17.6	99.1	Fail	N/A	
SL-028A	11/01/93	44314.1	78391.5	2	104.8	19.7	105.4	19.0	97.4	Pass	N/A	
SL-029	11/01/93	44230.7	78364.8	2	103.9	20.4	103.8	20.5	95.9	Pass	N/A	
SL-030	11/01/93	44149.9	78416.3	2	103.6	18.4	102.6	19.6	94.8	Pass	N/A	
SL-031	11/01/93	44116.8	78381.5	2	103.1	19.3	103.4	18.9	95.6	Pass	N/A	
SL-031RB	11/01/93	44116.8	78381.5	2	N/A	N/A	106.6	18.9	98.5	Pass	N/A	

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		-----			-----		TEST VALUES				
TEST NUMBER (1,2,3)	DATE	NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION	PASS or FAIL	NOTES (4)
SL-032	11/09/93	44083.6	78805.8	2	99.2	22.5	100.5	20.9	92.7	Pass	N/A
SL-033	11/09/93	44138.3	78752.9	2	103.9	20.4	104.3	19.8	96.3	Pass	N/A
SL-034	11/09/93	44176.0	78725.1	2	103.7	19.8	104.4	19.0	96.3	Pass	N/A
SL-035	11/09/93	44219.0	78714.4	2	103.7	19.7	103.8	19.6	95.7	Pass	N/A
SL-036	11/09/93	44337.1	78704.5	3	102.4	20.8	102.0	21.3	94.1	Pass	N/A
SL-037	11/09/93	44276.6	78647.8	3	104.7	19.4	105.2	18.9	97.1	Pass	N/A
SL-038	11/09/93	44278.2	78551.9	3	102.0	19.9	103.0	18.7	95.0	Pass	N/A
SL-039	11/09/93	44297.5	78494.3	3	101.2	21.3	103.2	19.0	95.2	Pass	N/A
SL-040	11/09/93	44176.3	78502.0	1	103.3	20.8	103.9	20.1	95.9	Pass	N/A
SL-041	11/09/93	44234.0	78448.4	2	101.0	21.8	101.4	21.3	93.5	Pass	N/A
SL-042	11/09/93	44167.9	78527.9	1	99.9	19.0	98.3	20.8	90.7	Pass	N/A
SL-043	11/09/93	44162.0	78496.5	1	105.1	20.7	104.9	21.0	96.7	Pass	N/A
SL-044	11/09/93	44201.8	78520.5	1	98.6	23.5	99.3	22.6	91.6	Pass	N/A
SL-045	11/09/93	44194.0	78586.2	1	105.9	18.8	105.1	19.8	96.9	Pass	N/A
SL-045RB	11/09/93	44194.0	78586.2	1	N/A	N/A	106.3	19.8	98.1	Pass	N/A
SL-046	11/10/93	44166.7	78682.2	1	105.2	20.3	105.3	19.9	97.2	Pass	N/A
SL-047	11/10/93	44044.6	78778.8	1	101.6	19.4	100.7	20.6	92.9	Pass	N/A
SL-048	11/10/93	44170.0	78621.4	1	102.6	21.4	103.4	20.4	95.4	Pass	N/A
SL-049	11/10/93	44151.6	78611.6	1	99.3	22.2	99.3	22.2	91.6	Pass	N/A
SL-050	11/10/93	44123.8	78516.4	1	100.7	22.3	100.9	22.0	93.1	Pass	N/A
SL-051	11/10/93	44113.8	78405.1	3	101.2	21.8	102.1	20.7	94.2	Pass	N/A
SL-052	11/10/93	44193.5	78433.9	3	98.5	19.0	97.7	20.0	90.1	Pass	N/A
SL-053	11/10/93	44223.0	78392.6	3	102.5	21.3	104.4	19.1	96.3	Pass	N/A
SL-054	11/10/93	44064.7	78533.4	2	103.5	19.6	105.2	17.6	97.0	Fail	N/A
SL-054A	11/11/93	44064.7	78533.4	2	100.0	21.0	101.7	19.0	93.9	Pass	N/A
SL-055	11/10/93	44058.4	78596.6	3	104.7	20.3	105.8	19.0	97.6	Pass	Shelby
SL-056	11/10/93	44089.2	78620.7	2	102.9	21.6	103.9	20.5	95.8	Pass	N/A
SL-057	11/10/93	44100.8	78661.2	3	102.3	19.6	102.9	18.9	95.0	Pass	N/A
SL-058	11/10/93	44141.7	78667.5	3	103.0	20.4	103.3	20.0	95.2	Pass	N/A
SL-059	11/10/93	44223.4	78626.9	2	102.2	20.6	102.1	20.8	94.2	Pass	N/A
SL-060	11/10/93	44149.8	78794.6	3	103.1	19.8	103.6	19.2	95.6	Pass	N/A
SL-061	11/10/93	44186.5	78738.8	3	102.2	19.1	101.2	20.4	93.3	Pass	N/A
SL-061RB	11/10/93	44186.5	78738.8	3	N/A	N/A	101.6	20.4	93.7	Pass	N/A
SL-062	11/10/93	44206.5	78753.1	3	103.7	19.0	103.7	19.0	95.7	Pass	N/A
SL-063	11/10/93	44233.3	78728.5	3	101.5	20.4	102.2	19.6	94.3	Pass	N/A
SL-064	11/10/93	44231.9	78692.7	2	106.2	19.2	104.2	21.4	96.1	Pass	N/A
SL-065	11/10/93	44278.6	78693.2	4	105.2	19.2	104.6	19.9	96.5	Pass	N/A
SL-066	11/10/93	44225.2	78662.8	2	105.0	19.0	103.9	20.3	95.9	Pass	N/A
SL-066RB	11/10/93	44225.2	78662.8	2	N/A	N/A	106.2	20.3	97.9	Pass	N/A

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		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
SL-067	11/10/93	44208.4	78590.2	2	103.8	19.8	103.3	20.4	95.3	Pass	N/A	
SL-068	11/10/93	44199.4	78552.5	2	102.3	19.4	101.1	20.8	93.2	Pass	N/A	
SL-069	11/10/93	44128.6	78486.1	2	101.4	21.3	101.7	20.8	93.9	Pass	N/A	
SL-070	11/10/93	44135.1	78450.2	2	99.8	22.5	101.5	20.4	93.6	Pass	N/A	
SL-071	11/11/93	44281.6	78578.2	4	102.1	19.3	101.8	19.7	94.0	Pass	N/A	
SL-072	11/11/93	44228.0	78573.8	3	98.0	21.2	98.3	20.9	90.8	Pass	N/A	
SL-073	11/11/93	44218.6	78546.9	3	102.8	21.0	103.2	20.5	95.3	Pass	N/A	
SL-074	11/11/93	44266.8	78529.5	4	102.6	19.2	101.8	20.1	94.0	Pass	N/A	
SL-075	11/11/93	44216.0	78504.2	3	99.8	22.7	101.3	20.8	93.6	Pass	N/A	
SL-076	11/11/93	44217.1	78486.4	3	102.8	19.5	101.5	21.0	93.7	Pass	N/A	
SL-077	11/11/93	44253.0	78475.5	4	102.6	19.9	101.8	20.7	94.0	Pass	N/A	
SL-078	11/11/93	44182.8	78497.4	3	103.0	19.5	102.2	20.4	94.3	Pass	N/A	
SL-079	11/11/93	44188.5	78564.2	3	99.4	23.6	101.7	20.9	93.9	Pass	N/A	
SL-080	11/11/93	44164.4	78647.9	3	104.8	19.1	103.6	20.5	95.6	Pass	N/A	
SL-081	11/11/93	44142.3	78416.4	4	102.0	19.6	101.5	20.2	93.7	Pass	N/A	
SL-082	11/11/93	44209.9	78419.2	4	99.2	22.6	101.0	20.5	93.3	Pass	N/A	
SL-083	11/11/93	44221.3	78431.1	4	101.8	19.9	101.8	19.9	94.0	Pass	N/A	
SL-084	11/11/93	44063.5	78432.3	1	104.8	19.6	104.5	20.0	96.5	Pass	N/A	
SL-085	11/11/93	44109.9	78551.2	1	103.4	19.5	103.3	19.7	95.3	Pass	N/A	
SL-085RB	11/11/93	44109.9	78551.2	1	N/A	N/A	105.2	19.7	97.1	Pass	N/A	
SL-086	11/11/93	44130.2	78694.3	4	101.9	21.2	102.3	20.7	94.5	Pass	Shelby	
SL-086A	11/16/93	44130.2	78694.3	4	101.9	20.5	101.5	21.0	93.7	Pass	Shelby	
SL-087	11/11/93	44104.1	78691.3	4	99.2	20.9	99.9	20.0	92.3	Pass	N/A	
SL-088	11/13/93	44146.7	78554.7	6	100.7	20.1	100.8	19.8	93.1	Pass	N/A	
SL-089	11/11/93	44079.5	78631.9	4	100.6	20.1	101.0	19.6	93.3	Pass	N/A	
SL-090	11/11/93	44065.4	78573.7	4	102.0	20.5	102.3	20.1	94.5	Pass	N/A	
SL-091	11/11/93	44115.7	78754.9	4	101.0	22.0	103.1	19.5	95.2	Pass	N/A	
SL-092	11/11/93	44184.4	78741.9	4	103.2	19.7	103.9	19.0	95.9	Pass	N/A	
SL-093	11/11/93	44236.2	78736.4	4	100.0	22.7	101.9	20.4	94.1	Pass	N/A	
SL-094	11/11/93	44239.2	78704.6	4	100.0	22.0	101.7	20.1	93.9	Pass	N/A	
SL-095	11/11/93	44242.7	78651.4	5	102.1	21.0	102.9	20.0	95.0	Pass	N/A	
SL-096	11/11/93	44280.3	78588.4	5	103.5	20.4	104.7	19.0	96.7	Pass	N/A	
SL-097	11/11/93	44272.4	78528.7	5	104.2	19.4	103.3	20.4	95.4	Pass	N/A	
SL-098	11/11/93	44248.0	78488.4	5	101.7	20.4	101.7	20.5	93.9	Pass	N/A	
SL-099	11/11/93	44259.7	78430.4	5	102.0	20.7	102.2	20.5	94.3	Pass	N/A	
SL-100	11/11/93	44223.4	78414.0	5	101.1	22.2	102.5	20.6	94.6	Pass	N/A	
SL-101	11/11/93	44137.4	78423.4	5	102.0	20.3	102.1	20.3	94.3	Pass	N/A	
SL-102	11/11/93	44251.7	78484.8	4	100.2	21.8	101.2	20.5	93.5	Pass	N/A	
SL-103	11/11/93	44198.9	78495.7	4	99.3	22.1	100.3	20.8	92.6	Pass	N/A	

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		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
SL-103RB	11/11/93	44198.9	78515.3	4	N/A	N/A	103.3	20.8	95.4	Pass	N/A	
SL-104	11/11/93	44202.3	78580.5	4	103.8	19.0	102.8	20.1	95.0	Pass	N/A	
SL-105	11/11/93	44142.5	78561.3	3	103.1	19.5	102.8	20.0	94.9	Pass	N/A	
SL-106	11/11/93	44120.6	78483.8	3	101.5	20.4	102.1	19.7	94.3	Pass	N/A	
SL-107	11/12/93	44197.2	78668.8	5	99.6	22.0	101.3	20.0	93.6	Pass	N/A	
SL-108	11/12/93	44207.1	78589.7	5	103.0	20.0	102.4	20.6	94.6	Pass	N/A	
SL-109	11/12/93	44183.9	78569.3	5	102.3	20.5	102.8	19.9	94.9	Pass	N/A	
SL-110	11/12/93	44132.9	78441.0	5	103.0	20.1	102.5	20.6	94.6	Pass	N/A	
SL-111	11/12/93	44095.2	78431.0	5	102.9	19.6	102.7	20.0	94.8	Pass	N/A	
SL-112	11/12/93	44069.5	78628.0	5	97.8	22.8	99.6	20.6	92.0	Pass	N/A	
SL-113	11/12/93	44091.7	78642.9	5	101.0	19.4	100.5	20.0	92.8	Pass	N/A	
SL-114	11/12/93	44188.0	78641.1	3	97.8	21.4	99.1	19.8	91.5	Pass	N/A	
SL-115	11/12/93	44078.1	78697.8	5	101.2	21.2	101.8	20.5	94.0	Pass	N/A	
SL-116	11/12/93	44052.6	78681.6	5	101.6	21.3	103.1	19.5	95.2	Pass	N/A	
SL-117	11/12/93	44150.9	78452.1	4	99.7	22.2	100.4	21.3	92.7	Pass	N/A	
SL-118	11/12/93	44151.8	78599.4	4	102.7	20.5	103.5	19.5	95.6	Pass	N/A	
SL-119	11/12/93	44249.0	78781.2	5	103.4	19.9	103.3	20.0	95.4	Pass	N/A	
SL-120	11/12/93	44138.5	78759.9	5	99.2	22.0	101.4	19.3	93.7	Pass	N/A	
SL-121	11/12/93	44179.8	78724.2	5	101.5	20.8	102.3	19.8	94.5	Pass	N/A	
SL-122	11/12/93	44235.8	78720.8	5	100.6	22.3	102.5	20.1	94.6	Pass	N/A	
SL-123	11/12/93	44267.8	78651.6	6	102.6	18.9	102.3	19.3	94.4	Pass	N/A	
SL-123RB	11/12/93	44267.8	78651.6	6	N/A	N/A	103.0	19.3	95.1	Pass	N/A	
SL-124	11/12/93	44255.6	78612.2	6	101.4	20.3	101.8	19.9	94.0	Pass	N/A	
SL-125	11/12/93	44270.1	78534.8	6	103.4	19.2	103.0	19.7	95.1	Pass	N/A	
SL-126	11/12/93	44284.0	78471.7	6	102.8	20.7	103.6	19.7	95.7	Pass	N/A	
SL-127	11/13/93	44259.8	78390.3	6	99.8	22.1	102.0	19.5	94.2	Pass	N/A	
SL-128	11/13/93	44189.9	78395.0	6	100.4	21.8	102.0	19.9	94.2	Pass	N/A	
SL-129	11/13/93	44168.3	78443.6	6	103.9	19.8	103.7	20.0	95.7	Pass	Shelby	
SL-130	11/13/93	44218.3	78401.8	6	103.6	19.6	103.6	19.6	95.7	Pass	N/A	
SL-131	11/13/93	44210.5	78588.6	6	102.2	21.4	103.5	19.9	95.6	Pass	N/A	
SL-132	11/13/93	44166.6	78695.3	6	101.3	21.0	102.5	19.6	94.7	Pass	N/A	
SL-133	11/13/93	44120.5	78645.4	6	103.2	19.8	103.3	19.7	95.4	Pass	N/A	
SL-134	11/13/93	44096.0	78516.1	6	103.8	19.2	102.9	20.2	95.0	Pass	N/A	
SL-135	11/13/93	44163.7	78466.1	6	103.5	19.3	102.3	20.7	94.5	Pass	N/A	
SL-136	11/13/93	44181.6	78517.1	6	100.9	22.1	102.7	20.0	94.8	Pass	Shelby	
SL-137	11/13/93	44041.3	78458.8	6	104.5	20.2	105.1	19.5	97.0	Pass	N/A	
SL-137RB	11/13/93	44041.3	78458.8	6	N/A	N/A	105.6	19.5	97.5	Pass	N/A	
SL-138	11/13/93	44101.7	78597.6	6	102.1	20.6	103.4	19.0	95.4	Pass	N/A	
SL-139	11/13/93	44076.2	78722.7	6	99.1	19.2	98.9	19.5	91.3	Pass	N/A	

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		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
SL-140	11/13/93	44128.9	78751.1	6	101.4	20.8	102.2	19.9	94.3	Pass	N/A	
SL-141	11/13/93	44166.6	78708.0	6	99.0	22.1	100.8	19.9	93.1	Pass	N/A	
SL-142	11/13/93	44077.2	78373.2	6	103.0	18.6	101.9	19.8	94.1	Pass	N/A	
SL-143	11/13/93	44198.9	78481.6	1	102.9	20.4	104.2	18.9	96.2	Pass	N/A	
SL-144	11/13/93	44179.1	78470.3	2	101.3	20.9	102.9	18.9	95.1	Pass	N/A	
SL-145	11/13/93	44205.8	78502.7	3	102.9	18.2	102.1	19.1	94.3	Pass	N/A	
SL-146	11/13/93	44178.6	78462.5	4	104.3	18.8	104.1	19.0	96.1	Pass	N/A	
SL-146RB	11/13/93	44178.6	78462.5	4	N/A	N/A	106.3	19.0	98.2	Pass	N/A	
SL-147	11/14/93	44200.8	78509.3	5	99.5	22.3	102.4	18.9	94.6	Pass	N/A	
SL-148	11/14/93	44187.1	78477.1	6	105.4	19.4	105.0	19.9	97.0	Pass	N/A	
SL-148RB	11/14/93	44187.1	78477.1	6	N/A	N/A	104.2	19.9	96.2	Pass	N/A	
SL-149	11/15/93	44072.6	78463.6	7	103.6	21.8	105.6	19.5	97.5	Pass	N/A	
SL-150	11/15/93	44118.3	78553.3	8	102.3	19.8	102.8	19.3	94.9	Pass	N/A	
SL-151	11/15/93	44124.5	78593.6	9	100.0	21.5	102.1	18.9	94.3	Pass	N/A	
SL-152	11/15/93	44079.2	78513.0	10	105.3	19.2	105.2	19.3	97.1	Pass	N/A	
SL-152RB	11/15/93	44079.2	78513.0	10	N/A	N/A	106.1	19.3	98.0	Pass	N/A	
SL-153	11/16/93	44230.8	78692.9	4	101.2	22.4	102.9	20.4	95.0	Pass	Shelby	
SL-154	11/16/93	44151.0	78702.0	4	104.1	19.9	104.8	19.2	96.8	Pass	Shelby	
SL-155	11/16/93	44120.7	78705.8	1	102.3	19.9	102.0	20.2	94.2	Pass	N/A	
SL-156	11/16/93	44127.9	78695.0	2	102.1	20.7	102.2	20.6	94.4	Pass	N/A	
SL-157	11/16/93	44117.4	78711.2	3	102.7	18.9	101.4	20.4	93.6	Pass	N/A	
SL-158	11/16/93	44130.5	78695.4	5	101.7	19.8	101.0	20.6	93.3	Pass	N/A	
SL-159	11/16/93	44143.4	78688.5	6	103.7	19.2	103.1	20.0	95.2	Pass	N/A	
SL-159RB	11/16/93	44143.4	78688.5	6	N/A	N/A	105.6	20.0	97.5	Pass	N/A	
SL-160	12/01/93	44080.6	78501.9	6	108.0	17.4	106.6	18.9	98.4	Pass	Shelby	
SL-161	12/01/93	44185.2	78600.9	6	106.1	18.4	105.4	19.2	97.2	Pass	Shelby	
SL-162	12/01/93	44143.0	78435.3	6	105.1	18.4	104.5	19.1	96.4	Pass	Shelby	
SL-162RB	12/01/93	44143.0	78435.3	6	N/A	N/A	103.9	19.1	95.9	Pass	N/A	

NOTES

- (1) Test numbers with a suffix of "A" indicate retests of failing moisture-density tests.
- (2) Test numbers with suffixes of RB indicate rubber balloon tests.
- (3) Test number SL-088 is not in chronological order due to an error in ordering sequence.
- (4) The note "Shelby" indicates that a Shelby tube sample of the soil liner was obtained at this test location.

APPENDIX K-2
PRIMARY SOIL LINER

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF SOIL LINER MOISTURE-DENSITY TESTS
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANFORD NUCLEAR RESERVATION
PRIMARY SOIL LINER

933-1354

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TEST NUMBER (1,2)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES				PASS or FAIL	NOTES (3)
		NORTH	WEST	LIFT	DRY	FIELD	DRY	LAB	PERCENT			
		COORDINATE	COORDINATE	No.	DENS.	MOIST	DENSITY	MOIST	COMPACTION			
					(pcf)	(%)	(pcf)	(%)				
PL-001	12/19/93	44107.3	78602.0	1	107.9	17.3	106.1	19.3	97.9	Pass	N/A	
PL-002	12/19/93	44083.3	78527.3	1	107.4	18.7	107.0	19.1	98.7	Pass	N/A	
PL-003	12/19/93	44050.5	78435.0	1	107.9	18.1	107.0	19.1	98.7	Pass	N/A	
PL-003RB	12/19/93	44050.5	78435.0	1	N/A	N/A	106.0	19.1	97.8	Pass	N/A	
PL-004	01/06/94	44059.2	78433.3	1	106.6	19.3	103.8	22.5	95.7	Pass	N/A	
PL-004RB	01/06/94	44059.2	78433.3	1	N/A	N/A	106.6	22.5	98.4	Pass	N/A	
PL-005	01/06/94	44092.8	78529.2	1	108.7	16.5	105.1	20.5	96.9	Pass	N/A	
PL-006	01/06/94	44121.3	78608.4	1	104.9	17.1	102.5	19.9	94.6	Pass	N/A	
PL-007	01/19/94	44137.6	78687.9	1	106.9	18.6	105.9	19.6	97.7	Pass	N/A	
PL-008	01/19/94	44227.8	78677.7	1	104.1	19.4	103.4	20.2	95.4	Pass	N/A	
PL-009	01/19/94	44222.6	78585.4	1	104.2	19.6	103.9	20.0	95.9	Pass	N/A	
PL-010	01/19/94	44179.5	78563.1	1	102.9	19.5	102.5	20.0	94.6	Pass	N/A	
PL-011	01/19/94	44174.2	78490.8	1	104.4	19.0	103.2	20.4	95.2	Pass	N/A	
PL-012	01/19/94	44204.7	78462.6	1	103.1	20.1	102.7	20.6	94.7	Pass	N/A	
PL-013	01/19/94	44235.4	78485.8	1	104.3	19.6	104.0	20.0	95.9	Pass	N/A	
PL-014	01/19/94	44206.1	78519.7	2	107.1	18.0	105.2	20.1	97.0	Pass	N/A	
PL-015	01/19/94	44213.9	78578.3	2	105.9	19.1	103.9	21.4	95.8	Pass	Shelby	
PL-016	01/19/94	44182.2	78652.3	2	107.9	18.5	105.9	20.7	97.7	Pass	N/A	
PL-016RB	01/19/94	44182.2	78652.3	2	N/A	N/A	103.5	20.7	95.5	Pass	N/A	

NOTES

- (1) Test numbers with a suffix of "A" indicate retests of failing moisture-density tests.
- (2) Test numbers with suffixes of RB indicate rubber balloon tests.
- (3) The note "Shelby" indicates that a Shelby tube sample of the soil liner was obtained at this test location.

APPENDIX L
SUBGRADE ACCEPTANCE CERTIFICATES

4.5

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The north slope and 20' of the floor on the north end of the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

DEAN S. MARTIN [Signature] GeoPacific Lining Co. 11-19-93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

DAVID H. MATHEWS [Signature] Golder Construction Services, Inc. 11-19-93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider [Signature] DelHur Industries, Inc.
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The west and south slopes and 20' of the floor on the west and souths ends of the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Dennis Martin GeoPacific Lining Co.
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis 11-20-93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc.
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY <u>GeoPacific Lining Co.</u> ADDRESS <u>1300 Dexter Avenue</u> <u>Suite 250</u> <u>Seattle, WA 98109</u>	LOCATION <u>Hanford, Washington</u> PROJECT <u>Non-Drag Off Landfill</u> OWNER <u>Department of Energy</u>
---	--

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

Panels S-043 through S-049 on the south slope and panels S-050 through S-052 on the floor of the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

<u>Steve Hewitt</u>		<u>GeoPacific Lining Co. 12/05/93</u>
NAME	SIGNATURE	DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

<u>David H. Mathis</u>		<u>Golder Const. Services, Inc. 12/05/93</u>
NAME	SIGNATURE	DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

<u>Don Schneider</u>		<u>DelHur Industries, Inc. 12/05/93</u>
NAME	SIGNATURE	DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE
OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

Panels S-053 through S-055 on the south slope and panels S-056 through S-065 on the east slope of the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Steve Hewitt GeoPacific Lining Co. 12/05/93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 12/05/93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 12/05/93
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE
OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of
GeoPacific Lining Inc. do hereby accept the area of soil surface
bounded by:

Panels S-066 through S-071 on the south slope and north slopes of
the cell.

and shall be responsible for maintaining its integrity and
suitability in accordance with project specifications from this
date to the completion of the installation.

Steve Hewitt GeoPacific Lining Co. 12/06/93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 12/06/93
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 12/06/93
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining, Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The entire surface of primary admix on the floor of the cell except
the area at the end of the access ramp in the southwest corner of
the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Dennis Martin
NAME

SIGNATURE

GeoPacific Lining Inc.

1-20-94
DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis
NAME

SIGNATURE

Golder Const. Services, Inc.

1-20-94
DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider
NAME

SIGNATURE

DelHur Industries, Inc.

1-20-94
DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining, Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The surface of primary admix on the access ramp into the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Steve Hewitt GeoPacific Lining Inc.
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 1/26/94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 1-26-94
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining, Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The entire surface of primary admix on the floor of the cell.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Dennis Martin GeoPacific Lining Inc. 1-26-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 1-26-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 1-26-94
NAME SIGNATURE DATE

GCS FORM: G4

CERTIFICATE OF ACCEPTANCE
OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining, Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The surface of subgrade in the truck turn around area where panels T-001 through T-007 were installed.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Steve Hewitt GeoPacific Lining Inc. 2-10-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 2-10-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 2-10-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE OF SOIL SURFACE

4.5

GEOSYNTHETIC
INSTALLER

PROJECT

COMPANY GeoPacific Lining, Co.
ADDRESS 1300 Dexter Avenue
Suite 250
Seattle, WA 98109

LOCATION Hanford, Washington
PROJECT Non-Drag Off Landfill
OWNER Department of Energy

I, the Undersigned, the duly authorized representative of GeoPacific Lining Inc. do hereby accept the area of soil surface bounded by:

The surface of subgrade in the truck staging area where panels T-001 through T-007 were installed.

and shall be responsible for maintaining its integrity and suitability in accordance with project specifications from this date to the completion of the installation.

Steve Hewitt GeoPacific Lining Inc. 2-16-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY QA/QC MANAGER

David H. Mathis Golder Const. Services, Inc. 2-11-94
NAME SIGNATURE DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY GENERAL CONTRACTOR

Don Schneider DelHur Industries, Inc. 2-16-94
NAME SIGNATURE DATE

GCS FORM: G4

APPENDIX M
SECONDARY HDPE GEOMEMBRANE LINER INSTALLATION

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APPENDIX M-1

GEOMEMBRANE DEPLOYMENT OBSERVATION SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
 SECONDARY GEOMEMBRANE LINER DEPLOYMENT OBSERVATION SUMMARY
 DEPARTMENT OF ENERGY
 NON-DRAG OFF LANDFILL FACILITY
 HANFORD NUCLEAR RESERVATION

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 Page 1

PANEL NUMBER(1)	ROLL NUMBER	DATE DEPLOYED	APPROX.	VISUAL PANEL INSP (2)	MINIMUM	AVERAGE PANEL THICKNESS			DEPLOYMENT	REMARKS
			PANEL LENGTH (ft)		PANEL OVERLAP (inches)	Leading Edge	Side Edge	Trailing Edge	MONITOR (4)	
S-001	AC6931	11/19/93	131	OK	5	60.1	61.1	60.6	NE	
S-002	AC6931	11/19/93	135	OK	5	60.8	64.9	60.2	NE	
S-003	AC6931	11/19/93	134	OK	5	60.2	64.8	60.6	NE	
S-004	AC6893	11/19/93	135	OK	5	60.4	62.1	60.2	NE	
S-005	AC6893	11/19/93	135	OK	5	60.2	63.4	60.4	NE	
S-006	AC6893	11/19/93	122	OK	5	60.4	64.0	60.9	NE	
S-007	AC6894	11/19/93	19	OK	5	60.6	64.6	60.6	NE	
S-008	AC6894	11/20/93	134	OK	5	67.0	61.9	67.9	NE	
S-009	AC6894	11/20/93	132	OK	5	67.9	66.1	67.0	NE	
S-010	AC6894	11/20/93	131	OK	5	65.6	63.6	68.9	NE	
S-011	AC6907	11/20/93	131	OK	5	65.3	63.9	66.9	NE	
S-012	AC6907	11/20/93	132	OK	5	66.9	63.0	67.4	NE	
S-013	AC6907	11/20/93	126	OK	5	67.4	64.5	67.8	NE	
S-014	AC7683	11/20/93	108	OK	5	67.9	65.3	67.8	NE	
S-015	AC7683	11/20/93	83	OK	5	67.8	65.5	67.2	NE	
S-016	AC7683	11/20/93	61	OK	5	67.2	64.6	68.0	NE	
S-017	AC6894	11/20/93	42	OK	5	67.8	63.9	68.5	NE	
S-018	AC7683	11/20/93	56	OK	5	68.5	65.9	68.8	NE	
S-019	AC7683	11/20/93	90	OK	5	68.8	66.1	67.7	NE	
S-020	AC6928	11/20/93	114	OK	5	67.8	66.6	65.7	NE	
S-021	AC6928	11/20/93	138	OK	5	65.7	66.2	68.4	NE	
S-022	AC6928	11/20/93	152	OK	5	68.4	65.8	69.2	NE	
S-023	AC6929	11/20/93	153	OK	5	67.3	62.5	67.3	NE	
S-024	AC6929	11/20/93	151	OK	5	67.3	64.2	67.0	NE	
S-025	AC6929	11/20/93	152	OK	5	67.0	66.0	69.0	NE	
S-026	AC6929	11/20/93	18	OK	5	69.0	66.5	67.9	NE	
S-027	AC6926	11/20/93	152	OK	5	68.2	64.9	68.0	NE	
S-028	AC6926	11/20/93	152	OK	5	68.0	65.9	68.8	NE	
S-029	AC6926	11/20/93	114	OK	5	68.8	64.4	68.5	NE	
S-030	AC6910	11/20/93	90	OK	5	68.6	67.1	68.7	NE	
S-031	AC6910	11/20/93	69	OK	5	68.7	66.0	67.3	NE	
S-032	AC6910	11/20/93	50	OK	5	67.3	65.4	67.7	NE	
S-033	AC6910	11/20/93	31	OK	5	67.8	67.8	64.7	NE	
S-034	AC6910	11/20/93	28	OK	5	64.7	64.3	68.1	NE	
S-035	AC6910	11/20/93	87	OK	5	68.1	66.0	68.4	NE	
S-036	AC6910	11/20/93	88	OK	5	68.4	66.0	68.4	NE	
S-037	AC6910	11/20/93	34	OK	5	68.4	68.5	67.3	NE	
S-038	AC6914	11/21/93	110	OK	5	67.4	65.3	67.4	NE	
S-039	AC6914	11/21/93	168	OK	5	67.4	65.3	67.4	NE	
S-040	AC6914	11/21/93	157	OK	5	67.4	66.8	67.8	NE	

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES, INC.
SECONDARY GEOMEMBRANE LINER DEPLOYMENT OBSERVATION SUMMARY
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANFORD NUCLEAR RESERVATION

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Page 2

PANEL NUMBER(1)	ROLL NUMBER	DATE DEPLOYED	APPROX.	VISUAL PANEL INSP (2)	MINIMUM	AVERAGE PANEL THICKNESS			DEPLOYMENT	REMARKS
			PANEL LENGTH (ft)		PANEL OVERLAP (inches)	Leading Edge	Side Edge	Trailing Edge	MONITOR (4)	
S-041	AC6895	11/21/93	153	OK	5	67.1	66.6	67.7	NE	
S-042	AC6895	11/21/93	155	OK	5	67.7	63.7	67.3	NE	
S-043	AC6896	12/04/93	155	OK	5	68.9	63.5	68.5	NE	
S-044	AC6896	12/05/93	157	OK	5	68.5	61.6	65.5	NE	
S-045	AC6916	12/05/93	155	OK	5	68.5	64.9	68.5	NE	
S-046	AC6916	12/05/93	151	OK	5	68.5	64.5	68.5	NE	
S-047	AC6916	12/05/93	146	OK	5	68.5	63.8	68.5	NE	
S-048	AC6913	12/05/93	149	OK	5	68.2	62.8	66.8	NE	
S-049	AC6913	12/05/93	149	OK	5	68.1	62.0	69.3	NE	
S-050	AC7684	12/05/93	189	OK	5	65.4	64.8	64.5	NE	
S-051	AC7684	12/05/93	188	OK	5	64.5	64.9	64.8	NE	
S-052	AC7682	12/05/93	187	OK	5	64.7	63.0	64.6	NE	
S-053	AC6913	12/05/93	145	OK	5	69.3	62.5	68.5	NE	
S-054	AC6927	12/05/93	125	OK	5	68.1	64.8	69.0	NE	
S-055	AC6927	12/05/93	103	OK	5	69.0	65.0	68.8	NE	
S-056	AC6927	12/05/93	63	OK	5	68.8	65.3	68.2	NE	
S-057	AC6927	12/05/93	79	OK	5	68.2	63.4	68.2	NE	
S-058	AC6927	12/05/93	94	OK	5	68.2	61.9	68.5	NE	
S-059	AC7681	12/05/93	152	OK	5	68.8	64.4	69.0	NE	
S-060	AC7681	12/05/93	157	OK	5	69.0	64.0	69.3	NE	
S-061	AC7681	12/05/93	158	OK	5	69.3	64.8	68.9	NE	
S-062	AC6930	12/05/93	155	OK	5	67.7	62.5	68.4	NE	
S-063	AC6930	12/05/93	113	OK	5	68.4	62.0	67.1	NE	
S-064	AC6930	12/05/93	97	OK	5	67.1	62.1	68.3	NE	
S-065	AC6913	12/06/93	30	OK	5	67.7	62.5	67.8	NE	
S-066	AC6895	12/06/93	90	OK	5	67.6	64.2	68.0	NE	
S-067	AC6895	12/06/93	72	OK	5	68.0	64.7	67.3	NE	
S-068	AC6916	12/06/93	46	OK	5	67.7	63.8	68.4	NE	
S-069	AC6896	12/06/93	69	OK	5	68.0	62.1	67.7	NE	
S-070	AC6895	12/06/93	36	OK	5	68.4	63.2	68.8	NE	
S-071	AC6927	12/06/93	24	OK	5	68.1	62.7	68.1	NE	

NOTES

- (1) A panel number with a prefix of S indicates a panel of the secondary HDPE geomembrane liner.
- (2) OK indicates that the panel was free of visual defects when deployed in the landfill.
- (3) Average sheet thickness based upon the average of five micrometer measurements made along each end and one side of the panel.
- (4) See Weld Observation Summary for monitor identification.

APPENDIX M-2
TRIAL SEAM OBSERVATION SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
SECONDARY GEOMEMBRANE LINER TRIAL SEAM OBSERVATION SUMMARY
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANFORD NUCLEAR RESERVATION

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						FIELD TEST RESULTS (4,5)							
SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	PEEL(7)				SHEAR		PASS or FAIL	
						Inside Track		Outside Track		Code	Strength		
						Code	Strength	Code	Strength				
TS-001	11/17/93	AB	X3	DHM	530	F1	170.0			P1	215.0	Fail	
TS-002R	11/17/93	AB	X3	DHM	530	P2	178.0			P1	224.0	Pass	
						P2	158.0			P1	230.0		
TS-003	11/18/93	ET	X3	SM	525	P2	158.0			P1	220.0	Pass	
						P2	123.0			P1	228.0		
TS-004	11/19/93	SH	F3	SM	700	P2	148.0			P1	223.0	Pass	
						P2	148.0	P2	160.0	P1	155.0		
TS-005	11/19/93	ET	F2	SM	700	P2	161.0	P2	156.0	P1	177.0	Pass	
						P2	123.0	P2	135.0	P1	164.0		
TS-006	11/19/93	SH	F3	DHM	700	P2	146.0	P2	141.0	P1	161.0	Pass	
						P2	128.0	P2	145.0	P1	162.0		
TS-007	11/19/93	ET	F2	DHM	700	P2	134.0	P2	139.0	P1	155.0	Pass	
						P2	144.0	P2	137.0	P1	166.0		
TS-008	11/20/93	ET	F2	DHM	700	P2	142.0	P2	140.0	P1	166.0	Pass	
						P2	165.0	P2	148.0	P1	209.0		
TS-009	11/20/93	SH	F3	SM	720	P2	157.0	P2	177.0	P1	191.0	Pass	
						P2	149.0	P2	146.0	P1	176.0		
TS-010	11/20/93	AB	F5	SM	705	P2	165.0	P2	155.0	P1	175.0	Pass	
						P2	201.0	P2	198.0	P1	214.0		
TS-011	11/20/93	SH	F3	SM	720	P2	194.0	P2	199.0	P1	225.0	Pass	
						P2	159.0	P2	160.0	P1	179.0		
TS-012	11/20/93	AB	F5	SM	700	P2	161.0	P2	155.0	P1	179.0	Pass	
						P2	149.0	P2	158.0	P1	182.0		
TS-013	11/20/93	ET	F2	SM	700	P2	156.0	P2	147.0	P1	185.0	Pass	
						P2	150.0	P2	146.0	P1	183.0		
TS-014	11/20/93	ET	F2	SM	700	P2	141.0	P2	146.0	P1	174.0	Pass	
						P2	145.0	P2	151.0	P1	179.0		
TS-015	11/20/93	ET	F2	SM	700	P2	150.0	P2	152.0	P1	177.0	Pass	
						P2	171.0	P2	159.0	P1	194.0		
TS-016	11/20/93	AB	F5	SM	700	P2	164.0	P2	165.0	P1	198.0	Pass	
						P2	146.0	P2	156.0	P1	194.0		
TS-017	11/20/93	SH	F3	SM	720	P2	159.0	P2	158.0	P1	191.0	Pass	
						P2	151.0	P2	153.0	P1	185.0		
TS-018	11/20/93	ET	F2	SM	700	P2	149.0	P2	156.0	P1	182.0	Pass	
						P2	154.0	P2	155.0	P1	171.0		
TS-019	11/21/93	ET	F2	SM	700	P2	152.0	P2	151.0	P1	185.0	Pass	
						P2	141.0	P2	146.0	P1	178.0		
TS-020	11/21/93	AB	F5	SM	700	P2	149.0	P2	148.0	P1	182.0	Pass	
						P2	141.0	P2	146.0	P1	166.0		
						P2	141.0	P2	140.0	P1	180.0		

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						FIELD TEST RESULTS (4,5)							
						PEEL(7)				SHEAR		PASS	
SAMPLE	DATE	SEAMER	GUN	MONITOR	TYPICAL	Inside Track		Outside Track					
NUMBER(1)	WELDED	ID (2)	NO.(6)	(3)	GUN TEMP	Code	Strength	Code	Strength	Code	Strength	or	
					DEGREES (F)							FAIL	
TS-021	11/21/93	ET	F5	SM	700	P2	156.0	P2	146.0	P1	185.0	Pass	
TS-022	11/21/93	SH	F3	SM	710	P2	158.0	P2	153.0	P1	188.0	Fail	
						F1							
TS-023R	11/21/93	SH	F3	SM	720	P2	146.0	P2	153.0	P1	168.0	Pass	
						P2	146.0	P2	152.0	P1	179.0		
TS-024	11/22/93	AB	F5	SM	720	P2	154.0	P2	163.0	P1	213.0	Pass	
						P2	159.0	P2	171.0	P1	211.0		
TS-025	11/22/93	ET	F2	SM	730	P2	175.0	P2	175.0	P1	201.0	Pass	
						P2	163.0	P2	155.0	P1	197.0		
TS-026	11/22/93	ET	F2	SM	730	P2	156.0	P2	155.0	P1	194.0	Pass	
						P2	158.0	P2	157.0	P1	183.0		
TS-027	11/30/93	ET	X2	SM	545	P3	122.0			P5	178.0	Pass	
						P3	119.0			P5	176.0		
TS-028	11/30/93	GH	X1	SM	545	F4	82.0					Fail	
						P3	97.0						
TS-029	11/30/93	ET	X2	SM	545	P3	95.0			P4	187.0	Pass	
						P3	121.0			P4	187.0		
TS-030R	11/30/93	GH	X1	SM	545	F4	125.0					Fail	
TS-031	11/30/93	ET	X1	SM	550	P3	119.0			P4	181.0	Pass	
						P3	144.0			P4	182.0		
TS-032R	11/30/93	GH	X1	SM	550	P3	170.0			P4	190.0	Pass	
						P3	104.0			P4	182.0		
TS-033R	11/30/93	GH	X1	SM	550	P3	116.0			P4	169.0	Pass	
						P3	130.0			P4	195.0		
TS-034	12/01/93	ET	X1	SM	530	P3	121.0			P4	185.0	Pass	
						P3	119.0			P4	175.0		
TS-035	12/01/93	ET	F2	SM	740	P2	140.0	P2	154.0	P1	181.0	Pass	
						P2	148.0	P2	146.0	P1	189.0		
TS-036	12/01/93	ET	F2	SM	740	P2	154.0	P2	158.0	P1	185.0	Pass	
						P2	162.0	P2	160.0	P1	186.0		
TS-037	12/02/93	ET	X1	SM	530	P3	106.0			P5	174.0	Pass	
						P3	123.0			P5	162.0		
TS-038	12/02/93	GH	X3	SM	530	P3	116.0			P4	192.0	Pass	
						P3	146.0			P4	197.0		
TS-039	12/02/93	DW	X3	SM	530	P3	140.0			P4	185.0	Pass	
						P3	137.0			P5	181.0		
TS-040	12/03/93	GH	X1	SM	530	P3	120.0			P5	154.0	Pass	
						P3	108.0			P5	170.0		

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						PASS or FAIL
						PEEL(7)				SHEAR		
						Inside Track		Outside Track				
						Code	Strength	Code	Strength	Code	Strength	
TS-041	12/03/93	DW	X1	SM	530	P3	112.0			P5	167.0	Pass
TS-042	12/03/93	ET	X2	SM	525	P3	132.0			P5	167.0	Pass
						P3	72.0			P5	172.0	
TS-043	12/03/93	GM	X3	SM	530	P3	96.0			P5	168.0	Pass
						P3	118.0			P5	175.0	
TS-044	12/03/93	SA	X3	SM	530	P3	124.0			P5	168.0	Pass
						P3	129.0			P5	165.0	
TS-045	12/03/93	DW	X3	SM	530	P3	112.0			P5	167.0	Pass
						P3	133.0			P5	171.0	
TS-046	12/03/93	ET	X2	SM	525	P3	140.0			P5	170.0	Pass
						P3	113.0			P5	183.0	
TS-047	12/03/93	ET	X2	SM	525	P3	117.0			P5	173.0	Pass
						P3	110.0			P5	180.0	
TS-048	12/03/93	ET	X2	SM	525	P3	108.0			P5	176.0	Pass
						P3	112.0			P5	176.0	
TS-049	12/04/93	ET	X2	SM	535	P3	124.0			P5	172.0	Pass
						P3	158.0	P2	156.0	P1	176.0	
TS-050	12/04/93	RA	F3	SM	760	P2	159.0	P2	156.0	P1	167.0	Pass
						P2	157.0	P2	152.0	P1	179.0	
TS-051	12/04/93	RA	F3	SM	760	P2	146.0	P2	150.0	P1	176.0	Pass
						P2	157.0	P2	158.0	P1	198.0	
TS-052	12/05/93	ET	F2	SM	760	P2	174.0	P2	163.0	P1	192.0	Pass
						P2	156.0	P2	157.0	P1	191.0	
TS-053	12/05/93	ET	F2	SM	760	P2	151.0	P2	162.0	P1	187.0	Pass
						P2	155.0	P2	147.0	P1	191.0	
TS-054	12/05/93	DW	F3	SM	750	P2	144.0	P2	148.0	P1	192.0	Pass
						P2	189.0	P2	153.0	P1	198.0	
TS-055	12/05/93	RA	F5	SM	770	P2	140.0	P2	164.0	P1	183.0	Pass
						P2	153.0	P2	164.0	P1	188.0	
TS-056	12/05/93	RA	F5	SM	770	P2	160.0	P2	165.0	P1	187.0	Pass
						P2	161.0	P2	152.0	P1	185.0	
TS-057	12/05/93	DW	F3	SM	750	P2	157.0	P2	168.0	P1	182.0	Pass
						P2	146.0	P2	152.0	P1	168.0	
TS-058	12/05/93	ET	F2	SM	750	P2	154.0	P2	147.0	P1	169.0	Pass
						P2	149.0	P2	146.0	P1	171.0	
TS-059	12/05/93	ET	F2	SM	750	P2	138.0	P2	147.0	P1	167.0	Pass
						P2	141.0	P2	146.0	P1	184.0	
TS-060	12/05/93	RA	F5	SM	770	P2	155.0	P2	145.0	P1	178.0	Pass
						P2	148.0	P2	151.0	P1	194.0	
						P2	147.0	P2	159.0	P1	194.0	

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						SHEAR Strength	PASS or FAIL
						PEEL(7)							
						Inside Track		Outside Track					
						Code	Strength	Code	Strength	Code	Strength		
TS-061	12/05/93	DW	F3	SM	750	P2	173.0	P2	156.0	P1	203.0		Pass
TS-062	12/05/93	ET	F2	SM	750	P2	153.0	P2	174.0	P1	200.0		Pass
						P2	149.0	P2	153.0	P1	195.0		
TS-063	12/05/93	ET	F2	SM	750	P2	154.0	P2	151.0	P1	190.0		Pass
						P2	154.0	P2	168.0	P1	190.0		
TS-064	12/06/93	SH	X3	SM	525	P3	129.0			P5	188.0		Pass
						P3	151.0			P5	203.0		
TS-065	12/06/93	DW	F3	SM	750	P2	142.0	P2	161.0	P1	186.0		Pass
						P2	169.0	P2	161.0	P1	189.0		
TS-066	12/06/93	ET	X2	SM	535	P3	97.0			P5	157.0		Pass
						P3	122.0			P4	184.0		
TS-067	12/06/93	DW	F3	SM	750	P2	145.0	P2	148.0	P1	181.0		Pass
						P2	151.0	P2	152.0	P1	168.0		
TS-068	12/06/93	ET	X2	SM	535	P3	121.0			P4	171.0		Pass
						P3	132.0			P5	174.0		
TS-069	12/06/93	DW	X3	SM	530	P3	127.0			P4	173.0		Pass
						P3	128.0			P4	177.0		
TS-070	12/10/93	ET	X2	SM	535	P3	97.0			P4	168.0		Pass
						P3	129.0			P4	156.0		
TS-071	12/10/93	ET	X3	SM	535	P3	104.0			P5	158.0		Pass
						P3	128.0			P5	142.0		
TS-072	12/10/93	DW	X3	SM	535	P3	128.0			P4	158.0		Pass
						P3	127.0			P4	156.0		
TS-073	12/11/93	ET	X2	SM	535	P3	117.0			P4	177.0		Pass
						P3	103.0			P5	181.0		
TS-074	12/11/93	ET	X2	SM	535	P3	186.0			P4	162.0		Pass
						P3	117.0			P4	163.0		
TS-075	12/12/93	ET	X2	SM	535	P3	126.0			P4	193.0		Pass
						P3	92.0			P5	196.0		
TS-076	12/12/93	DW	F2	SM	750	P2	164.0	P2	151.0	P1	186.0		Pass
						P2	159.0	P2	167.0	P1	184.0		
TS-077	12/12/93	DW	F3	SM	750	P2	155.0	P2	130.0	P1	190.0		Pass
						P2	165.0	P2	175.0	P1	196.0		
TS-078	12/12/93	DW	F3	SM	750	P2	161.0	P2	158.0	P1	176.0		Pass
						P2	164.0	P2	150.0	P1	176.0		
TS-079	12/12/93	SH	F2	SM	750	P2	156.0	P2	161.0	P1	179.0		Pass
						P2	154.0	P2	153.0	P1	184.0		
TS-080	12/12/93	ET	X2	SM	535	P3	120.0			P4	168.0		Pass
						P3	144.0			P4	169.0		

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						FIELD TEST RESULTS (4,5)								
SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	PEEL(7)				SHEAR		PASS		
						Inside Track		Outside Track		Code	Strength	Code	Strength	or FAIL
						Code	Strength	Code	Strength					
TS-081	12/12/93	DW	F3	SM	750	P2	134.0	P2	146.0	P1	176.0	Pass		
TS-082	12/13/93	ET	X2	SM	535	P2	146.0	P2	148.0	P1	173.0	Pass		
						P3	117.0			P4	189.0			
TS-083	12/13/93	DW	X7	SM	530	P3	144.0			P4	195.0	Pass		
						P3	123.0			P5	184.0			
TS-084	12/14/93	DW	F3	SM	750	P3	116.0			P5	137.0	Pass		
						P2	158.0	P2	162.0	P1	191.0			
TS-085	12/14/93	ET	F2	SM	750	P2	164.0	P2	153.0	P1	194.0	Pass		
						P2	167.0	P2	163.0	P1	183.0			
TS-086	12/14/93	ET	X2	SM	535	P2	163.0	P2	162.0	P1	184.0	Pass		
						P3	122.0			P4	177.0			
TS-087	12/14/93	DW	X7	SM	535	P3	135.0			P4	177.0	Pass		
						P3	104.0			P5	169.0			
TS-088	12/15/93	ET	X2	SM	535	P3	124.0			P5	168.0	Pass		
						P3	125.0			P4	188.0			
TS-089	12/15/93	TH	X7	SM	530	P4	194.0			P4	194.0	Pass		
						P3	146.0			P4	187.0			
TS-090	12/15/93	TH	X7	SM	530	P3	153.0			P4	184.0	Pass		
						P3	172.0			P4	229.0			
TS-091	12/15/93	TH	X7	SM	530	P3	172.0			P4	226.0	Pass		
						P3	149.0			P4	174.0			
TS-092	12/15/93	ET	X2	SM	535	P3	149.0			P5	178.0	Pass		
						P3	125.0			P5	161.0			
TS-093	12/16/93	ET	X2	SM	550	P3	127.0			P5	166.0	Pass		
						P3	120.0			P5	197.0			
TS-094	12/17/93	ET	X2	SM	550	P3	140.0			P4	195.0	Pass		
						P3	118.0			P6	171.0			
TS-095	12/18/93	ET	F2	SM	750	P3	107.0			P6	191.0	Pass		
						P2	157.0	P2	155.0	P1	187.0			
TS-096	12/18/93	ET	X2	SM	550	P2	157.0	P2	165.0	P1	201.0	Pass		
						P3	96.0			P5	176.0			
TS-097	12/19/93	ET	F2	SM	750	P3	91.0			P5	178.0	Pass		
						P2	155.0	P2	154.0	P1	201.0			
TS-098	12/19/93	ET	F2	SM	750	P2	158.0	P2	154.0	P1	192.0	Pass		
						P2	144.0	P2	152.0	P1	195.0			
TS-099	12/19/93	ET	F2	SM	750	P2	159.0	P2	155.0	P1	192.0	Pass		
						P2	148.0	P2	153.0	P1	187.0			
TS-100	12/19/93	ET	F2	SM	750	P2	157.0	P2	151.0	P1	186.0	Pass		
						P2	160.0	P2	151.0	P1	176.0			
						P2	157.0	P2	152.0	P1	180.0			

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						FIELD TEST RESULTS (4,5)							
						PEEL(7)				SHEAR		PASS	
SAMPLE	DATE	SEAMER	GUN	MONITOR	TYPICAL	Inside Track		Outside Track					
NUMBER(1)	WELDED	ID (2)	NO.(6)	(3)	DEGREES (F)	Code	Strength	Code	Strength	Code	Strength	or	FAIL
TS-101	12/19/93	SH	F3	SM	750	P2	164.0	P2	144.0	P1	184.0	Pass	
						P2	152.0	P2	149.0	P1	187.0		
TS-102	12/19/93	TH	F3	SM	750	P2	154.0	P2	147.0	P1	193.0	Pass	
						P2	159.0	P2	151.0	P1	191.0		
TS-103	12/20/93	ET	X2	NE	535	P3	111.0			P5	185.0	Pass	
						P3	121.0			P5	191.0		
TS-104	12/20/93	SH	F3	NE	750	P2	148.0	P2	156.0	P1	196.0	Pass	
						P2	135.0	P2	159.0	P1	193.0		
TS-105	12/20/93	TH	X10	DHM	525	P3	123.0			P5	179.0	Pass	
						P3	131.0			P5	185.0		
TS-106	12/20/93	ET	X2	DHM	525	P3	132.0			P5	173.0	Pass	
						P3	118.0			P5	179.0		
TS-107	12/21/93	ET	X2	SAM	550	P1	109.0			P3	186.0	Pass	
						P1	106.0			P3	188.0		
TS-108	12/21/93	ET	X2	SAM	550	P1	121.0			P3	197.0	Pass	
						P1	149.0			P3	197.0		
TS-109	12/21/93	DW	X10	NE	530	P1	124.0			P3	192.0	Pass	
						P1	131.0			P3	191.0		
TS-110	12/21/93	ET	X2	NE	530	P1	131.0			P3	179.0	Pass	
						P1	120.0			P3	163.0		
TS-111	12/21/93	DW	X10	NE	530	P1	146.0			P3	186.0	Pass	
						P1	155.0			P3	189.0		
TS-112	12/22/93	ET	F2	NE	750	P2	143.0	P2	137.0	P1	182.0	Pass	
						P2	139.0	P2	147.0	P1	184.0		
TS-113	12/22/93	DW	F3	NE	750	P2	151.0	P2	166.0	P1	189.0	Pass	
						P2	158.0	P2	163.0	P1	190.0		
TS-114	12/22/93	ET	F2	NE	750	P2	132.0	P2	142.0	P1	179.0	Pass	
						P2	137.0	P2	156.0	P1	195.0		
TS-115	12/22/93	DW	X2	NE	530	P1	122.0			P3	165.0	Pass	
						P1	119.0			P3	178.0		
TS-116	12/22/93	ET	F2	NE	750	P2	134.0	P2	152.0	P1	182.0	Pass	
						P2	138.0	P2	156.0	P1	176.0		
TS-117	12/22/93	ET	F2	NE	750	P2	115.0	P2	133.0	P1	172.0	Pass	
						P2	150.0	P2	133.0	P1	178.0		
TS-118	12/22/93	ET	F2	NE	750	P2	150.0	P2	159.0	P1	214.0	Pass	
						P2	155.0	P2	157.0	P1	183.0		
TS-119	01/03/93	ET	X2	NE	535	P3	113.0			P6	183.0	Pass	
						P3	106.0			P6	177.0		
TS-120	01/03/93	DW	F3	NE	750	P2	150.0	P2	165.0	P1	179.0	Pass	
						P2	154.0	P2	149.0	P1	179.0		

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						FIELD TEST RESULTS (4,5)							
SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	PEEL(7)				SHEAR		PASS or FAIL	
						Inside Track		Outside Track		Code	Strength		
						Code	Strength	Code	Strength				
TS-121	01/04/94	ET	X2	NE	535	P2	146.0			P1	173.0	Pass	
TS-122	01/04/94	ET	X2	NE	535	P2	137.0			P1	171.0	Pass	
						P2	127.0			P1	149.0		
TS-123	01/04/94	ET	X2	NE	535	P2	115.0			P1	158.0	Pass	
						P2	128.0			P1	162.0		
TS-124	01/04/94	ET	X2	NE	535	P2	137.0			P1	162.0	Pass	
						P2	138.0			P1	148.0		
TS-125	01/05/94	ET	X2	NE	535	P2	122.0			P1	152.0	Pass	
						P2	120.0			P1	153.0		
TS-126	01/05/94	ET	X2	NE	535	P2	113.0			P1	155.0	Pass	
						P2	110.0			P1	148.0		
TS-127	01/06/94	ET	X2	NE	535	P2	120.0			P1	148.0	Pass	
						P2	112.0			P1	158.0		
TS-128	01/06/94	ET	X2	NE	535	P2	124.0			P1	152.0	Pass	
						P2	103.0			P1	141.0		
TS-129	01/06/94	DW	F2	NE	750	P2	104.0			P1	151.0	Pass	
						P2	145.0	P2	132.0	P1	169.0		
TS-130	01/06/94	DW	F2	NE	750	P2	136.0	P2	149.0	P1	162.0	Pass	
						P2	135.0	P2	128.0	P1	147.0		
TS-131	01/06/94	ET	X2	NE	535	P2	132.0	P2	126.0	P1	153.0	Pass	
						P2	125.0			P1	146.0		
TS-132	01/06/94	ET	X2	NE	535	P2	131.0			P1	148.0	Pass	
						P2	130.0			P1	147.0		
TS-133	01/06/94	TH	X10	NE	525	P2	118.0			P1	152.0	Pass	
						P2	130.0			P1	162.0		
TS-134	01/07/94	DW	F2	DHM	750	P2	124.0			P1	174.0	Pass	
						P2	129.0	P2	139.0	P1	176.0		
TS-135	01/07/94	TH	X2	DHM	535	P2	145.0	P2	153.0	P1	177.0	Pass	
						P1	119.0			P3	187.0		
TS-136	01/07/94	DW	F2	DHM	750	P1	130.0			P3	186.0	Pass	
						P2	140.0	P2	149.0	P1	172.0		
TS-137	01/07/94	DW	F2	DHM	750	P2	146.0	P2	153.0	P1	171.0	Pass	
						P2	147.0	P2	150.0	P1	180.0		
TS-138	01/07/94	SH	F3	DHM	750	P2	149.0	P2	128.0	P1	181.0	Fail	
						P2	146.0	P2	114.0				
TS-139	01/07/94	TH	X2	DHM	535	F1	101.0					Pass	
						P1	129.0			P3	167.0		
TS-140	01/07/94	SH	F2	DHM	750	P1	109.0			P3	187.0	Pass	
						P2	130.0	P2	135.0	P2	176.0		
						P2	126.0	P2	130.0	P2	177.0		

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						FIELD TEST RESULTS (4,5)							
SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	PEEL(7)				SHEAR		PASS or FAIL	
						Inside Track		Outside Track		Code	Strength		
						Code	Strength	Code	Strength				
TS-141	01/07/94	DW	X10	NE	530	P1	122.0					Fail	
						F1	97.0						
TS-142R	01/07/94	DW	X10	NE	530	P1	133.0			P3	170.0	Pass	
						P1	115.0			P3	156.0		
TS-143	01/08/94	TH	X2	NE	450	P1	106.0			P3	172.0	Pass	
						P1	117.0			P3	188.0		
TS-144	01/08/94	DW	X10	NE	530	P1	108.0			P3	159.0	Pass	
						P1	94.0			P3	164.0		
TS-145	01/08/94	PR	X10	NE	530	P1	117.0			P3	175.0	Pass	
						P1	101.0			P3	173.0		
TS-146	01/09/94	TH	X2	NE	500	P1	101.0			P2	180.0	Pass	
						P1	97.0			P2	176.0		
TS-147	01/09/94	TH	X2	NE	500	P1	129.0			P2	163.0	Pass	
						P1	127.0			P2	132.0		
TS-148	01/09/94	DW	F2	NE	750	P2	133.0	P2	129.0	P1	162.0	Pass	
						P2	145.0	P2	138.0	P1	161.0		
TS-149	01/10/94	DW	F2	NE	750	P2	127.0	P2	132.0	P1	157.0	Pass	
						P2	138.0	P2	133.0	P1	162.0		
TS-150	01/10/94	TH	X2	NE	500	P1	134.0			P3	160.0	Pass	
						P1	128.0			P3	165.0		
TS-151	01/10/94	DW	F2	NE	750	P2	135.0	P2	150.0	P1	164.0	Pass	
						P2	145.0	P2	146.0	P1	164.0		
TS-152	01/11/94	ET	X2	NE	525	P1	108.0			P2	135.0	Pass	
						P1	121.0			P2	138.0		
TS-153	01/11/94	DW	F2	NE	750	P2	121.0	P2	133.0	P1	151.0	Pass	
						P2	133.0	P2	125.0	P1	155.0		
TS-154	01/11/94	DW	F2	NE	750	P2	151.0	P2	147.0	P1	178.0	Pass	
						P2	148.0	P2	144.0	P1	169.0		
TS-155	01/11/94	TH	X6	NE	450	P1	107.0			P2	158.0	Pass	
						P1	108.0			P2	155.0		
TS-156	01/11/94	ET	X2	DHM	525	P1	109.0			P2	141.0	Pass	
						P1	103.0			P2	135.0		
TS-157	01/12/94	ET	X2	NE	525	P1	131.0			P2	179.0	Pass	
						P1	121.0			P2	170.0		
TS-158	01/13/94	ET	X2	NE	535	F1	39.0	F1	63.0			Fail	
						P1	97.0						
TS-159	01/13/94	DW	F2	NE	750	P2	141.0	P2	152.0	P1	158.0	Pass	
						P2	147.0	P2	147.0	P1	165.0		
TS-160	01/13/94	DW	F2	NE	750	P2	147.0	P2	144.0	P1	175.0	Pass	
						P2	137.0	P2	135.0	P1	165.0		

APPENDIX M-3

GEOMEMBRANE WELD OBSERVATION AND NON-DESTRUCTIVE
TESTING SUMMARY

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
S-001/002	S-001	S-002	11/19/93	SH	F3	700		DHM	11/20/93	SM	
S-001/063	S-001	S-063	12/05/93	DW	F3	750		SM	12/11/93	SM	
S-001/064	S-001	S-064	12/05/93	DW	F3	750		SM	12/11/93	SM	
S-001/066	S-001	S-066	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-002/003	S-002	S-003	11/19/93	ET	F2	700		DHM	11/20/93	SM	
S-002/062	S-002	S-062	12/05/93	DW	F3	750		SM	12/08/93	SM	
S-003/004	S-003	S-004	11/19/93	SH	F3	700	DS-001	DHM	11/20/93	SM	
S-003/052	S-003	S-052	12/05/93	RA	F5	770		SM	11/11/11	DHM	3
S-003/062	S-003	S-062	12/05/93	DW	F3	750		SM	12/11/93	SM	
S-003/S01A	S-003	S01A	12/03/93	GM	X1	530	DS-015	SM	12/03/93	SM	
S-003/S01A	S-003	S01A	12/03/93	ET	X2	525		SM	12/03/93	SM	
S-003/S10G	S-003	S10G	12/22/93	ET	F2	750		NE	01/07/94	NE	
S-004/005	S-004	S-005	11/19/93	ET	F2	700	DS-002	DHM	11/20/93	SM	
S-004/052	S-004	S-052	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-004/S01A	S-004	S01A	12/03/93	ET	X2	525		SM	12/03/93	SM	
S-004/S01A	S-004	S01A	12/03/93	GM	X1	530		SM	12/03/93	SM	
S-004/S10G	S-004	S10G	12/22/93	ET	F2	750		NE	01/04/94	NE	
S-005/006	S-005	S-006	11/19/93	SH	F3	700		DHM	11/20/93	SM	
S-005/007	S-005	S-007	11/19/93	SH	F3	700		DHM	11/20/93	SM	
S-005/052	S-005	S-052	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-006/007	S-006	S-007	11/19/93	ET	F2	700		DHM	11/20/93	SM	
S-006/008	S-006	S-008	11/20/93	ET	F2	720		DHM	11/20/93	SM	
S-007/008	S-007	S-008	11/20/93	ET	F2	720		DHM	11/20/93	SM	
S-007/052	S-007	S-052	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-008/009	S-008	S-009	11/20/93	ET	F2	720		DHM	11/20/93	SM	
S-008/052	S-008	S-052	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-009/010	S-009	S-010	11/20/93	AB	F5	705		SM	11/20/93	SM	
S-009/052	S-009	S-052	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-010/011	S-010	S-011	11/20/93	SH	F3	720		SM	11/20/93	SM	
S-010/052	S-010	S-052	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-011/012	S-011	S-012	11/20/93	AB	F5	705		SM	11/22/93	SM	
S-011/052	S-011	S-052	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-011/S03X	S-011	S03X	12/04/93	ET	X2	535		SM	12/04/93	SM	
S-012/013	S-012	S-013	11/20/93	SH	F3	720	DS-003	SM	11/22/93	SM	
S-012/022	S-012	S-022	12/06/93	ET	X2	535		SM	12/20/93	DHM	
S-012/022	S-012	S-022	11/20/93	ET	F2	700		SM	12/20/93	DHM	
S-012/052	S-012	S-052	12/05/93	RA	F5	770	DS-023	SM	12/06/93	SM	
S-012/S03X	S-012	S03X	12/04/93	ET	X2	535		SM	12/04/93	SM	
S-013/014	S-013	S-014	11/20/93	ET	F2	720	DS-004	DHM	11/22/93	SM	
S-013/021	S-013	S-021	11/20/93	ET	F2	700		SM	12/02/93	SM	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
S-013/022	S-013	S-022	11/20/93	ET	F2	700		SM	12/11/93	SM	
S-014/015	S-014	S-015	11/20/93	AB	F5	705	DS-005	SM	11/22/93	SM	
S-014/020	S-014	S-020	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-014/021	S-014	S-021	11/20/93	ET	F2	700	DS-008	SM	11/21/93	NE	
S-014/S03J	S-014	S03J	12/03/93	ET	X2	525		SM	12/03/93	SM	
S-015/016	S-015	S-016	11/20/93	SH	F3	720		SM	11/22/93	SM	
S-015/019	S-015	S-019	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-015/020	S-015	S-020	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-015/S03J	S-015	S03J	12/03/93	ET	X2	525		SM	12/03/93	SM	
S-016/017	S-016	S-017	11/20/93	ET	F2	720		DHM	11/22/93	SM	
S-016/018	S-016	S-018	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-016/019	S-016	S-019	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-017/018	S-017	S-018	11/20/93	ET	F2	700		DHM	12/02/93	SM	
S-017/026	S-017	S-026	11/21/93	ET	F2	700		SM	12/02/93	SM	
S-018/019	S-018	S-019	11/20/93	AB	F5	700		SM	11/22/93	SM	
S-018/026	S-018	S-026	11/21/93	ET	F2	700		SM	11/22/93	SM	
S-019/020	S-019	S-020	11/20/93	AB	F5	700	DS-006	SM	11/21/93	NE	
S-020/021	S-020	S-021	11/20/93	ET	F2	700		DHM	11/22/93	SM	
S-021/022	S-021	S-022	11/20/93	AB	F5	700		SM	11/22/93	SM	
S-022/023	S-022	S-023	11/20/93	AB	F5	700	DS-007	SM	11/21/93	NE	
S-022/052	S-022	S-052	12/05/93	RA	F5	770		SM	11/11/11	DHM	3
S-022/S10N	S-022	S10N	01/05/94	ET	X2	535		NE	01/06/93	SAM	
S-022/S10N	S-022	S10N	01/03/94	DW	F3	750	DS-039	NE	01/06/93	SAM	
S-023/024	S-023	S-024	11/20/93	AB	F5	700		SM	11/22/93	SM	
S-023/051	S-023	S-051	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-023/052	S-023	S-052	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-023/S10N	S-023	S10N	01/03/94	DW	F3	750		NE	01/06/93	SAM	
S-023/S10N	S-023	S10N	01/05/94	ET	X2	535		NE	01/06/93	SAM	
S-024/025	S-024	S-025	11/20/93	AB	F5	700	DS-009	SM	11/21/93	NE	
S-024/050	S-024	S-050	12/05/93	RA	F5	770		SM	11/11/11	DHM	3
S-024/051	S-024	S-051	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-025/027	S-025	S-027	11/20/93	ET	F2	700		SM	11/22/93	SM	
S-025/039	S-025	S-039	12/03/93	SA	X3	530		NE	12/17/93	SM	
S-025/050	S-025	S-050	12/05/93	RA	F5	770		SM	11/11/11	SM	3
S-027/028	S-027	S-028	11/20/93	AB	F5	700		SM	11/22/93	SM	
S-027/039	S-027	S-039	12/03/93	SA	X3	530	DS-016	NE	12/17/93	SM	
S-028/029	S-028	S-029	11/20/93	SH	F3	720		SM	11/22/93	SM	
S-028/038	S-028	S-038	12/01/93	ET	X1	530	DS-014	SM	11/11/11	SM	3
S-028/039	S-028	S-039	12/03/93	SA	X3	530		NE	12/17/93	SM	
S-028/S02P	S-028	S02P	12/06/93	ET	X2	535		SM	11/11/11	SM	3
S-028/S09C	S-028	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
S-029/030	S-029	S-030	11/20/93	ET	F2	700		SM	11/22/93	SM	
S-029/037	S-029	S-037	11/20/93	ET	F2	700		SM	11/11/11	SM	3
S-029/S02P	S-029	S02P	12/06/93	ET	X2	535		SM	11/11/11	SM	3
S-029/S09C	S-029	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	
S-030/031	S-030	S-031	11/20/93	SH	F3	720		SM	11/22/93	SM	
S-030/035	S-030	S-035	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-030/036	S-030	S-036	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-030/S02P	S-030	S02P	12/06/93	ET	X2	535	DS-030	SM	11/11/11	NE	3
S-030/S09C	S-030	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	
S-031/032	S-031	S-032	11/20/93	AB	F5	700		SM	11/22/93	SM	
S-031/034	S-031	S-034	11/20/93	ET	F2	700	DS-011	SM	11/21/93	NE	
S-031/035	S-031	S-035	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-031/S09C	S-031	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	
S-032/033	S-032	S-033	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-032/034	S-032	S-034	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-032/S09C	S-032	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	
S-033/034	S-033	S-034	11/20/93	ET	F2	700		SM	11/22/93	SM	
S-033/S09C	S-033	S09C	12/18/93	ET	F2	750		SM	12/18/93	SM	
S-034/035	S-034	S-035	11/20/93	AB	F5	700	DS-010	SM	11/21/93	NE	
S-034/S09C	S-034	S09C	12/18/93	ET	F2	750	DS-033	SM	12/18/93	SM	
S-035/036	S-035	S-036	11/21/93	AB	F5	700		SM	12/15/93	SM	
S-035/S09C	S-035	S09C	12/18/93	ET	F2	750		SM	12/18/93	SM	
S-036/037	S-036	S-037	11/20/93	ET	F2	700		SM	11/11/11	NE	3
S-036/038	S-036	S-038	11/21/93	AB	F5	700		SM	11/22/93	SM	
S-036/S09C	S-036	S09C	12/18/93	ET	F2	750		SM	12/18/93	SM	
S-037/038	S-037	S-038	12/01/93	ET	X1	530		SM	11/11/11	NE	3
S-037/S02P	S-037	S02P	12/06/93	ET	X2	535		SM	11/11/11	NE	3
S-037/S09C	S-037	S09C	12/18/93	ET	F2	750		SM	12/18/93	SM	
S-038/039	S-038	S-039	11/21/93	ET	F2	700		SM	11/22/93	SM	
S-038/S02P	S-038	S02P	12/06/93	ET	X2	535		SM	11/11/11	NE	3
S-038/S09C	S-038	S09C	12/18/93	ET	F2	750		SM	12/21/93	NE	
S-039/040	S-039	S-040	11/21/93	AB	F5	700		SM	11/22/93	SM	
S-039/050	S-039	S-050	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-039/S02P	S-039	S02P	12/06/93	ET	X2	535		SM	11/11/11	NE	3
S-040/041	S-040	S-041	11/21/93	SH	F3	720	DS-012	SM	11/22/93	SM	
S-040/050	S-040	S-050	12/05/93	RA	F5	770		SM	12/15/93	NE	
S-041/042	S-041	S-042	11/21/93	ET	F2	700	DS-013	SM	11/22/93	SM	
S-041/050	S-041	S-050	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-042/043	S-042	S-043	12/04/93	RA	F3	760	DS-017	SM	11/11/11	NE	
S-042/050	S-042	S-050	12/05/93	RA	F5	770	DS-024	SM	12/15/93	NE	
S-042/S06R	S-042	S06R	12/12/93	DW	F3	750	DS-031	SM	12/13/93	SM	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
S-043/050	S-043	S-050	12/05/93	RA	F5	770		SM	12/15/93	NE	
S-043/S06R	S-043	S06R	12/12/93	DW	F3	750		SM	12/15/93	SM	
S-044/045	S-044	S-045	12/05/93	ET	F2	760		SM	12/08/93	SM	
S-044/045	S-044	S-045	12/05/93	DW	F3	750		SM	12/08/93	SM	
S-044/050	S-044	S-050	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-045/046	S-045	S-046	12/05/93	ET	F2	760	DS-018	SM	12/08/93	SM	
S-045/050	S-045	S-050	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-046/047	S-046	S-047	12/05/93	DW	F3	750	DS-019	SM	12/08/93	SM	
S-046/050	S-046	S-050	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-046/S06G	S-046	S06G	12/13/93	ET	X2	535		SM	12/15/93	SM	
S-047/048	S-047	S-048	12/05/93	ET	F2	760		SM	12/08/93	SM	
S-047/050	S-047	S-050	12/05/93	RA	F5	770		SM	12/16/93	SM	
S-047/050	S-047	S-050	12/05/93	RA	F5	770		SM	12/16/93	SM	
S-047/059	S-047	S-059	12/05/93	DW	F3	750		SM	12/16/93	SM	
S-047/S06G	S-047	S06G	12/13/93	ET	X2	535		SM	12/08/93	SM	
S-048/049	S-048	S-049	12/05/93	ET	F2	760	DS-020	SM	12/08/93	SM	
S-048/059	S-048	S-059	12/05/93	DW	F3	750	DS-026	SM	12/16/93	SM	
S-049/053	S-049	S-053	12/05/93	DW	F3	750		SM	12/11/93	SM	
S-049/059	S-049	S-059	12/05/93	DW	F3	750		SM	12/12/93	SM	
S-050/051	S-050	S-051	12/05/93	ET	F2	750		SM	12/06/93	SM	
S-050/059	S-050	S-059	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-050/060	S-050	S-060	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-051/052	S-051	S-052	12/05/93	ET	F2	750	DS-021	SM	12/06/93	SM	
S-051/060	S-051	S-060	12/05/93	RA	F5	770		SM	12/11/93	SM	
S-051/061	S-051	S-061	12/05/93	RA	F5	770		SM	12/06/93	SM	
S-052/061	S-052	S-061	12/05/93	RA	F5	770		SM	12/16/93	SM	
S-052/062	S-052	S-062	12/05/93	RA	F5	770		SM	12/16/93	SM	
S-053/054	S-053	S-054	12/05/93	DW	F3	750	DS-022	SM	12/11/93	SM	
S-053/058	S-053	S-058	12/05/93	DW	F3	750		SM	12/16/93	SM	
S-053/059	S-053	S-059	12/05/93	DW	F3	750		SM	12/16/93	SM	
S-054/055	S-054	S-055	12/05/93	DW	F3	750		SM	12/11/93	SM	
S-054/056	S-054	S-056	12/05/93	DW	F3	750		SM	12/12/93	SH	
S-054/057	S-054	S-057	12/05/93	DW	F3	750		SM	12/12/93	SH	
S-054/058	S-054	S-058	12/05/93	DW	F3	750		SM	12/16/93	SH	
S-055/056	S-055	S-056	12/05/93	DW	F3	750		SM	12/12/93	SH	
S-055/071	S-055	S-071	12/06/93	DW	F3	750		SM	12/16/93	SH	
S-056/057	S-056	S-057	12/05/93	ET	F2	750		SM	12/11/93	SH	
S-056/065	S-056	S-065	12/06/93	DW	F3	750		SM	12/11/93	SH	
S-057/058	S-057	S-058	12/05/93	ET	F2	750		SM	12/16/93	SH	
S-058/059	S-058	S-059	12/05/93	ET	F2	750	DS-025	SM	12/06/93	SH	
S-059/060	S-059	S-060	12/05/93	ET	F2	750		SM	12/06/93	SH	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
S-060/061	S-060	S-061	12/05/93	DW	F3	750		SM	12/16/93	SM	
S-061/062	S-061	S-062	12/05/93	ET	F2	750	DS-027	SM	12/08/93	SM	
S-061/S10S	S-061	S10S	01/07/94	DW	F2	750		DHM	01/09/94	DHM	
S-062/063	S-062	S-063	12/05/93	ET	F2	750		SM	12/08/93	SM	
S-063/064	S-063	S-064	12/06/93	DW	F3	750		SM	12/08/93	SM	
S-064/066	S-064	S-066	12/06/93	DW	F3	750		NE	12/11/93	SM	
S-064/069	S-064	S-069	12/06/93	DW	F3	750	DS-028	NE	12/08/93	SM	
S-065/071	S-065	S-071	12/06/93	DW	F3	750		NE	12/11/93	SM	
S-066/067	S-066	S-067	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-066/069	S-066	S-069	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-067/068	S-067	S-068	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-067/069	S-067	S-069	12/06/93	DW	F3	750	DS-029	NE	12/08/93	SM	
S-067/070	S-067	S-070	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-068/070	S-068	S-070	12/06/93	DW	F3	750		NE	12/08/93	SM	
S-069/070	S-069	S-070	12/06/93	DW	F3	750		NE	12/08/93	SM	

NOTES

(1) A prefix of S indicates a seam between panels of secondary liner.

(2) Inspector Identification:

DHM - David H. Mathis
SM - Steve Milka
SAM - Scott A. Matthees
NE - Nancy Evans

Seamer Identification:

ET - Erwin Tsosie
AB - Arnold Barker
SH - Steve Hewitt
GM - Grant Martin
PR - Paul Rhodes
DW - Dwight Wilson
TH - Tim Harding
RA - Raymond Ashley
SA - Simon Ashley
SP - Scott Prydatko

(3) Seams with a Non-Destructive Test Date of 11/11/11 indicates that the seam was capped, so non-destructive testing of seam was not required. The cap that covered the seam was non-destructively tested.

APPENDIX M-4

DESTRUCTIVE TEST OBSERVATION SUMMARY

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	
DS-001	11/20/93	Seam Number: S-003/004	162.1	P1	161.0	P2	104.5	F3	Fail
		50' South of Crest of Slope	160.8	P1	152.1	P2	44.1	F3	
			165.0	P1	83.8	F3	150.3	P2	
		Seam Type: Fus (2) Repair Id: S01A	163.9	P1	156.3	P2	150.5	P2	
		Seaming Apparatus: F3 Tech: SH	161.3	P1	156.3	P2	150.9	P2	
DS-001A1	12/14/93	Seam Number: S-005/006	168.4	P1	160.2	P2	157.4	P2	Pass
		13' North of Crest of Slope	169.4	P1	158.3	P2	155.9	P2	
			170.8	P1	160.3	P2	157.5	P2	
		Seam Type: Fus (2) Repair Id: S07G	166.0	P1	160.3	P2	158.8	P2	
		Seaming Apparatus: F3 Tech: SH	168.9	P1	159.7	P2	158.8	P2	
DS-001B1	12/14/93	Seam Number: S-001/002	177.0	P1	168.9	P2	153.7	P2	Pass
		4' North of South End of Seam	173.4	P1	169.4	P2	156.6	P2	
			170.5	P1	165.1	P2	156.3	P2	
		Seam Type: Fus (2) Repair Id: S08C	178.2	P1	164.1	P2	157.9	P2	
		Seaming Apparatus: F3 Tech: SH	171.0	P1	164.9	P2	153.6	P2	
DS-002	11/20/93	Seam Number: S-004/005	164.1	P1	136.1	P2	147.2	P2	Pass
		76' South of Crest of Slope	163.2	P1	144.6	P2	143.1	P2	
			163.9	P1	145.4	P2	148.4	P2	
		Seam Type: Fus (2) Repair Id: S01B	163.1	P1	145.5	P2	144.7	P2	
		Seaming Apparatus: F2 Tech: ET	160.0	P1	142.6	P2	146.1	P2	
DS-003	11/30/93	Seam Number: S-012/013	168.5	P1	156.7	P2	143.8	P2	Pass
		48' South of Crest of Slope	163.3	P1	155.5	P2	144.4	P2	
			161.8	P1	154.4	P2	149.5	P2	
		Seam Type: Fus (2) Repair Id: S02C	161.8	P1	152.0	P2	129.9	P2	
		Seaming Apparatus: F3 Tech: SH	162.5	P1	157.7	P2	150.9	P2	
DS-004	11/22/93	Seam Number: S-013/014	164.9	P1	142.0	P2	154.3	P2	Pass
		48' South of Crest of Slope	161.4	P1	146.0	P2	152.8	P2	
			161.0	P1	146.6	P2	150.7	P2	
		Seam Type: Fus (2) Repair Id: S02D	163.9	P1	141.1	P2	151.3	P2	
		Seaming Apparatus: F2 Tech: ET	162.1	P1	143.6	P2	151.3	P2	
DS-005	11/23/93	Seam Number: S-014/015	162.6	P1	145.9	P2	149.0	F1	Fail
		17' South of Crest of Slope	157.2	P1	150.7	P2	122.0	F1	
			145.9	P1	149.7	P2	144.2	F1	
		Seam Type: Fus (2) Repair Id: S02E	154.0	P1	146.9	P2	151.2	P2	
		Seaming Apparatus: F5 Tech: AB	163.7	P1	149.2	P2	153.0	P2	

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-005A1	12/02/93	Seam Number: S-014/015	168.6	P1	151.2	P2	146.7	P2	Pass
		33' South of Crest of Slope	168.1	P1	156.4	P2	159.1	P2	
			166.7	P1	154.3	P2	156.5	P2	
		Seam Type: Fus (2) Repair Id: S03J	167.9	P1	153.5	P2	152.5	P2	
		Seaming Apparatus: F5 Tech: AB	163.2	P1	150.6	P2	154.7	P2	
DS-005B1	12/03/93	Seam Number: S-011/012	167.2	P1	152.3	P2	150.6	P2	Pass
		3' North of Toe of Slope	166.2	P1	151.0	P2	150.5	P2	
			168.9	P1	151.5	P2	139.2	P2	
		Seam Type: Fus (2) Repair Id: S03X	166.7	P1	151.2	P2	141.9	P2	
		Seaming Apparatus: F5 Tech: AB	167.0	P1	150.9	P2	150.1	P2	
DS-006	11/21/93	Seam Number: S-019/020	164.2	P1	137.9	P2	152.7	P2	Pass
		6' West of Crest of Slope	164.1	P1	149.7	P2	143.2	P2	
			165.0	P1	144.1	P2	152.3	P2	
		Seam Type: Fus (2) Repair Id: S02F	161.7	P1	136.2	P2	144.5	P2	
		Seaming Apparatus: F5 Tech: AB	165.2	P1	153.2	P2	143.2	P2	
DS-007	11/21/93	Seam Number: S-022/023	167.5	P1	153.7	P2	143.3	P2	Fail
		53' East of Crest of Slope	164.1	P1	143.2	F3	145.2	P2	
			164.9	P1	151.7	P2	142.6	P2	
		Seam Type: Fus (2) Repair Id: S02J	166.0	P1	153.3	P2	143.9	P2	
		Seaming Apparatus: F5 Tech: AB	165.6	P1	131.4	F1	148.6	P2	
DS-007A1	12/02/93	Seam Number: S-002/023	171.7	P1	154.6	P2	162.1	P2	Pass
		14' East of DS-007	174.3	P1	158.4	P2	153.8	P2	
			173.1	P1	151.4	P2	164.0	P2	
		Seam Type: Fus (2) Repair Id: S03N	170.5	P1	146.0	P2	142.6	P2	
		Seaming Apparatus: F5 Tech: AB	171.7	P1	148.6	P2	158.1	P2	
DS-007B1	12/02/93	Seam Number: S-022/023	164.4	P1	148.8	P2	154.3	P2	Pass
		17' West of DS-007	167.5	P1	146.4	P2	156.1	P2	
			166.5	P1	147.3	P2	156.2	P2	
		Seam Type: Fus (2) Repair Id: S03M	164.8	P1	147.5	P2	149.6	P2	
		Seaming Apparatus: F5 Tech: AB	166.7	P1	154.3	P2	145.8	P2	
DS-008	11/22/93	Seam Number: S-014/021	179.2	P1	156.6	P2	156.9	P2	Pass
		6' East of West End of Seam	178.4	P1	152.2	P2	167.6	P2	
			174.2	P1	165.0	P2	157.6	P2	
		Seam Type: Fus (2) Repair Id: S02K	176.6	P1	154.7	P2	162.1	P2	
		Seaming Apparatus: F2 Tech: ET	170.0	P1	152.8	P2	165.6	P2	

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-009	11/21/93	Seam Number: S-024/025	165.6	P1	152.4	P2	141.4	P2	Pass
		26' East of Crest of Slope	164.8	P1	146.2	P2	141.5	P2	
			164.0	P1	148.7	P2	139.0	P2	
		Seam Type: Fus (2) Repair Id: S02M	162.6	P1	145.2	P2	141.1	P2	
		Seaming Apparatus: F5 Tech: AB	159.8	P1	152.1	P2	145.3	P2	
DS-010	11/21/93	Seam Number: S-034/035	162.7	P1	151.6	P2	157.2	P2	Pass
		31' North of Crest of Slope	166.5	P1	150.9	P2	151.2	P2	
			165.9	P1	151.8	P2	151.1	P2	
		Seam Type: Fus (2) Repair Id: S02N	169.6	P1	151.9	P2	154.6	P2	
		Seaming Apparatus: F5 Tech: AB	166.4	P1	150.7	P2	154.3	P2	
DS-011	11/21/93	Seam Number: S-031/034	164.3	P1	153.3	P2	150.6	P2	Fail
		13' North of South End of Seam	168.5	P1	156.7	P2	71.7	F1	
			164.7	P1	157.2	P2	89.3	F1	
		Seam Type: Fus (2) Repair Id: S02P	168.2	P1	156.5	P2	136.6	P2	
		Seaming Apparatus: F2 Tech: ET	167.9	P1	154.5	P2	139.7	P2	
DS-011A1	12/14/93	Seam Number: S-036/037	180.8	P2	64.4	F1	118.5	F1	Fail
		6' North of South End of Seam	180.5	P2	98.7	F1	51.8	F1	
			179.5	P2	146.2	F1	161.2	P2	
		Seam Type: Fus (2) Repair Id: S04S	182.3	P2	72.0	F1	164.8	P2	
		Seaming Apparatus: F2 Tech: ET	183.5	P2	114.0	F1	152.4	P2	
DS-011A2	12/15/93	Seam Number: S-038/039	174.8	P1	152.9	P2	160.7	P2	Pass
		11' South of Crest of Slope	170.1	P1	155.5	P2	158.2	P2	
			174.6	P1	155.3	P2	156.3	P2	
		Seam Type: Fus (2) Repair Id: S04T	165.9	P1	156.1	P2	159.2	P2	
		Seaming Apparatus: F2 Tech: ET	169.3	P1	159.1	P2	158.4	P2	
DS-011B1	12/04/93	Seam Number: S-032/033	154.4	P2	160.4	P2	152.2	P2	Fail
		5' West of East End of Seam	172.0	P1	159.1	P2	140.0	P2	
			166.6	P1	152.1	P2	129.7	P2	
		Seam Type: Fus (2) Repair Id: S01G	170.9	P1	152.8	P2	135.8	P2	
		Seaming Apparatus: F2 Tech: ET	173.2	P1	144.2	P2	95.9	F1	
DS-011B2	12/16/93	Seam Number: S-033/034	190.2	P1	152.3	P2	166.3	P2	Pass
		11' South of Anchor Trench Crest	191.5	P1	161.0	P2	176.1	P2	
			188.0	P1	162.0	P2	172.4	P2	
		Seam Type: Fus (2) Repair Id: S07H	193.8	P1	172.9	P2	170.4	P2	
		Seaming Apparatus: F2 Tech: ET	194.3	P1	164.3	P2	164.9	P2	

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			DESTRUCTIVE TEST OBSERVATIONS							
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT	
			Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)		
DS-012	11/22/93	Seam Number: S-040/041	167.8	P1	149.2	P2	151.7	P2	Pass	
		42' North of Crest of Slope	165.2	P1	148.1	P2	152.6	P2		
			167.0	P1	157.8	P2	154.8	P2		
		Seam Type: Fus (2) Repair Id: S02Q	163.2	P1	154.5	P2	151.2	P2		
		Seaming Apparatus: F3 Tech: SH	165.5	P1	152.4	P2	149.6	P2		
DS-013	11/22/93	Seam Number: S-041/042	162.9	P1	154.0	P2	154.7	P2	Pass	
		70' North of Crest of Slope	162.0	P1	156.4	P2	151.2	P2		
			162.0	P1	152.3	P2	149.0	P2		
		Seam Type: Fus (2) Repair Id: S02R	159.9	P1	146.4	P2	147.9	P2		
		Seaming Apparatus: F2 Tech: ET	162.2	P1	143.9	P2	146.7	P2		
DS-014	12/03/93	Seam Number: S-028/038	180.5	P6	101.1	F1			Fail	
		3' West of East End of Seam	174.8	P5	138.4	P2				
			181.8	P5	92.8	F1				
		Seam Type: Ext (2) Repair Id: S03G	174.6	P5	87.8	F1				
		Seaming Apparatus: X1 Tech: ET	173.6	P5	101.4	F1				
DS-014A1	12/15/93	Seam Number: S-019/S03L	188.4	P6	128.2	P2			Fail	
		3' North of South End of Seam	189.5	P6	88.9	F1				
			189.1	P6	100.3	F3				
		Seam Type: Ext (2) Repair Id: S08P	189.5	P6	126.0	P2				
		Seaming Apparatus: X1 Tech: ET	190.7	P6	115.2	P2				
DS-014A2	12/15/93	Seam Number: S-003/01A	181.1	P6	141.1	P2			Pass(3)	
		20' South of Crest of Slope	173.9	P6	124.6	P2				
			178.0	P6	114.2	P2				
		Seam Type: Ext (2) Repair Id: S04U	177.7	P6	108.6	P2				
		Seaming Apparatus: X1 Tech: ET	179.6	P6	124.2	P2				
DS-014B1	12/06/93	Seam Number: S-037/038	142.0	P1	121.9	P1			Pass	
		4' South of North End of Seam	153.1	P1	103.4	P1				
			173.8	P1	121.3	P1				
		Seam Type: Ext (2) Repair Id: S04E	161.7	P1	133.0	P1				
		Seaming Apparatus: X1 Tech: ET	170.1	P1	151.4	P1				
DS-015	12/03/93	Seam Number: S-003/S01A	171.1	P6	101.9	P2			Fail	
		60' South of Crest of Slope	170.6	P6	134.6	P2				
			163.0	P6	121.9	F1				
		Seam Type: Ext (2) Repair Id: S02X	172.8	P6	137.0	P2				
		Seaming Apparatus: X1 Tech: GM	175.1	P6	122.5	F1				

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	
DS-015A1	12/15/93	Seam Number: S-003/S01A							Pass(4)
		20' South of Crest of Slope							
		Seam Type: Ext (2) Repair Id:							
		Seaming Apparatus: X1 Tech: ET							
DS-015B1	12/15/93	Seam Number: S-003/S01A	181.1	P6	141.1	P2			Pass(3)
		20' South of Crest of Slope	173.9	P1	124.6	P2			
			178.0	P6	114.2	P2			
		Seam Type: Ext (2) Repair Id: S04U	177.7	P6	108.6	P2			
		Seaming Apparatus: X1 Tech: GH	179.6	P6	124.2	P2			
DS-016	12/03/93	Seam Number: S-027/039	180.9	P6	142.7	P2			Pass
		6' South of North End of Seam	165.1	P5	146.2	P2			
			161.7	P5	143.2	P2			
		Seam Type: Ext (2) Repair Id: S05B	180.4	P6	134.2	P2			
		Seaming Apparatus: X3 Tech: SA	180.9	P6	94.7	P2			
DS-017	12/06/93	Seam Number: S-042/043	160.3	P1	152.8	P2	121.3	F1	Fail
		30' North of Crest of Slope	160.3	P1	160.1	P2	125.2	F1	
			164.0	P1	154.4	P2	161.2	P2	
		Seam Type: Fus (2) Repair Id: S01H	156.2	P1	153.6	P2	156.7	P2	
		Seaming Apparatus: F3 Tech: RA	161.1	P1	148.2	P2	97.4	F1	
DS-017A1	12/11/93	Seam Number: S-044/045	167.5	P1	157.3	P2	155.9	P2	Pass
		4' South of Crest of Slope	167.9	P1	157.1	P2	143.3	P2	
			171.0	P1	157.2	P2	142.3	P2	
		Seam Type: Fus (2) Repair Id: S06Q	169.1	P1	157.5	P2	144.7	P2	
		Seaming Apparatus: F3 Tech: DW	173.1	P1	149.3	P2	161.2	P2	
DS-017B1	12/11/93	Seam Number: S-040/041	171.8	P1	149.9	P2	150.5	P2	Pass
		2' South of Toe of Slope	171.2	P1	156.1	P2	150.2	P2	
			174.5	P1	155.8	P2	150.2	P2	
		Seam Type: Fus (2) Repair Id: S06P	172.3	P1	154.6	P2	152.7	P2	
		Seaming Apparatus: F3 Tech: SH	170.7	P1	151.2	P2	150.6	P2	
DS-018	12/08/93	Seam Number: S-045/046	162.7	P1	151.8	P2	152.9	P2	Pass
		22' North of Crest of Slope	163.1	P1	158.6	P2	156.4	P2	
			164.1	P1	154.9	P2	155.7	P2	
		Seam Type: Fus (2) Repair Id: S01L	165.4	P1	160.1	P2	159.7	P2	
		Seaming Apparatus: F2 Tech: ET	158.5	P1	158.6	P2	156.1	P2	

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SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-019	12/08/93	Seam Number: S-046/047	166.8	P1	154.9	P2	149.8	P2	Pass
		40' North of Crest of Slope	168.0	P1	157.0	P2	157.8	P2	
			164.2	P1	161.4	P2	147.4	P2	
		Seam Type: Fus (2) Repair Id: S01M	165.7	P1	160.9	P2	156.1	P2	
		Seaming Apparatus: F3 Tech: DW	160.9	P1	159.0	P2	153.8	P2	
DS-020	12/09/93	Seam Number: S-048/049	164.7	P1	146.4	P2	148.7	P2	Pass
		28' North of Crest of Slope	167.0	P1	147.4	P2	152.1	P2	
			165.3	P1	140.7	P2	156.8	P2	
		Seam Type: Fus (2) Repair Id: S01N	169.2	P1	151.3	P2	150.1	P2	
		Seaming Apparatus: F2 Tech: ET	160.7	P1	157.5	P2	148.7	P2	
DS-021	12/06/93	Seam Number: S-051/052	170.0	P1	159.0	P2	156.3	P2	Pass
		10' West of East End of Seam	174.4	P1	160.2	P2	157.4	P2	
			168.6	P1	154.7	P2	155.4	P2	
		Seam Type: Fus (2) Repair Id: S01P	175.2	P1	157.2	P2	157.0	P2	
		Seaming Apparatus: F2 Tech: ET	174.4	P1	156.1	P2	158.0	P2	
DS-022	12/09/93	Seam Number: S-053/054	161.5	P1	158.5	P2	155.7	P2	Pass
		53' North of Crest of Slope	164.5	P1	158.1	P2	151.2	P2	
			166.3	P1	152.0	P2	149.1	P2	
		Seam Type: Fus (2) Repair Id: S01Q	165.6	P1	155.7	P2	150.0	P2	
		Seaming Apparatus: F3 Tech: DW	161.8	P1	156.1	P2	144.4	P2	
DS-023	12/06/93	Seam Number: S-012/052	175.7	P1	160.4	P2	154.1	P2	Pass
		11' East of West End of Seam	175.3	P1	160.5	P2	153.1	P2	
			173.9	P1	162.8	P2	161.5	P2	
		Seam Type: Fus (2) Repair Id: S01R	177.0	P1	159.7	P2	161.9	P2	
		Seaming Apparatus: F5 Tech: RA	173.9	P1	162.0	P2	156.5	P2	
DS-024	12/11/93	Seam Number: S-042/050	181.2	P1	178.1	P2	171.8	P2	Pass
		12' West of East End of Seam	177.1	P1	170.7	P2	167.4	P2	
			179.3	P1	163.1	P2	160.0	P2	
		Seam Type: Fus (2) Repair Id: S01S	181.3	P1	162.8	P2	165.2	P2	
		Seaming Apparatus: F5 Tech: RA	178.9	P1	148.6	P2	146.3	P2	
DS-025	12/08/93	Seam Number: S-058/059	164.6	P1	152.7	P2	151.1	P2	Pass
		52' West of Crest of Slope	164.7	P1	146.7	P2	150.6	P2	
			163.0	P1	145.8	P2	153.6	P2	
		Seam Type: Fus (2) Repair Id: S01T	170.5	P1	153.6	P2	151.8	P2	
		Seaming Apparatus: F2 Tech: ET	163.4	P1	150.7	P2	158.1	P2	

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SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT	
			Strength	Code	Strength	Code	Strength	Code		
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)		
DS-026	12/11/93	Seam Number: S-048/059	192.2	P1	177.3	P2	169.5	P2	Pass	
		13' East of West End of Seam	182.0	P1	175.0	P2	164.4	P2		
			188.1	P1	174.7	P2	161.4	P2		
		Seam Type: Fus (2) Repair Id: S01U	184.1	P1	155.2	P2	157.1	P2		
		Seaming Apparatus: F3 Tech: DW	182.5	P1	171.4	P2	163.0	P2		
DS-027	12/08/93	Seam Number: S-061/062	167.1	P1	153.3	P2	144.0	P2	Pass	
		39' West of Crest of Slope	164.9	P1	150.6	P2	145.2	P2		
			164.8	P1	157.5	P2	148.3	P2		
		Seam Type: Fus (2) Repair Id: S01W	164.4	P1	154.7	P2	144.8	P2		
		Seaming Apparatus: F2 Tech: ET	168.4	P1	154.7	P2	148.5	P2		
DS-028	12/08/93	Seam Number: S-064/069	165.1	P1	152.4	P2	153.2	P2	Pass	
		9' West of Crest of Slope	173.8	P1	155.6	P2	150.4	P2		
			163.2	P1	152.4	P2	149.8	P2		
		Seam Type: Fus (2) Repair Id: S05C	168.9	P1	154.2	P2	149.5	P2		
		Seaming Apparatus: F3 Tech: DW	169.8	P1	152.1	P2	145.7	P2		
DS-029	12/08/93	Seam Number: S-067/069	178.8	P1	151.3	P2	156.7	P2	Pass	
		5' North of South End of Seam	174.2	P1	144.1	P2	156.7	P2		
			176.5	P1	151.1	P2	161.9	P2		
		Seam Type: Fus (2) Repair Id: S05F	170.9	P1	154.6	P2	162.3	P2		
		Seaming Apparatus: F3 Tech: DW	172.2	P1	146.0	P2	168.0	P2		
DS-030	12/08/93	Seam Number: S-030/S02P	189.8	P6	108.7	P1			Fail	
		4' West of East End of Seam	186.2	P6	72.5	F1				
			190.3	P6	73.8	F1				
		Seam Type: Ext (2) Repair Id: S04J	184.8	P6	99.2	P1				
		Seaming Apparatus: X2 Tech: ET	189.4	P6	111.2	F1				
DS-030A1	12/14/93	Seam Number: S-030/S02P	187.2	P6	140.0	P1			Pass	
		10' North of South End of Seam	186.9	P6	162.0	P1				
			187.3	P6	144.7	P1				
		Seam Type: Ext (2) Repair Id: S04R	186.2	P6	147.6	P1				
		Seaming Apparatus: X2 Tech: ET	183.3	P6	125.8	P1				
DS-030B1	12/15/93	Seam Number: S-038/S04E	172.7	P6	170.9	P2			Pass	
		1' South of North End of Seam	174.5	P6	155.7	P2				
			176.8	P6	160.2	P2				
		Seam Type: Ext (2) Repair Id: S08Q	178.8	P6	156.9	P2				
		Seaming Apparatus: X2 Tech: ET	177.6	P6	160.3	P2				

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-031	12/13/93	Seam Number: S-042/S06R	187.7	P1	174.4	P2	168.4	P2	Pass
		54' North of Crest of Slope	187.3	P1	175.3	P2	176.0	P2	
			182.6	P1	174.7	P2	172.1	P2	
		Seam Type: Fus (2) Repair Id: S07B	189.2	P1	180.4	P2	169.9	P2	
		Seaming Apparatus: F3 Tech: DW	183.9	P1	174.1	P2	174.0	P2	
DS-032	12/15/93	Seam Number: S-047/S06G	176.2	P6	140.4	P2			Pass
		11' South of Crest of Slope	174.5	P6	130.7	P2			
			181.6	P6	123.8	P2			
		Seam Type: Fus (2) Repair Id: S04W	173.3	P6	141.5	P2			
		Seaming Apparatus: X2 Tech: ET	176.9	P6	155.3	P2			
DS-033	12/18/93	Seam Number: S-034/S09C	178.1	P1	162.7	P2	160.9	P2	Pass
		6' South of North End of Seam	173.7	P1	161.8	P2	163.8	P2	
			175.8	P1	163.1	P2	160.3	P2	
		Seam Type: Fus (2) Repair Id: S09D	180.5	P1	164.0	P2	161.0	P2	
		Seaming Apparatus: F2 Tech: ET	177.5	P1	161.0	P2	161.3	P2	
DS-039	01/03/94	Seam Number: S-022/S10N	190.5	P1	160.9	P2	170.7	P2	Pass
		East End of Seam	187.3	P1	156.3	P2	161.1	P2	
			186.0	P1	141.7	P2	166.5	P2	
		Seam Type: Fus (2) Repair Id: S10M	188.5	P1	150.5	P2	165.6	P2	
		Seaming Apparatus: F3 Tech: DW	183.6	P1	164.8	P2	169.2	P2	
DS-040	01/03/94	Seam Number: S-004/S10G	182.8	P1	172.3	P2	186.3	P2	Pass
		17' North of Crest of Slope	180.1	P1	175.1	P2	188.6	P2	
			182.7	P1	170.4	P2	169.0	P2	
		Seam Type: Fus (2) Repair Id: S10L	177.3	P1	172.1	P2	177.1	P2	
		Seaming Apparatus: F2 Tech: ET	178.4	P1	171.5	P2	178.7	P2	

NOTES

- =====
- 1) See Figures for illustration of mode of failure codes.
 - 2) Fus - Fusion Seam
Ext - Extrusion Seam
 - 3) Destructive Test Sample DS-014A2 is the same sample as DS-015B1.
Tracking failed destructive sample DS-014 in the after direction ended at the same location
as tracking failed destructive test sample DS-015 in the before direction.
 - 4) All deficient seams and repairs welded by extrusion welder X1 were capped.
X1 was removed from the project after welding the seam from which sample
DS-015 was obtained.

APPENDIX M-5
GEOMEMBRANE REPAIR SUMMARY

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REPAIR NUMBER	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (1)	DATE TESTED (1)	SIZE (ft) (2)	REPAIR MONITOR (3)
S01A	11/19/93	S-003/004	50' South of Crest of Slope	12/03/93	12/03/93	3 x 140	SM
S01B	11/19/93	S-004/005	76' South of Crest of Slope (Capped by S11R)	12/02/93	12/03/93	4 x 7	SM
S01C	11/19/93	S-006/007	At Intersection With S-005	12/03/93	12/03/93	2 x 2	SM
S01D	11/21/93	S-034/035	Anchor Trench Crest	12/15/93	12/21/93	1 x 2	SM
S01E	11/21/93	S-031/032	At Intersection With S-034 (Capped by S09C)	11/11/11	11/11/11		SM
S01F	11/21/93	S-036	2' East of S-035/036, 6' S of North End of Panel	12/20/93	12/21/93	1	DHM
S01G	12/04/93	S-032/033	5' West of East End of Seam (Capped by S09C)	11/11/11	11/11/11		DHM
S01H	12/04/93	S-042/043	30' North of Crest of Slope (Capped by S06R)	11/11/11	11/11/11		SM
S01J	12/04/93	S-042/043	85' North of Crest of Slope (Capped by S06R)	11/11/11	11/11/11		SM
S01K	12/04/93	S-042/043	Crest of Slope (Capped by S06R)	11/11/11	11/11/11		SM
S01L	12/05/93	S-045/046	22' North of Crest of Slope	12/12/93	12/15/93	2 x 5	SM
S01M	12/05/93	S-046/047	40' North of Crest of Slope	12/12/93	12/15/93	2 x 5	SM
S01N	12/05/93	S-048/049	28' North of Crest of Slope	12/13/93	12/15/93	2 x 6	SM
S01P	12/05/93	S-051/052	10' West of East End of Seam	12/06/93	12/20/93	2 x 5	SM
S01Q	12/05/93	S-053/054	53' North of Crest of Slope	12/13/93	12/15/93	2 x 5	SM
S01R	12/05/93	S-012/052	11' East of West End of Seam	12/06/93	12/20/93	2 x 5	SM
S01S	12/05/93	S-042/050	12' West of East End of Seam	12/12/93	12/15/93	1 x 4	NE
S01T	12/05/93	S-058/059	52' West of Crest of Slope	12/14/93	12/16/93	2 x 5	SM
S01U	12/05/93	S-048/059	13' East of West End of Seam	12/15/93	12/16/93	2 x 5	SM
S01W	12/05/93	S-061/062	39' West of Crest of Slope	12/21/93	01/04/94	2 x 5	NE
S01X	12/06/93	S-055/056	At Intersection With S-065	12/14/93	12/16/93	2 x 2	NE

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S02A	11/20/93	S-011/012	4' North of South End of Seam (Capped by S03X)	12/02/93	11/11/11	2 x 2	SM
S02B	11/20/93	S-011	1' North, 11' W of S End of Panel (Capped by S04G)	12/02/93	11/11/11	1 x 1	SM
S02C	11/20/93	S-012/013	48' South of Crest of Slope	11/30/93	12/02/93	2 x 6	SM
S02D	11/20/93	S-013/014	48' South of Crest of Slope (Capped by S11P)	12/02/93	12/02/93	2 x 5	SM
S02E	11/20/93	S-014/015	17' South of Crest of Slope (Capped by S03J)	12/06/93	11/11/11	2 x 5	SM
S02F	11/20/93	S-019/020	6' West of Crest of Slope	12/02/93	01/06/94	2 x 5	SM
S02G	11/20/93	S-006/008	Anchor Trench Crest (Capped by S11X)	12/02/93	12/02/93	2 x 2	SM
S02H	11/20/93	S-006/007	At Intersection With S-008	12/03/93	12/03/93	1 x 3	SM
S02J	11/20/93	S-022/023	53' East of Crest of Slope (Capped by S03M)	11/11/11	11/11/11		SM
S02K	11/20/93	S-014/021	6' East of West End of Seam (Capped by S10E)	12/02/93	12/02/93	3 x 6	SM
S02L	11/20/93	S-012/013	At Intersection With S-022	12/06/93	12/20/93	2 x 2	SM
S02M	11/20/93	S-024/025	26' East of Crest of Slope	12/02/93	12/02/93	2 x 5	SM
S02N	11/21/93	S-034/035	10' North of Crest of Slope	12/15/93	12/21/93	2 x 5	SM
S02P	11/21/93	S-031/034	13' N. of South End of Seam (Cap by S09C & S09T)	11/11/11	11/11/11		SM
S02Q	11/21/93	S-040/041	42' North of Slope Crest	12/06/93	12/15/93	2 x 4	SM
S02R	11/21/93	S-041/042	70' North of Slope Crest	12/06/93	12/15/93	2 x 5	SM
S02S	11/21/93	S-017/018	At Intersection With S-026	12/02/93	01/06/94	2 x 3	SM
S02T	11/22/93	S-040/041	15' North of Toe of Slope	12/03/93	12/15/93	3 x 4	NE
S02U	11/22/93	S-035/036	6' South of Crest of Slope	12/15/93	12/21/93	1 x 1	SM
S02V	01/03/94	S-028	7' N. of S-028/038, 97' E. of Crest of Slope	01/03/94	01/03/94	4 x 5	NE
S02X	12/03/93	S-003/S01A	60' South of Crest of Slope	12/03/93	12/03/93	3 x 5	SM
S03A	12/01/93	S-036/037	At Intersection With S-038 (Capped by S09S)	12/01/93	11/11/11	2 x 2	SM

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S03B	12/01/93	S-028	7' N of S-028/038, 97' E of W Crest (Cap by S02W)	12/01/93	12/21/93	1 x 1	SM
S03C	12/01/93	S-028	S03B to S-028/038 (Capped by S02W)	12/01/93	11/11/11	6	SM
S03D	12/01/93	S-038	S03E to S03F, 75' N of Slope Crest (Cap by S09U)	12/01/93	11/11/11	14	SM
S03E	12/01/93	S-038	5' E of S-037/038, 80' N of Crest (Capped by S09U)	12/01/93	11/11/11	1 x 1	SM
S03F	12/01/93	S-028/038	10' West of East End of Seam (Capped by S02P)	12/01/93	11/11/11	1 x 1	SM
S03G	12/02/93	S-028/038	3' West of East End of Seam (Capped by S09T)	12/03/93	11/11/11	2 x 5	NE
S03H	12/02/93	S-017/018	1' East of West End of Seam	12/02/93	01/06/94	1 x 1	SM
S03J	12/02/93	S-014/015	33' South of Crest of Slope	12/03/93	12/03/93	3 x 57	SM
S03K	12/02/93	S-016/017	At Intersection With S-018/019	12/02/93	12/02/93	3 x 5	SM
S03L	12/02/93	S-015/016	At Intersection With S-019/020 (Capped by S10D)	12/02/93	12/02/93	2 x 14	SM
S03M	12/02/93	S-022/023	17' West of 02J (Capped by S10N)	12/02/93	12/02/93	3 x 22	SM
S03N	12/02/93	S-022/023	14' East of 02J (Capped by S10N)	12/02/93	12/02/93	3 x 22	SM
S03P	12/02/93	S-014/015	At Intersection With S-020 (Capped by S11N)	12/02/93	12/02/93	2 x 2	SM
S03Q	12/02/93	S-020/021	At Intersection With S-014 (Capped by S11M)	12/02/93	12/02/93	2 x 2	SM
S03R	12/02/93	S-013/014	At Intersection With S-021 (Capped by S11L)	12/02/93	12/02/93	1 x 1	SM
S03S	12/02/93	S-021/022	At Intersection With S-013 (Capped by S11K)	12/02/93	12/02/93	1 x 1	SM
S03T	12/02/93	S-017/026	1' North of South End of Seam	12/02/93	01/06/94	1 x 1	SM
S03U	12/02/93	S-038/039	At Intersection With S-028 (Cap by S02P & S09T)	12/02/93	11/11/11	1 x 1	SM
S03W	12/03/93	S-003/S01A	7' North of South End of Seam (Capped by S10G)	12/04/93	11/11/11	3 x 30	SM
S03X	12/03/93	S-011/012	3' North of Toe of Slope	12/04/93	12/04/93	2 x 30	SM
S04A	12/06/93	S-044/045	65' North of Crest of Slope	12/12/93	12/15/93	2 x 9	NE
S04B	12/06/93	S-24/25/50	NEOS S-024/050 to SEOS S-025/050	12/20/93	12/20/93	3 x 14	DHM

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S04C	12/06/93	S-051/052	At Intersection With S-023	12/20/93	12/20/93	3 x 9	DHM
S04D	12/06/93	S-022/052	North End of Seam to South End of Seam	12/06/93	12/20/93	1 x 7	SM
S04E	12/06/93	S-037/038	4' South of North End of Seam (Capped by S09S)	12/06/93	11/11/11	2 x 5	SM
S04F	12/06/93	S-011/012	At Intersection With S-052	12/06/93	12/20/93	2 x 5	SM
S04G	12/06/93	S-011/052	12' East of West End of Seam	12/06/93	12/20/93	2 x 4	SM
S04H	12/06/93	S-010/011	At Intersection with S-052	12/06/93	12/20/93	2 x 4	SM
S04J	12/06/93	S-030/S02P	4' West of East End of Seam (Capped by S09C)	11/11/11	11/11/11		SM
S04K	12/06/93	S-047/059	At Intersection With S-050	12/15/93	12/16/93	2 x 2	SM
S04L	12/06/93	S-050/060	0' - 6' North of South End of Seam	12/15/93	12/15/93	3 x 5	SM
S04M	12/06/93	S-061	45' West of Crest of Slope	12/21/93	01/04/94	2 x 14	NE
S04N	12/06/93	S-060/061	20' East of West End of Seam	12/11/93	01/04/94	1 x 1	SM
S04P	12/06/93	S-060/061	28' East of West End of Seam	12/11/93	01/04/94	2 x 2	SM
S04Q	12/06/93	S-009/010	At Intersection With S-052	12/20/93	12/20/93	2 x 4	DHM
S04R	12/14/93	S-030/S02P	10' South of S04J (Capped by S09C)	11/11/11	11/11/11		SM
S04S	12/14/93	S-036/037	6' North of South End of Seam (Capped by S09R)	11/11/11	11/11/11		DHM
S04T	12/15/93	S-038/039	11' South of Crest of Slope	12/21/93	12/21/93	2 x 5	DHM
S04U	12/15/93	S-003/S01A	20' S. of Crest of Slope (Capped by S10G)	11/11/11	11/11/11		DHM
S04W	12/15/93	S-047/S06G	11' South of Crest of Slope	12/15/93	12/16/93	2 x 4	SM
S04X	12/15/93	S-053/054	10' South of Crest of Slope	12/15/93	12/16/93	2 x 7	SM
S05A	12/03/93	S-028/039	4' North of South End of Seam	12/03/93	12/17/93	2 x 2	NE
S05B	12/03/93	S-027/039	6' South of North End of Seam	12/03/93	12/17/93	2 x 4	NE
S05C	12/06/93	S-064/069	9' West of Crest of Slope	12/11/93	12/16/93	2 x 4	NE

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S05D	12/06/93	S-064/069	3' East of Crest of Slope	01/09/94	01/11/94	1 x 1	NE
S05E	12/06/93	S-001/063	14' North of South End of Seam	12/21/93	01/04/94	1 x 1	NE
S05F	12/06/93	S-067/069	5' North of South End of Seam	12/11/93	12/16/93	1 x 8	SH
S05G	12/06/93	S-055/071	3' South of North End of Seam	12/16/93	12/16/93	4 x 10	SH
S05H	12/06/93	S-054/055	At Intersection With S-056	12/17/93	12/17/93	2 x 3	SH
S05J	12/06/93	S-056/057	At Intersection With S-054	12/17/93	12/17/93	2 x 2	SH
S05K	12/06/93	S-057/058	At Intersection With S-053/054	12/14/93	12/16/93	4 x 5	SH
S05L	12/06/93	S-058/059	At Intersection With S-053	12/14/93	12/16/93	2 x 2	SH
S05M	12/06/93	S-049/053	At Intersection With S-059	12/14/93	12/16/93	2 x 4	SH
S05N	12/06/93	S-048/049	At Intersection With S-059	12/15/93	12/16/93	2 x 3	SH
S05P	12/06/93	S-046/047	At Intersection With S-050	12/11/93	12/15/93	2 x 2	SH
S05Q	12/06/93	S-045/046	At Intersection With S-050	12/11/93	12/15/93	2 x 2	SH
S05R	12/06/93	S-044/045	At Intersection With S-050	12/12/93	12/15/93	2 x 8	NE
S05S	12/06/93	S-043/044	At Intersection With S-050	12/12/93	12/15/93	1 x 1	NE
S05T	12/06/93	S-042/043	At Intersection With S-050	12/12/93	12/15/93	2 x 2	NE
S05U	12/06/93	S-041/042	At Intersection With S-050	12/12/93	12/15/93	1 x 1	NE
S05V	12/06/93	S-040/041	At Intersection With S-050	12/12/93	12/15/93	2 x 4	NE
S05X	12/06/93	S-039/040	At Intersection With S-050	12/12/93	12/15/93	1 x 1	NE
S06A	12/08/93	S-067/069	At Intersection With S-068/070	12/11/93	12/16/93	3 x 6	NE
S06B	12/08/93	S-064/069	At Intersection With S-066	12/11/93	12/16/93	2 x 2	SH
S06C	12/08/93	S-001/066	At Intersection With S-064	12/11/93	12/16/93	2 x 3	SH
S06D	12/08/93	S-063/064	At Intersection With S-001	12/21/93	01/04/94	4 x 4	NE

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S06E	12/08/93	S-062/063	At Intersection With S-002	12/20/93	12/20/93	2 x 4	DHM
S06F	12/08/93	S-057/058	3' West of Crest of Slope	12/16/93	12/16/93	2 x 2	SH
S06G	12/08/93	S-046/047	13' North of Crest of Slope	12/12/93	12/15/93	3 x 29	SH
S06H	12/08/93	S-048/049	50' North of Crest of Slope	12/13/93	12/15/93	1 x 1	SH
S06J	12/08/93	S-048/049	5' South of Anchor Trench Crest	12/15/93	12/15/93	1 x 2	SH
S06K	12/08/93	S-049/053	30' North of Crest of Slope	12/13/93	12/15/93	2 x 11	SH
S06L	12/09/93	S-049/053	5' South of Anchor Trench Crest	12/16/93	12/16/93	2 x 6	SH
S06M	12/09/93	S-049/053	24' N of Crest of Slope (Covered by S06K)	12/13/93	12/15/93	2 x 11	SH
S06N	12/11/93	S-047/050	5' South of North End of Seam	12/11/93	12/15/93	2 x 4	SH
S06P	12/11/93	S-040/041	3' South of Toe of Slope	12/12/93	12/15/93	2 x 7	NE
S06Q	12/11/93	S-044/045	4' South of Anchor Trench Crest	12/15/93	12/15/93	2 x 4	SH
S06R	12/12/93	S-042/043	South End of Seam to North End of Seam	12/12/93	12/15/93	3 x 150	SH
S06S	12/12/93	S-043/S06R	3' North of Toe of Slope	12/15/93	12/15/93	4 x 5	SH
S06T	12/12/93	S-043/S06R	73' North of Slope Crest	12/14/93	12/15/93	2 x 3	SH
S06U	12/12/93	S-043/S06R	61' North of Slope Crest (Same Patch as S06U)	12/14/93	12/15/93	2 x 12	SH
S06W	12/12/93	S-043/S06R	53' North of Slope Crest (Same Patch as S06U)	12/14/93	12/15/93	1 x 1	SH
S06X	12/12/93	S-043/S06R	22' North of Slope Crest	12/14/93	12/15/93	1 x 2	NE
S07A	12/12/93	S-043/S06R	Crest of Slope	12/14/93	12/15/93	1 x 1	NE
S07B	12/12/93	S-042/S06R	54' North of Crest of Slope	12/14/93	12/15/93	2 x 5	SH
S07C	12/13/93	S-042/S06R	101' North of Crest of Slope	12/14/93	12/15/93	2 x 7	SH
S07D	12/13/93	S-042/S06R	75' N of Crest of Slope (Same Patch as S07E)	12/14/93	12/15/93	2 x 9	SH
S07E	12/13/93	S-042/S06R	68' N of Crest of Slope (Same Patch as S07D)	12/14/93	12/15/93	2 x 9	SH

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S07F	12/13/93	S-043/S06R	4' South of Anchor Trench Crest	12/15/93	12/15/93	1 x 1	SH
S07G	12/14/93	S-005/006	13' North of Crest of Slope	01/09/94	01/09/94	2 x 3	NE
S07H	12/16/93	S-033/034	11' South of Crest of Slope	12/21/93	12/21/93	2 x 4	NE
S07J	12/15/93	S-044/045	11' South of Crest of Slope	12/15/93	12/15/93	1 x 1	SH
S07K	12/15/93	S-046/047	Toe of Anchor Trench (Capped by S06G)	12/15/93	12/15/93	2 x 5	SH
S07L	12/15/93	S-050/051	At intersection with S-060	12/20/93	12/20/93	3 x 4	SH
S07M	12/15/93	S-047/048	At Intersection With S-059	12/15/93	12/16/93	2 x 2	SH
S07N	12/15/93	S-040	8' E. of S-039/040, 30' S. of Toe of Slope	12/15/93	12/16/93	1 x 1	SH
S07P	01/04/94	S-004/S10G	6' North of South End of Seam	01/04/94	01/05/94	2 x 7	NE
S07Q	01/04/94	S-055	7' South, 4' E of Crest of Slope to 22' Southeast	12/16/93	12/16/93	3 x 22	SH
S07R	01/04/94	S-054	3' South of Access Ramp, 8' West of S-054/055	12/15/93	12/16/93	3 x 6	SH
S07S	01/04/94	S-054	5' South of Access Ramp, 4' West of S-054/055	12/15/93	12/16/93	2 x 3	SH
S07T	01/04/94	S-054	6' South of Access Ramp, 5' East of S-053/054	12/15/93	12/16/93	3 x 7	SH
S07U	01/04/94	S-054	5' South of Access Ramp, 5' East of S-053/054	12/15/93	12/16/93	1 x 2	SH
S07W	01/04/94	S-054/055	2' South of Access Ramp	12/16/93	12/16/93	1 x 2	SH
S07X	01/04/94	S-071	7' S of Crest of Slope, 2' to 12' SE of S-055/071	12/16/93	12/16/93	3 x 12	SH
S08A	12/13/93	S-024/051	3' North of South End of Seam	12/20/93	12/20/93	2 x 2	DHM
S08B	12/13/93	S-024/051	9' South of North End of Seam	12/20/93	12/20/93	2 x 2	DHM
S08C	12/14/93	S-001/002	4' North of South End of Seam	12/20/93	12/20/93	2 x 4	DHM
S08D	12/13/93	S-008/009	At Intersection With S-052	12/20/93	12/20/93	2 x 4	DHM
S08E	12/13/93	S-007/008	At Intersection With S-052	12/20/93	12/20/93	2 x 2	DHM
S08F	12/13/93	S-005/006	At Intersection With S-052	12/20/93	12/20/93	2 x 2	DHM

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S08G	12/13/93	S-004/005	At Intersection With S-052	12/20/93	12/20/93	2 x 2	DHM
S08H	12/13/93	S-004/S01A	At Intersection With S-052	12/20/93	12/20/93	2 x 2	DHM
S08J	12/13/93	S-003/S01A	At Intersection With S-052	12/20/93	12/20/93	2 x 4	DHM
S08K	12/13/93	S-003/062	At Intersection With S-052	12/20/93	12/20/93	3 x 3	DHM
S08L	12/13/93	S-003/062	8' West of East End of Seam	12/15/93	01/04/94	2 x 2	SM
S08M	12/13/93	S-003/062	4' West of East End of Seam	12/15/93	01/04/94	1 x 3	SM
S08N	12/13/93	S-002/003	At Intersection With S-062	12/15/93	01/05/94	1 x 2	SM
S08P	12/15/93	S-019/S03L	3' North of South End of Seam (Capped by S100)	11/11/11	11/11/11		NE
S08Q	12/15/93	S-038/S04E	1' South of North End of Seam (Capped by S09S)	11/11/11	11/11/11		NE
S08R	12/16/93	S-054/055	8' South of Crest of Slope	12/16/93	12/16/93	1 x 2	SM
S08S	12/16/93	S-053	2' East of S-049/053, 35' North of Crest of Slope	12/16/93	12/16/93	1 x 2	SM
S08T	12/16/93	S-047	Toe of Slope, 7' East of S-046/047	12/16/93	12/16/93	1 x 2	SM
S08U	12/17/93	S-060/061	At Intersection With S-051	12/20/93	12/20/93	2 x 6	DHM
S08W	12/17/93	S-051/052	At Intersection With S-061	12/20/93	12/20/93	2 x 3	DHM
S08X	12/17/93	S-061/062	At Intersection With S-052	12/20/93	12/20/93	3 x 5	DHM
S09A	12/14/93	S-032/033	9' South of Crest of Slope (Capped by S09C)	11/11/11	11/11/11		NE
S09B	12/14/93	S-055/065	At Intersection With S-071 (Capped by S05G)	11/11/11	11/11/11		NE
S09C	12/18/93	S-32/33/28	SW corner seams S-032/033 through S-028/038	12/18/93	12/21/93	6 x 139	SM
S09D	12/18/93	S-034/S09C	6' South of North End of Seam	12/18/93	12/21/93	2 x 4	SM
S09E	12/18/93	S-033/034	At Intersection with S09C	12/18/93	12/21/93	2 x 3	SM
S09F	12/18/93	S-034/035	At Intersection with S09C	12/18/93	12/21/93	2 x 4	SM
S09G	12/18/93	S-035/036	At Intersection with S09C	12/18/93	12/21/93	1 x 2	SM

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REPAIR NUMBER	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (1)	DATE TESTED (1)	SIZE (ft) (2)	REPAIR MONITOR (3)
S09H	12/18/93	S-036/037	At Intersection with S09C (Capped by S09R)	11/11/11	11/11/11		SM
S09J	12/18/93	S-037/038	At Intersection with S09C (Capped by S09S)	11/11/11	11/11/11		SM
S09K	12/18/93	S-029/S09C	16' North of South End of Seam	12/21/93	12/21/93	2 x 2	NE
S09L	12/18/93	S-028/029	At Intersection With S09C	12/21/93	12/21/93	1 x 3	NE
S09M	12/18/93	S-029/030	At Intersection With S09C	12/21/93	12/21/93	2 x 3	NE
S09N	12/18/93	S-030/031	At Intersection With S09C	12/21/93	12/21/93	2 x 3	NE
S09P	12/18/93	S-031/032	At Intersection With S09C	12/21/93	12/21/93	1 x 2	NE
S09Q	12/18/93	S-028/S09C	10' North of South End of Seam (Capped by S02W)	12/21/93	12/21/93	1 x 1	NE
S09R	12/21/93	S-036/037	North End of Seam to South End of Seam	12/21/93	12/21/93	3 x 16	NE
S09S	12/21/93	S-037/038	North End of Seam to South End of Seam	12/21/93	12/21/93	4 x 14	NE
S09T	12/21/93	S-028/038	West End of Seam to East End of Seam	12/21/93	12/21/93	6 x 17	NE
S09U	12/21/93	S-038	Caps repairs S03D and S03E	12/21/93	12/21/93	3 x 12	NE
S09W	12/21/93	S-033/S09C	11' South of Crest of Slope	12/21/93	01/03/94	6 x 7	NE
S09X	12/21/93	S-029/S09C	14' North of South End of Seam	12/21/93	12/21/93	1 x 1	NE
S10A	12/21/93	S-028/S09T	East End of S09T	12/21/93	12/21/93	2 x 4	NE
S10B	12/21/93	S-022/S03H	8' West of East End of Seam (Capped by S10N)	12/21/93	11/11/11	1 x 1	NE
S10C	12/21/93	S-014/S02D	Northwest Corner of S02D (Capped by S11P)	12/21/93	11/11/11	1 x 1	NE
S10D	12/21/93	S-015/016	At Intersection with S-019/020	12/21/93	01/06/94	4 x 15	NE
S10E	12/21/93	S-014/021	6' East of West End of Seam	12/21/93	01/06/94	4 x 9	NE
S10F	12/21/93	S-061	Sump	12/21/93	01/05/94	6 x 15	NE
S10G	12/22/93	S-003/004	South End of Seam to North End of Seam	12/22/93	01/07/94	5 x 130	NE
S10H	01/03/94	S-028	11' West of Slope Crest, 6' South of S-027/028	01/05/94	01/05/94	1 x 2	NE

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S10J	01/03/94	S-024/025	14' West of Slope Crest	01/05/94	01/05/94	2 x 3	NE
S10K	01/03/94	S-021/022	15' West of Slope Crest	01/06/94	01/06/94	2 x 3	NE
S10L	01/03/94	S-004/S10G	17' North of Slope Crest	01/07/94	01/07/94	3 x 3	DHM
S10M	01/03/94	S-022/S10N	East End of Seam	01/05/94	01/06/94	3 x 5	NE
S10N	01/05/94	S-022/023	35'-78' East of Crest of Slope	01/05/94	01/06/94	7 x 42	NE
S10P	01/04/94	S-057/058	12' East of Crest of Slope	01/10/94	01/11/94	2 x 3	NE
S10Q	01/04/94	S-059	At East End of Panel	01/09/94	01/11/94	2 x 23	NE
S10R	01/04/94	S-060/061	10' East of Crest of Slope	01/09/94	01/09/94	1 x 1	NE
S10S	01/04/94	S-061	At East End of Panel	01/09/94	01/09/94	3 x 23	NE
S10T	01/04/94	S-063/064	1' West of East End of Seam	01/07/94	01/09/94	2 x 2	DHM
S10U	01/04/94	S-064/069	1' West of East End of Seam	01/07/94	01/09/94	3 x 3	DHM
S10W	01/04/94	S-015/016	North End of Seam	01/09/94	01/09/94	2 x 2	DHM
S10X	01/04/94	S-016/017	North End of Seam	01/09/94	01/09/94	2 x 2	NE
S11A	12/22/93	S-004/S10G	At South End of Seam	12/22/93	01/04/94	1 x 1	NE
S11B	12/22/93	S-003/S10G	At South End of Seam	12/22/93	01/04/94	1 x 1	NE
S11C	01/04/04	S-003/S10G	53' North of South End of Seam	01/04/94	01/11/94	2 x 6	NE
S11D	01/04/04	S-003/S10G	3' North of South End of Seam	01/04/94	01/05/94	2 x 2	NE
S11E	01/04/04	S-003/S10G	21' South of Crest of Slope	01/07/94	01/07/94	4	DHM
S11F	01/04/04	S-003/S10G	2' North of Crest of Slope	01/07/94	01/07/94	2 x 2	DHM
S11G	01/05/94	S-023/S10N	East End of Seam	01/05/94	01/06/94	2 x 2	NE
S11H	01/05/94	S-023/S10N	West End of Seam	01/05/94	01/06/94	1 x 2	NE
S11J	01/05/94	S-022/S10N	West End of Seam	01/05/94	01/06/94	1 x 2	NE

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REPAIR NUMBER	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (1)	DATE TESTED (1)	SIZE (ft) (2)	REPAIR MONITOR (3)
S11K	01/06/94	S-021/022	At Intersection with S-013	01/06/94	01/06/94	3 x 3	NE
S11L	01/06/94	S-013/014	At Intersection with S-021	01/06/94	01/06/94	3 x 3	NE
S11M	01/06/94	S-020/021	At Intersection with S-014	01/06/94	01/06/94	3 x 3	NE
S11N	01/06/94	S-014/015	At Intersection with S-020	01/06/94	01/06/94	3 x 3	NE
S11P	01/06/94	S-013/014	48' South of Crest of Slope	01/06/94	01/06/94	3 x 7	NE
S11Q	01/06/94	S-061/S10F	Northeast Corner of S10F	01/07/94	01/11/94	2 x 3	DHM
S11R	01/06/94	S-004/005	76' South of Crest of Slope	01/06/94	01/11/94	7 x 12	NE
S11S	01/06/94	S-061	6' North of S-060/061, 6' West of Toe of Slope	01/11/94	01/11/94	4 x 8	NE
S11T	01/07/94	S-061/S10F	South End of S10F	01/07/94	01/11/94	2 x 2	DHM
S11U	01/07/93	S-051	34' East of S-024/051, 9' North of S-050/051	01/07/94	01/07/94	12 x 14	DHM
S11W	01/08/94	S-056/065	10' East of Crest of Slope	01/10/94	01/11/94	5 x 10	NE
S11X	01/09/94	S-006/008	Crest of Anchor Trench	01/09/94	01/09/94	3 x 3	NE
S12A	01/10/94	S-061	3' E of Crest, 6' N of S-060 (Capped by S12N)	01/10/94	01/12/94	2 x 2	NE
S12B	01/09/94	S-061	S12A to S12C (Capped by S12N)	01/09/94	01/09/94	8	NE
S12C	01/09/94	S-061/S10S	6' North of S-060/061	01/09/94	01/09/94	1 x 1	NE
S12D	01/09/94	S-061/S10S	At Intersection With S-060	01/09/94	01/09/94	1 x 1	NE
S12E	01/09/94	S-061/062	At Intersection With S10S	01/09/94	01/09/94	3 x 5	NE
S12F	01/09/94	S-059/060	At Intersection With S10Q	01/10/94	01/11/94	2 x 4	NE
S12G	01/09/94	S-058/059	At Intersection With S10Q	01/09/94	01/11/94	1 x 1	NE
S12H	01/09/94	S-060/S10S	S12D to East End of Seam	01/09/94	01/09/94	1 x 4	NE
S12J	01/09/94	S-058/S10Q	S12G to East End of Seam	01/09/94	01/11/94	2	NE
S12K	01/10/94	S-057/058	S10P to East End of Seam	01/10/94	01/11/94	3	NE

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REPAIR NUMBER	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (1)	DATE TESTED (1)	SIZE (ft) (2)	REPAIR MONITOR (3)
S12L	01/12/94	S-061	1' North of S-060/061, Toe to Crest of Slope	01/13/94	01/13/94	6 x 95	NE
S12M	11/22/93	S-027/028	Intersection with S-039	12/20/93	12/20/93	1 x 1	SAM
S12N	01/19/94	S-061	3' N of S-060/061, 3' W of E End of Panel	01/27/94	01/27/94	4 x 6	DHM

NOTES:

- (1) A repair date and/or test date of 11/11/11 indicates a repair which was capped.
- (2) A repair with no size indicates a repair which was capped.
A repair with only one size dimension indicates a grind and weld repair.
- (3) See Weld Observation Summary for monitor identification.

APPENDIX N

PRIMARY HDPE GEOMEMBRANE LINER INSTALLATION

APPENDIX N-1

GEOMEMBRANE DEPLOYMENT OBSERVATION SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
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PANEL NUMBER(1)	ROLL NUMBER	DATE DEPLOYED	APPROX.	VISUAL PANEL INSP (2)	MINIMUM	AVERAGE PANEL THICKNESS			DEPLOYMENT	REMARKS
			PANEL LENGTH (ft)		PANEL OVERLAP (inches)	Leading Edge	Side Edge	Trailing Edge	MONITOR (4)	
L-001	AC8309	11/17/93	50	OK		82.5	80.5	82.1	DHM	
P-001	AC6924	12/19/93	100	OK	5	67.8	65.1	68.1	NE	
P-002	AC6924	12/19/93	137	OK	5	68.1	64.6	68.1	NE	
P-003	AC6924	12/19/93	153	OK	5	68.1	64.4	68.0	NE	
P-004	AC6909	12/19/93	148	OK	5	68.1	63.1	67.8	NE	
P-005	AC6909	12/19/93	138	OK	5	67.8	63.5	68.3	NE	
P-006	AC6909	12/19/93	136	OK	5	68.3	63.6	67.8	NE	
P-007	AC6923	12/19/93	138	OK	5	67.1	61.7	68.1	NE	
P-008	AC6923	12/19/93	141	OK	5	68.1	61.9	68.0	NE	
P-009	AC6923	12/19/93	139	OK	5	68.0	61.4	68.3	NE	
P-010	AC6911	12/19/93	139	OK	5	68.3	62.5	68.0	NE	
P-011	AC6911	12/19/93	146	OK	5	68.0	62.3	68.4	NE	
P-012	AC6906	12/19/93	146	OK	5	68.9	63.3	68.6	NE	
P-013	AC6906	12/22/93	150	OK	5	65.1	61.2	66.1	NE	
P-014	AC6906	12/22/93	118	OK	5	66.1	61.9	67.2	NE	
P-015	AC6925	12/22/93	118	OK	5	65.8	64.7	66.3	NE	
P-016	AC6925	12/22/93	96	OK	5	66.3	63.3	66.0	NE	
P-017	AC6925	12/22/93	83	OK	5	66.0	63.8	67.2	NE	
P-018	AC6906	12/22/93	48	OK	5	67.2	62.5	67.1	NE	
P-019	AC6898	01/06/94	59	OK	5	67.7	63.9	67.8	NE	
P-020	AC6898	01/06/94	78	OK	5	67.8	64.2	68.0	NE	
P-021	AC6898	01/06/94	103	OK	5	68.0	64.2	68.5	NE	
P-022	AC6898	01/06/94	128	OK	5	68.5	63.9	67.7	NE	
P-023	AC6917	01/06/94	149	OK	5	67.4	62.0	67.6	NE	
P-024	AC6917	01/06/94	150	OK	5	67.6	62.7	67.1	NE	
P-025	AC6932	01/06/94	153	OK	5	67.6	61.3	67.9	NE	
P-026	AC6932	01/06/94	153	OK	5	67.9	61.0	67.1	NE	
P-027	AC6932	01/07/94	39	OK	5	67.5	64.0	67.6	DHM	
P-028	AC6904	01/10/94	156	OK	5	67.7	64.1	68.1	NE	
P-029	AC6904	01/10/94	158	OK	5	68.1	63.9	68.1	NE	
P-030	AC6904	01/10/94	120	OK	5	68.1	62.2	68.0	NE	
P-031	AC6905	01/10/94	100	OK	5	67.6	62.5	67.8	NE	
P-032	AC6932	01/10/94	77	OK	5	67.2	62.1	67.2	NE	
P-033	AC6904	01/13/94	39	OK	5	70.8	65.6	67.7	NE	
P-034	AC6904	01/13/94	8	OK	5	67.7	65.5	67.8	NE	
P-035	AC6917	01/13/94	59	OK	5	67.5	64.2	68.4	NE	
P-036	AC6905	01/13/94	82	OK	5	68.0	62.8	68.3	NE	
P-037	AC6905	01/13/94	92	OK	5	68.3	62.6	68.5	NE	
P-038	AC6905	01/13/94	110	OK	5	68.5	61.7	68.5	NE	
P-039	AC6915	01/13/94	119	OK	5	67.9	64.3	68.0	NE	

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			PANEL LENGTH (ft)			Leading Edge	Side Edge	Trailing Edge		
P-040	AC6915	01/13/94	105	OK	5	68.0	63.5	67.9	NE	
P-041	AC6915	01/13/94	106	OK	5	67.9	63.1	67.6	NE	
P-042	AC6912	01/17/94	108	OK	5	64.9	61.3	63.2	DHM	
P-043	AC6912	01/17/94	108	OK	5	63.2	60.4	63.6	DHM	
P-044	AC6912	01/17/94	109	OK	5	63.6	64.2	64.9	DHM	
P-045	AC6912	01/17/94	110	OK	5	64.9	61.3	64.3	DHM	
P-046	AC6899	01/17/94	112	OK	5	63.5	62.9	64.1	DHM	
P-047	AC6899	01/17/94	111	OK	5	64.1	61.8	65.4	DHM	
P-048	AC6899	01/17/94	111	OK	5	65.4	62.8	64.8	DHM	
P-049	AC6899	01/17/94	111	OK	5	64.8	61.8	65.9	DHM	
P-050	AC6908	01/17/94	98	OK	5	68.1	63.5	67.8	NE	
P-051	AC6908	01/17/94	74	OK	5	67.8	64.1	68.2	NE	
P-052	AC6915	01/17/94	50	OK	5	69.0	62.6	82.3	NE	
P-053	AC6908	01/17/94	48	OK	5	68.2	64.4	67.7	NE	
P-054	AC6908	01/17/94	74	OK	5	67.7	62.7	66.8	NE	
P-055	AC6908	01/17/94	99	OK	5	66.8	62.8	67.6	NE	
P-056	AC9604	01/17/94	121	OK	5	67.2	64.1	68.0	NE	
P-057	AC6908	01/17/94	8	OK	5	67.6	64.0	67.8	NE	
P-058	AC9604	01/17/94	158	OK	5	68.0	66.3	69.5	NE	
P-059	AC9604	01/17/94	158	OK	5	69.5	65.5	68.0	NE	
P-060	AC9605	01/18/94	125	OK	5	65.7	65.9	66.6	NE	
P-061	AC9605	01/18/94	112	OK	5	66.6	65.6	67.0	NE	
P-062	AC9605	01/18/94	94	OK	5	67.0	66.3	67.0	NE	
P-063	AC9605	01/18/94	72	OK	5	67.0	65.0	66.7	NE	
P-064	AC6924	01/18/94	50	OK	5	67.1	65.4	67.0	NE	
P-065	AC6932	01/18/94	20	OK	5	65.9	63.4	66.7	NE	
P-066	AC7680	01/20/94	178	OK	5	67.5	64.7	66.3	NE	
P-067	AC7680	01/20/94	180	OK	5	66.3	64.6	65.6	NE	
P-068	AC6905	01/20/94	30	OK	5	65.6	62.5	65.4	NE	
P-069	AC7680	01/20/94	103	OK	5	65.6	65.3	66.4	NE	
P-070	AC7682	01/20/94	79	OK	5	67.6	63.9	67.8	NE	
P-071	AC7684	01/20/94	85	OK	5	67.8	65.7	67.7	NE	
P-072	AC7682	01/20/94	63	OK	5	67.8	64.1	67.9	NE	
P-073	AC6908	01/20/94	53	OK	5	68.0	63.9	67.9	NE	
P-074	AC9604	01/20/94	23	OK	5	68.6	66.3	66.8	NE	
P-075	AC6906	01/20/94	13	OK	5	68.5	66.4	68.6	NE	
T-001	AC8388	02/10/94	99	OK	5	81.7	80.8	83.2	DHM	
T-002	AC8388	02/10/94	100	OK	5	83.2	81.1	82.5	DHM	
T-003	AC8388	02/10/94	100	OK	5	82.5	80.9	82.4	DHM	
T-004	AC8309	02/10/94	104	OK	5	81.8	80.9	82.3	DHM	
T-005	AC8309	02/10/94	37	OK	5	82.3	80.7	82.9	DHM	

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			PANEL LENGTH (ft)		PANEL OVERLAP (inches)	Leading Edge	Side Edge	Trailing Edge	MONITOR (4)	
T-006	AC8388	02/10/94	48	OK	5	82.7	81.2	82.6	DHM	
T-007	AC8388	02/10/94	19	OK	5	82.8	81.0	83.3	DHM	

NOTES

- (1) A panel number with a prefix of L indicates a panel of HDPE geomembrane liner installed in the containment basin for leachate temporary storage tank.
 A panel number with a prefix of P indicates a panel of the primary HDPE geomembrane liner in the landfill.
 A panel number with a prefix of T indicates a panel of HDPE geomembrane liner installed in the truck unloading area.
- (2) OK indicates that the panel was free of visual defects when deployed in the landfill.
- (3) Average sheet thickness based upon the average of five micrometer measurements made along each end and one side of the panel.
- (4) See Weld Observation Summary for monitor identification.

APPENDIX N-2
TRIAL SEAM OBSERVATION SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
 PRIMARY GEOMEMBRANE LINER TRIAL SEAM OBSERVATION SUMMARY
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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						SHEAR Code Strength	PASS or FAIL
						PEEL(7)		Inside Track		Outside Track			
						Code	Strength	Code	Strength	Code	Strength		
TS-097	12/19/93	ET	F2	SM	750	P2	155.0	P2	154.0	P1	201.0	Pass	
TS-098	12/19/93	ET	F2	SM	750	P2	158.0	P2	154.0	P1	192.0	Pass	
						P2	144.0	P2	152.0	P1	195.0		
TS-099	12/19/93	ET	F2	SM	750	P2	159.0	P2	155.0	P1	192.0	Pass	
						P2	148.0	P2	153.0	P1	187.0		
TS-100	12/19/93	ET	F2	SM	750	P2	157.0	P2	151.0	P1	186.0	Pass	
						P2	160.0	P2	151.0	P1	176.0		
TS-101	12/19/93	SH	F3	SM	750	P2	157.0	P2	152.0	P1	180.0	Pass	
						P2	164.0	P2	144.0	P1	184.0		
TS-102	12/19/93	TH	F3	SH	750	P2	152.0	P2	149.0	P1	187.0	Pass	
						P2	154.0	P2	147.0	P1	193.0		
TS-103	12/20/93	ET	X2	NE	535	P2	159.0	P2	151.0	P1	191.0	Pass	
						P3	111.0			P5	185.0		
TS-104	12/20/93	SH	F3	NE	750	P3	121.0			P5	191.0	Pass	
						P2	148.0	P2	156.0	P1	196.0		
TS-105	12/20/93	TH	X10	DHM	525	P2	135.0	P2	159.0	P1	193.0	Pass	
						P3	123.0			P5	179.0		
TS-106	12/20/93	ET	X2	DHM	525	P3	131.0			P5	185.0	Pass	
						P3	132.0			P5	173.0		
TS-107	12/21/93	ET	X2	SAM	550	P3	118.0			P5	179.0	Pass	
						P1	109.0			P3	186.0		
TS-108	12/21/93	ET	X2	SAM	550	P1	106.0			P3	188.0	Pass	
						P1	121.0			P3	197.0		
TS-109	12/21/93	DW	X10	NE	530	P1	149.0			P3	197.0	Pass	
						P1	124.0			P3	192.0		
TS-110	12/21/93	ET	X2	NE	530	P1	131.0			P3	191.0	Pass	
						P1	120.0			P3	163.0		
TS-111	12/21/93	DW	X10	NE	530	P1	146.0			P3	186.0	Pass	
						P1	155.0			P3	189.0		
TS-112	12/22/93	ET	F2	NE	750	P2	143.0	P2	137.0	P1	182.0	Pass	
						P2	139.0	P2	147.0	P1	184.0		
TS-113	12/22/93	DW	F3	NE	750	P2	151.0	P2	166.0	P1	189.0	Pass	
						P2	158.0	P2	163.0	P1	190.0		
TS-114	12/22/93	ET	F2	NE	750	P2	132.0	P2	142.0	P1	179.0	Pass	
						P2	137.0	P2	156.0	P1	195.0		
TS-115	12/22/93	DW	X2	NE	530	P1	122.0			P3	165.0	Pass	
						P1	119.0			P3	178.0		
TS-116	12/22/93	ET	F2	NE	750	P2	134.0	P2	152.0	P1	182.0	Pass	
						P2	138.0	P2	156.0	P1	176.0		

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO. (6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						PASS or FAIL
						PEEL(7)				SHEAR		
						Inside Track		Outside Track				
						Code	Strength	Code	Strength	Code	Strength	
TS-117	12/22/93	ET	F2	NE	750	P2	115.0	P2	133.0	P1	172.0	Pass
TS-118	12/22/93	ET	F2	NE	750	P2	150.0	P2	133.0	P1	178.0	Pass
						P2	150.0	P2	159.0	P1	214.0	
						P2	155.0	P2	157.0	P1	183.0	
TS-121	01/04/94	ET	X2	NE	535	P2	146.0			P1	173.0	Pass
						P2	137.0			P1	171.0	
TS-122	01/04/94	ET	X2	NE	535	P2	127.0			P1	149.0	Pass
						P2	115.0			P1	158.0	
TS-123	01/04/94	ET	X2	NE	535	P2	128.0			P1	162.0	Pass
						P2	137.0			P1	162.0	
TS-124	01/04/94	ET	X2	NE	535	P2	138.0			P1	148.0	Pass
						P2	122.0			P1	152.0	
TS-125	01/05/94	ET	X2	NE	535	P2	120.0			P1	153.0	Pass
						P2	113.0			P1	155.0	
TS-126	01/05/94	ET	X2	NE	535	P2	110.0			P1	148.0	Pass
						P2	120.0			P1	148.0	
TS-127	01/06/94	ET	X2	NE	535	P2	112.0			P1	158.0	Pass
						P2	124.0			P1	152.0	
TS-128	01/06/94	ET	X2	NE	535	P2	103.0			P1	141.0	Pass
						P2	104.0			P1	151.0	
TS-129	01/06/94	DW	F2	NE	750	P2	145.0	P2	132.0	P1	169.0	Pass
						P2	136.0	P2	149.0	P1	162.0	
TS-130	01/06/94	DW	F2	NE	750	P2	135.0	P2	128.0	P1	147.0	Pass
						P2	132.0	P2	126.0	P1	153.0	
TS-131	01/06/94	ET	X2	NE	535	P2	125.0			P1	146.0	Pass
						P2	131.0			P1	148.0	
TS-132	01/06/94	ET	X2	NE	535	P2	130.0			P1	147.0	Pass
						P2	118.0			P1	152.0	
TS-133	01/06/94	TH	X10	NE	525	P2	130.0			P1	162.0	Pass
						P2	124.0			P1	174.0	
TS-134	01/07/94	DW	F2	DHM	750	P2	129.0	P2	139.0	P1	176.0	Pass
						P2	145.0	P2	153.0	P1	177.0	
TS-135	01/07/94	TH	X2	DHM	535	P1	119.0			P3	187.0	Pass
						P1	130.0			P3	186.0	
TS-136	01/07/94	DW	F2	DHM	750	P2	140.0	P2	149.0	P1	172.0	Pass
						P2	146.0	P2	153.0	P1	171.0	
TS-137	01/07/94	DW	F2	DHM	750	P2	147.0	P2	150.0	P1	180.0	Pass
						P2	149.0	P2	128.0	P1	181.0	
TS-138	01/07/94	SH	F3	DHM	750	P2	146.0	P2	114.0			Fail
						F1	101.0					

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						SHEAR Strength	PASS or FAIL
						PEEL(7)							
						Inside Track		Outside Track					
						Code	Strength	Code	Strength	Code	Strength		
TS-139	01/07/94	TH	X2	DHM	535	P1	129.0			P3	167.0		Pass
TS-140	01/07/94	SH	F2	DHM	750	P1	109.0			P3	187.0		Pass
						P2	130.0	P2	135.0	P2	176.0		
TS-141	01/07/94	DW	X10	NE	530	P2	126.0	P2	130.0	P2	177.0		Fail
						P1	122.0						
TS-142R	01/07/94	DW	X10	NE	530	F1	97.0						Pass
						P1	133.0			P3	170.0		
TS-143	01/08/94	TH	X2	NE	450	P1	115.0			P3	156.0		Pass
						P1	106.0			P3	172.0		
TS-144	01/08/94	DW	X10	NE	530	P1	117.0			P3	188.0		Pass
						P1	108.0			P3	159.0		
TS-145	01/08/94	PR	X10	NE	530	P1	94.0			P3	164.0		Pass
						P1	117.0			P3	175.0		
TS-146	01/09/94	TH	X2	NE	500	P1	101.0			P3	173.0		Pass
						P1	101.0			P2	180.0		
TS-147	01/09/94	TH	X2	NE	500	P1	97.0			P2	176.0		Pass
						P1	129.0			P2	163.0		
TS-148	01/09/94	DW	F2	NE	750	P1	127.0			P2	132.0		Pass
						P2	133.0	P2	129.0	P1	162.0		
TS-149	01/10/94	DW	F2	NE	750	P2	145.0	P2	138.0	P1	161.0		Pass
						P2	127.0	P2	132.0	P1	157.0		
TS-150	01/10/94	TH	X2	NE	500	P2	138.0	P2	133.0	P1	162.0		Pass
						P1	134.0			P3	160.0		
TS-151	01/10/94	DW	F2	NE	750	P1	128.0			P3	165.0		Pass
						P2	135.0	P2	150.0	P1	164.0		
TS-152	01/11/94	ET	X2	NE	525	P2	145.0	P2	146.0	P1	164.0		Pass
						P1	108.0			P2	135.0		
TS-153	01/11/94	DW	F2	NE	750	P1	121.0			P2	138.0		Pass
						P2	121.0	P2	133.0	P1	151.0		
TS-154	01/11/94	DW	F2	NE	750	P2	133.0	P2	125.0	P1	155.0		Pass
						P2	151.0	P2	147.0	P1	178.0		
TS-155	01/11/94	TH	X6	NE	450	P2	148.0	P2	144.0	P1	169.0		Pass
						P1	107.0			P2	158.0		
TS-156	01/11/94	ET	X2	DHM	525	P1	108.0			P2	155.0		Pass
						P1	109.0			P2	141.0		
TS-157	01/12/94	ET	X2	NE	525	P1	103.0			P2	135.0		Pass
						P1	131.0			P2	179.0		
TS-158	01/13/94	ET	X2	NE	535	P1	121.0			P2	170.0		Fail
						F1	39.0	F1	63.0				
						P1	97.0						

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						PASS or FAIL
						PEEL(7)				SHEAR		
						Inside Track		Outside Track				
						Code	Strength	Code	Strength	Code	Strength	
TS-159	01/13/94	DW	F2	NE	750	P2	141.0	P2	152.0	P1	158.0	Pass
TS-160	01/13/94	DW	F2	NE	750	P2	147.0	P2	147.0	P1	165.0	Pass
						P2	137.0	P2	135.0	P1	165.0	
TS-161	01/13/94	PR	F5	NE	750	P2	141.0	P2	131.0	P1	176.0	Pass
						P2	134.0	P2	129.0	P1	164.0	
TS-162R	01/13/94	ET	X2	NE	525	P1	117.0			P3	165.0	Pass
						P1	132.0			P3	158.0	
TS-163	01/13/94	ET	X2	DHM	525	P1	109.0			P3	144.0	Pass
						P1	110.0			P3	152.0	
TS-164	01/13/94	DW	F2	NE	750	P2	125.0	P2	122.0	P1	125.0	Fail
						P2	134.0	P2	128.0	P1	128.0	
TS-165	01/13/94	PR	F5	NE	750	P2	127.0	P2	115.0	P1	137.0	Pass
						P2	123.0	P2	121.0	P1	139.0	
TS-166R	01/13/94	DW	F2	NE	750	P2	128.0	P2	127.0	P1	117.0	Fail
						P2	111.0	P2	126.0			
TS-167R	01/13/94	DW	F2	NE	750	P2	129.0	P2	133.0	P1	162.0	Pass
						P2	133.0	P2	134.0	P1	162.0	
TS-168	01/14/94	ET	X2	NE	525	P1	109.0			F3	157.0	Fail
						P1	96.0			F3	165.0	
TS-169R	01/14/94	ET	X2	NE	525	P1	119.0			P2	170.0	Pass
						P1	126.0			P2	177.0	
TS-170	01/14/94	PR	F5	NE	750	P2	147.0	P2	136.0	P1	171.0	Pass
						P2	128.0	P2	135.0	P1	176.0	
TS-171	01/14/94	DW	F2	NE	750	P2	150.0	P2	158.0	P1	175.0	Pass
						P2	154.0	P2	153.0	P1	172.0	
TS-172	01/15/94	DW	F2	NE	750	P2	141.0	P2	141.0	P1	172.0	Pass
						P2	140.0	P2	148.0	P1	165.0	
TS-173	01/15/94	PR	F5	NE	750	P2	140.0	P2	131.0	P1	162.0	Pass
						P2	134.0	P2	136.0	P1	162.0	
TS-174	01/15/94	ET	X2	NE	525	P1	126.0			P2	151.0	Pass
						P1	100.0			P2	160.0	
TS-175	01/17/94	SP	F5	DHM	750	P2	147.0	P2	138.0	P1	191.0	Pass
						P2	153.0	P2	152.0	P1	188.0	
TS-176	01/17/94	DW	F2	DHM	750	P2	149.0	P2	155.0	P1	180.0	Pass
						P2	157.0	P2	146.0	P1	163.0	
TS-177	01/17/94	ET	X2	DHM	515	P1	108.0			P3	167.0	Pass
						P1	113.0			P3	161.0	
TS-178	01/17/94	SP	F5	NE	750	P2	146.0	P2	128.0	P1	169.0	Pass
						P2	133.0	P2	146.0	P1	169.0	

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						FIELD TEST RESULTS (4,5)								
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						Inside Track		Outside Track		Code	Strength		Code	Strength
						Code	Strength	Code	Strength					
TS-179	01/17/94	DW	F2	NE	750	P2	140.0	P2	147.0	P1	166.0	Pass		
TS-180	01/17/94	DW	F2	NE	750	P2	142.0	P2	154.0	P1	165.0	Pass		
						P2	160.0	P2	146.0	P1	170.0			
TS-181	01/18/94	DW	F2	DHM	750	P2	148.0	P2	144.0	P1	174.0	Pass		
						P2	149.5	P2	147.3	P1	165.8			
TS-182	01/18/94	SP	F5	DHM	750	P2	147.1	P2	150.0	P1	161.2	Pass		
						P2	143.0	P2	144.5	P1	157.5			
TS-183	01/18/94	DW	F5	DHM	750	P2	138.4	P2	141.9	P1	156.7	Pass		
						P2	141.2	P2	154.7	P1	175.3			
TS-184	01/18/94	ET	X2	DHM	515	P2	132.1	P2	157.5	P1	171.9	Pass		
						P1	141.0			P3	161.2			
TS-185	01/19/94	ET	X2	DHM	515	P1	138.6			P3	160.0	Pass		
						P2	142.1			P1	162.4			
TS-186	01/20/94	DW	X11	DHM	500	P2	119.5			P1	164.1	Pass		
						P2	95.7			P6	177.9			
TS-187	01/20/94	DW	F2	NE	750	P2	177.3			P6	177.3	Pass		
						P2	135.4			P6	177.3			
TS-188	01/20/94	SP	F5	NE	750	P2	146.2	P2	139.1	P1	158.7	Pass		
						P2	141.8	P2	148.7	P1	156.1			
TS-189	01/20/94	SP	F5	DHM	750	P2	146.1	P2	137.3	P1	164.5	Pass		
						P2	147.3	P2	147.8	P1	157.2			
TS-190	01/20/94	SP	F5	DHM	750	P2	147.8	P2	147.8	P1	157.2	Pass		
						P2	135.2	P2	154.7	P1	163.7			
TS-191	01/20/94	TH	X25	DHM	475	P2	132.8	P2	143.7	P1	160.3	Pass		
						P2	132.8	P2	143.7	P1	160.3			
TS-192	01/20/94	SP	F5	DHM	750	P2	149.7	P2	131.5	P1	169.2	Pass		
						P2	146.7	P2	139.5	P1	165.0			
TS-193	01/20/94	TH	X25	DHM	475	P2	142.7			P6	160.5	Pass		
						P2	108.4			P6	161.9			
TS-194	01/20/94	DW	F2	NE	750	P2	134.2	P2	150.3	P1	166.1	Pass		
						P2	152.3	P2	150.5	P1	163.6			
TS-195	01/21/94	TH	X25	DHM	475	P2	134.4			P6	180.1	Pass		
						P2	117.7			P6	177.7			
TS-196	01/21/94	TH	X25	DHM	475	P2	165.2			P6	175.8	Pass		
						P2	137.3			P6	175.7			
TS-197	01/21/94	ET	X11	DHM	500	P2	120.2			P3	159.7	Pass		
						P6	147.2			P6	185.0			
TS-198	01/21/94	SP	F5	DHM	750	P2	142.4	P2	157.2	P1	173.6	Pass		
						P2	137.9	P2	158.6	P1	170.0			
TS-199	01/21/94	SP	F5	SAM	750	P2	163.6	P2	159.6	P1	178.1	Pass		
						P2	165.8	P2	160.7	P1	181.1			
TS-200	01/21/94	ET	X11	NE	500	P2	116.1			P1	173.7	Pass		
						P2	119.7			P1	167.0			

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						PASS or FAIL
						PEEL(7)				SHEAR		
						Inside Track		Outside Track				
						Code	Strength	Code	Strength	Code	Strength	
TS-199	01/21/94	TH	X11	DHM	500	P2	152.0			P3	164.9	Pass
						P2	159.7			P3	168.7	
TS-200	01/22/94	ET	X11	NE	500	P2	126.7			P6	170.3	Pass
						P2	119.8			P6	176.8	
TS-201	01/22/94	TH	X25	NE	475	P2	118.8			P1	152.8	Pass
						P2	121.7			P1	153.4	
TS-202	01/22/94	TH	X25	NE	475	P2	114.5			P1	143.9	Pass
						P2	113.0			P6	149.8	
TS-203	01/22/94	ET	X11	NE	475	F1	87.0					Fail
						F1	56.9					
TS-204R	01/22/94	ET	X11	NE	500	P2	128.8			P6	169.0	Pass
						P2	113.4			P6	158.8	
TS-205	01/22/94	TH	X25	DHM	475	P2	130.4			P3	160.6	Pass
						P2	123.2			P3	162.2	
TS-206	01/24/94	ET	X11	NE	515	P2	145.0			P6	177.0	Pass
						P2	144.0			P6	185.0	
TS-207	01/24/94	ET	X11	NE	515	P2	116.0			P6	189.0	Pass
						P2	120.0			P6	188.0	
TS-208	01/24/94	ET	X11	NE	515	P2	128.0			P6	189.0	Pass
						P2	132.0			P6	193.0	
TS-209	01/25/94	ET	X11	NE	515	P2	112.0			P6	187.0	Pass
						P2	115.0			P6	185.0	
TS-210	01/25/94	ET	X11	NE	515	P2	97.0			P1	186.0	Pass
						P2	103.0			P1	186.0	
TS-211	01/25/94	ET	X11	NE	515	P2	110.0			P6	179.0	Pass
						P2	120.0			P1	166.0	
TS-212	01/25/94	ET	X11	NE	515	P2	139.0			P1	183.0	Pass
						P2	136.0			P6	181.0	
TS-213	01/26/94	ET	X11	NE	515	P2	98.0			P6	188.0	Pass
						P2	113.0			P6	184.0	
TS-214	01/26/94	ET	X11	NE	515	P2	110.0			P1	200.0	Pass
						P2	115.0			P1	188.0	
TS-215	01/26/94	ET	X11	NE	515	P2	106.0			P1	185.0	Pass
						P2	109.0			P6	180.0	
TS-216	01/26/94	ET	X11	NE	515	P2	131.0			P1	177.0	Pass
						P2	123.0			P1	180.0	
TS-217	01/27/94	ET	X11	DHM	515	P2	108.0			P6	175.0	Pass
						P2	151.0			P6	176.0	
TS-218	01/27/94	ET	X11	DHM	515	P2	136.0			P1	157.0	Pass
						P2	116.0			P3	193.0	

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SAMPLE NUMBER(1)	DATE WELDED	SEAMER ID (2)	GUN NO.(6)	MONITOR (3)	TYPICAL GUN TEMP DEGREES (F)	FIELD TEST RESULTS (4,5)						PASS or FAIL
						PEEL(7)				SHEAR		
						Inside Track		Outside Track				
						Code	Strength	Code	Strength	Code	Strength	
TS-219	01/27/94	ET	X11	DHM	515	P2	166.0			P1	233.0	Pass
						P2	170.0			P3	239.0	
TS-220	01/27/94	ET	X11	DHM	515	P2	113.0			P3	194.0	Pass
						P2	170.0			P6	196.0	
TS-221	02/10/94	SH	F5	DHM	750	P2	189.0	P2	179.0	P1	221.0	Pass
						P2	181.0	P2	196.0	P1	239.0	
TS-222	02/11/94	SH	X25	DHM	540	P2	141.0			P3	191.0	Pass
						P2	168.0			P3	207.0	
TS-223	02/17/94	SH	X25	DHM	495	P2	136.0			P1	182.0	Fail
						P2	123.0					
TS-224	02/17/94	SH	X11	DHM	480	F1	70.0					Fail
						F1	114.0					
TS-225R	02/17/94	SH	X10	DHM	450	P2	146.0			P3	172.0	Pass
						P2	149.0			P3	148.0	
TS-226	02/17/94	SH	X10	DHM	450	P2	136.0			P3	192.0	Pass
						P2	136.0			P3	202.0	
TS-227	02/18/94	SH	X10	DHM	450	P2	134.0					Fail
						F1	88.0					
TS-228R	02/18/94	SH	X10	DHM	450	P2	152.0			P1	209.0	Pass
						P2	138.0			P1	211.0	
TS-229	02/18/94	SH	X10	DHM	450	P2	152.0			P3	174.0	Pass
						P2	134.0			P3	170.0	
TS-230	02/21/94	SH	X10	DHM	450	P2	151.2			P1	180.4	Pass
						P2	145.6			P1	180.0	
TS-231	02/22/94	SH	X10	DHM	450	P2	174.5			P3	183.3	Pass
						P2	153.1			P3	188.6	
TS-232	02/24/94	SH	X10	DHM	450	P2	174.5			P6	234.4	Pass
						P2	181.1			P6	227.3	

NOTES

- ====
- (1) Trial Weld Sample Numbers with an R suffix are retest samples for a previously failed test performed by the same welder on the same date. e.g. TS-162R is a retest for failed test sample TS-158 welded by X2.
 - (2) See Weld Inspection Summary for seamer identification.
 - (3) See Weld Inspection Summary for monitor identification.
 - (4) See Figures for illustrations of modes of passing or failing test codes.
 - (5) Strengths are reported in pounds per inch width.
 - (6) Gun Numbers with an X prefix are extrusion welders.
Gun Numbers with an F prefix are fusion welders.
 - (7) Passing Trial Seams without an outside track test result are for extrusion trial seams.

APPENDIX N-3

GEOMEMBRANE WELD OBSERVATION AND NON-DESTRUCTIVE
TESTING SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
 PRIMARY GEOMEMBRANE LINER WELD OBSERVATION AND NON-DESTRUCTIVE TESTING SUMMARY
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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
P-001/002	P-001	P-002	12/19/93	ET	F2	750		SM	12/20/93	DHM	
P-001/063	P-001	P-063	01/18/94	DW	F5	750		NE	01/18/94	NE	
P-001/064	P-001	P-064	01/18/94	DW	F5	750		NE	01/18/94	NE	
P-001/065	P-001	P-065	01/18/94	DW	F5	750		NE	01/18/94	NE	
P-002/003	P-002	P-003	12/19/93	ET	F2	750	DS-034	SM	12/20/93	DHM	
P-002/061	P-002	P-061	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-002/062	P-002	P-062	01/18/94	DW	F5	750		NE	01/18/94	NE	
P-003/004	P-003	P-004	12/19/93	ET	F2	750		SM	12/20/93	DHM	
P-003/061	P-003	P-061	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-003/P06A	P-003	P06A	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-004/005	P-004	P-005	12/19/93	ET	F2	750	DS-035	SM	12/20/93	DHM	
P-004/073	P-004	P-073	01/21/94	SP	F5	750		SAM	11/11/11	SAM	3
P-004/P06A	P-004	P06A	01/20/94	DW	F2	750		DHM	01/25/94	NE	
P-005/006	P-005	P-006	12/19/93	ET	F2	750		SM	12/20/93	DHM	
P-005/073	P-005	P-073	01/21/94	SP	F5	750		SAM	01/25/94	NE	
P-006/007	P-006	P-007	12/19/93	ET	F2	750		SM	12/20/93	DHM	
P-006/073	P-006	P-073	01/21/94	SP	F5	750		SAM	01/25/94	NE	
P-007/008	P-007	P-008	12/19/93	ET	F2	750	DS-036	SM	01/25/94	DHM	
P-007/008	P-007	P-008	01/20/94	DW	F2	750		DHM	01/25/94	DHM	
P-007/072	P-007	P-072	01/21/94	SP	F5	750		SAM	01/25/94	NE	
P-007/073	P-007	P-073	01/21/94	SP	F5	750		SAM	01/25/94	NE	
P-008/009	P-008	P-009	12/19/93	SH	F3	750		SM	12/20/93	DHM	
P-008/072	P-008	P-072	01/21/94	SP	F5	750	DS-056	SAM	01/24/94	NE	
P-009/010	P-009	P-010	12/19/93	ET	F2	750		SM	12/20/93	DHM	
P-009/072	P-009	P-072	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-010/011	P-010	P-011	01/20/94	DW	F2	750		DHM	01/25/94	DHM	
P-010/011	P-010	P-011	12/19/93	SH	F3	750	DS-037	SM	01/25/94	DHM	
P-010/071	P-010	P-071	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-010/072	P-010	P-072	01/21/94	SP	F5	750		SAM	11/11/11	NE	3
P-011/012	P-011	P-012	12/20/93	SH	F3	750		DHM	12/20/93	DHM	
P-011/071	P-011	P-071	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-012/013	P-012	P-013	12/22/93	ET	F2	750		NE	12/22/93	NE	
P-012/071	P-012	P-071	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-012/P08J	P-012	P08J	01/21/94	SP	F5	750		SAM	01/25/94	NE	
P-013/014	P-013	P-014	12/22/93	DW	F3	750		NE	12/22/93	NE	
P-013/023	P-013	P-023	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-013/024	P-013	P-024	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-013/071	P-013	P-071	01/21/94	SP	F5	750		SAM	01/21/94	NE	
P-014/015	P-014	P-015	12/22/93	ET	F2	750		NE	12/22/93	NE	
P-014/022	P-014	P-022	01/21/94	SP	F5	750		SAM	01/25/94	NE	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
P-014/023	P-014	P-023	01/21/94	SP	F5	750		SAM	11/11/11	NE	3
P-015/016	P-015	P-016	12/22/93	DW	F3	750		NE	12/22/93	NE	
P-015/021	P-015	P-021	01/07/94	DW	F2	750		DHM	11/11/11	NE	3
P-015/022	P-015	P-022	01/21/94	SP	F5	750		SAM	01/24/94	NE	
P-016/017	P-016	P-017	12/22/93	ET	F2	750	DS-038	NE	11/11/11	NE	
P-016/021	P-016	P-021	01/07/94	DW	F2	750		DHM	01/15/94	DHM	
P-016/P01W	P-016	P01W	12/22/93	ET	F2	750		NE	01/05/94	NE	
P-016/P01W	P-016	P01W	01/05/94	ET	X2	535		NE	01/05/94	NE	
P-017/018	P-017	P-018	12/22/93	DW	F3	750		NE	12/22/93	NE	
P-017/019	P-017	P-019	01/07/94	DW	F2	750		DHM	11/11/11	DHM	3
P-017/020	P-017	P-020	01/07/94	DW	F2	750		DHM	01/07/94	NE	
P-017/P01W	P-017	P01W	12/22/93	ET	F2	750		NE	01/05/94	NE	
P-018/019	P-018	P-019	01/07/94	DW	F2	750		DHM	01/07/94	NE	
P-018/027	P-018	P-027	01/07/94	DW	F2	750		DHM	01/07/94	DHM	
P-019/020	P-019	P-020	01/06/94	DW	F2	750		NE	01/06/94	NE	
P-019/027	P-019	P-027	01/07/94	DW	F2	750		DHM	01/07/94	DHM	
P-020/021	P-020	P-021	01/06/94	DW	F2	750		NE	01/06/94	NE	
P-020/P01W	P-020	P01W	01/07/94	DW	F2	750		DHM	11/11/11	DHM	3
P-021/022	P-021	P-022	01/06/94	DW	F2	750	DS-041	NE	01/06/94	NE	
P-022/023	P-022	P-023	01/06/94	DW	F2	750		NE	01/06/94	NE	
P-023/024	P-023	P-024	01/06/94	DW	F2	750		NE	01/06/94	NE	
P-024/025	P-024	P-025	01/06/94	DW	F2	750	DS-042	NE	01/24/94	NE	
P-024/071	P-024	P-071	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-025/026	P-025	P-026	01/06/94	DW	F2	750		NE	01/06/94	NE	
P-025/070	P-025	P-070	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-025/071	P-025	P-071	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-026/028	P-026	P-028	01/20/94	SP	F5	750		DHM	01/20/94	NE	
P-026/028	P-026	P-028	01/10/94	DW	F2	750	DS-043	NE	01/20/94	NE	
P-026/070	P-026	P-070	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-026/P05B	P-026	P05B	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-028/029	P-028	P-029	01/10/94	DW	F2	750		NE	01/20/94	NE	
P-028/066	P-028	P-066	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-028/067	P-028	P-067	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-028/P05B	P-028	P05B	01/20/94	SP	F5	750		DHM	01/26/94	NE	
P-029/030	P-029	P-030	01/10/94	DW	F2	750		NE	01/10/94	NE	
P-029/037	P-029	P-037	01/20/94	SP	F5	750		DHM	11/11/11	NE	3
P-029/038	P-029	P-038	01/20/94	SP	F5	750		DHM	01/20/94	NE	
P-029/039	P-029	P-039	01/20/94	SP	F5	750		DHM	01/20/94	NE	
P-030/031	P-030	P-031	01/10/94	DW	F2	750		NE	01/10/94	NE	
P-030/036	P-030	P-036	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-030/037	P-030	P-037	01/13/94	DW	F2	750		NE	01/13/94	DHM	

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	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
P-031/032	P-031	P-032	01/10/94	DW	F2	750		NE	01/10/94	NE	
P-031/036	P-031	P-036	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-031/P02X	P-031	P02X	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-032/033	P-032	P-033	01/13/94	DW	F2	750		NE	11/11/11	DHM	3
P-032/034	P-032	P-034	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-032/P02X	P-032	P02X	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-033/034	P-033	P-034	01/13/94	DW	F2	750		NE	01/13/94	NE	
P-033/035	P-033	P-035	01/13/94	DW	F2	750	DS-044	NE	01/13/94	NE	
P-033/P02X	P-033	P02X	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-035/036	P-035	P-036	01/13/94	PR	F5	750		NE	01/13/94	NE	
P-035/P02X	P-035	P02X	01/13/94	DW	F2	750		NE	01/13/94	DHM	
P-036/037	P-036	P-037	01/13/94	DW	F2	750		NE	01/13/94	NE	
P-037/038	P-037	P-038	01/13/94	PR	F5	750		NE	01/13/94	NE	
P-038/039	P-038	P-039	01/13/94	PR	F5	750		NE	01/14/94	NE	
P-039/040	P-039	P-040	01/13/94	PR	F5	750	DS-045	NE	01/14/94	NE	
P-039/066	P-039	P-066	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-040/041	P-040	P-041	01/13/94	PR	F5	750		NE	01/14/94	NE	
P-040/066	P-040	P-066	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-041/042	P-041	P-042	01/17/94	SP	F5	750		DHM	01/17/94	DHM	
P-041/066	P-041	P-066	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-042/043	P-042	P-043	01/17/94	DW	F2	750		DHM	01/25/94	DHM	
P-042/043	P-042	P-043	01/20/94	SP	F5	750		DHM	01/25/94	DHM	
P-042/066	P-042	P-066	01/20/94	SP	F5	750	DS-054	DHM	01/20/94	DHM	
P-043/044	P-043	P-044	01/17/94	SP	F5	750	DS-047	DHM	01/17/94	DHM	
P-043/066	P-043	P-066	01/20/94	SP	F5	750		DHM	01/20/94	NE	
P-044/045	P-044	P-045	01/17/94	SP	F5	750		DHM	01/17/94	DHM	
P-044/066	P-044	P-066	01/20/94	SP	F5	750		DHM	01/20/94	DHM	
P-045/046	P-045	P-046	01/17/94	DW	F2	750	DS-048	DHM	01/17/94	DHM	
P-045/066	P-045	P-066	01/20/94	SP	F5	750		DHM	01/20/94	DHM	
P-046/047	P-046	P-047	01/20/94	SP	F5	750		DHM	01/20/94	DHM	
P-046/047	P-046	P-047	01/17/94	DW	F2	750		DHM	01/20/94	DHM	
P-046/066	P-046	P-066	01/20/94	SP	F5	750		DHM	01/20/94	DHM	
P-047/048	P-047	P-048	01/17/94	DW	F2	750		DHM	01/17/94	DHM	
P-047/066	P-047	P-066	01/20/94	SP	F5	750		DHM	01/20/94	DHM	
P-047/068	P-047	P-068	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-047/P06B	P-047	P06B	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-048/049	P-048	P-049	01/17/94	SP	F5	750		DHM	01/17/94	DHM	
P-048/068	P-048	P-068	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-049/050	P-049	P-050	01/17/94	SP	F5	750		DHM	01/17/94	NE	
P-049/055	P-049	P-055	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-049/056	P-049	P-056	01/20/94	SP	F5	750		DHM	01/21/94	NE	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
P-050/051	P-050	P-051	01/17/94	DW	F2	750		DHM	01/17/94	NE	
P-050/054	P-050	P-054	01/17/94	DW	F2	750		DHM	11/11/11	NE	3
P-050/055	P-050	P-055	01/17/94	DW	F2	750		DHM	01/21/94	NE	
P-050/055	P-050	P-055	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-051/052	P-051	P-052	01/17/94	DW	F2	750		DHM	01/17/94	NE	
P-051/053	P-051	P-053	01/17/94	DW	F2	750		DHM	11/11/11	NE	3
P-051/054	P-051	P-054	01/17/94	DW	F2	750		DHM	01/18/94	NE	
P-052/053	P-052	P-053	01/17/94	DW	F2	750	DS-050	DHM	01/18/94	NE	
P-052/057	P-052	P-057	01/17/94	DW	F2	750		DHM	01/18/94	NE	
P-053/054	P-053	P-054	01/17/94	SP	F5	750		DHM	01/17/94	DHM	
P-053/057	P-053	P-057	01/17/94	DW	F2	750		DHM	01/18/94	NE	
P-054/055	P-054	P-055	01/17/94	SP	F5	750	DS-049	DHM	01/17/94	DHM	
P-055/056	P-055	P-056	01/17/94	DW	F2	750		DHM	01/20/94	DHM	
P-056/058	P-056	P-058	01/17/94	SP	F5	750		NE	01/20/94	NE	
P-056/058	P-056	P-058	01/20/94	DW	F2	750		NE	01/20/94	NE	
P-056/068	P-056	P-068	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-058/059	P-058	P-059	01/20/94	SP	F5	750		DHM	01/20/94	NE	
P-058/059	P-058	P-059	01/17/94	SP	F5	750		DHM	01/20/94	NE	
P-058/066	P-058	P-066	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-058/067	P-058	P-067	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-058/068	P-058	P-068	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-058/P06B	P-058	P06B	01/20/94	SP	F5	750		DHM	01/26/94	NE	
P-059/060	P-059	P-060	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-059/060	P-059	P-060	01/18/94	DW	F2	750		NE	01/21/94	NE	
P-059/067	P-059	P-067	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-059/069	P-059	P-069	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-059/074	P-059	P-074	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-059/075	P-059	P-075	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-060/061	P-060	P-061	01/18/94	SP	F5	750		NE	01/24/94	NE	
P-060/074	P-060	P-074	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-060/P04G	P-060	P04G	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-060/P06A	P-060	P06A	01/20/94	SP	F5	750	DS-055	DHM	01/21/94	NE	
P-061/062	P-061	P-062	01/18/94	SP	F5	750		NE	01/18/94	NE	
P-061/P04G	P-061	P04G	01/20/94	DW	F2	750		DHM	01/21/94	NE	
P-062/063	P-062	P-063	01/18/94	DW	F2	750		NE	01/18/94	NE	
P-063/064	P-063	P-064	01/18/94	SP	F5	750	DS-051	NE	01/18/94	NE	
P-064/065	P-064	P-065	01/18/94	DW	F2	750		NE	01/18/94	NE	
P-064/P04J	P-064	P04J	01/18/94	DW	F2	750		NE	01/18/94	NE	
P-065/P04J	P-065	P04J	01/18/94	DW	F2	750		NE	01/18/94	NE	
P-066/067	P-066	P-067	01/20/94	DW	F2	750		DHM	01/20/94	NE	
P-066/P06B	P-066	P06B	01/20/94	SP	F5	750		DHM	01/25/94	NE	

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SEAM NUMBER(1)	PANEL NUMBERS		DATE WELDED	SEAMER ID(2)	GUN NO.	TYPICAL GUN TEMP DEGREES (F)	DESTR. TEST	MONITOR (2)	NON-DESTRUCTIVE TEST		
	PANEL # 1	PANEL # 2							DATE (3)	MONITOR (2)	DEFECTS
P-067/069	P-067	P-069	01/20/94	DW	F2	750	DS-053	DHM	01/20/94	NE	
P-067/070	P-067	P-070	01/20/94	DW	F2	750		DHM	01/24/94	NE	
P-067/P05B	P-067	P05B	01/20/94	SP	F5	750		DHM	01/24/94	NE	
P-068/P06B	P-068	P06B	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-069/070	P-069	P-070	01/20/94	DW	F2	750		DHM	01/20/94	DHM	
P-069/071	P-069	P-071	01/20/94	DW	F2	750		DHM	01/25/94	NE	
P-069/072	P-069	P-072	01/20/94	DW	F2	750		DHM	01/25/94	NE	
P-069/073	P-069	P-073	01/20/94	DW	F2	750		DHM	01/25/94	NE	
P-069/075	P-069	P-075	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-070/071	P-070	P-071	01/20/94	DW	F2	750		DHM	01/20/94	NE	
P-070/P05B	P-070	P05B	01/22/94	TH	X25	475		NE	01/26/94	NE	
P-071/072	P-071	P-072	01/20/94	DW	F2	750		DHM	01/24/94	NE	
P-072/073	P-072	P-073	01/20/94	SP	F5	750		DHM	01/25/94	NE	
P-073/074	P-073	P-074	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-073/075	P-073	P-075	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-073/P06A	P-073	P06A	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-074/075	P-074	P-075	01/20/94	SP	F5	750		DHM	01/21/94	NE	
P-074/P06A	P-074	P06A	01/20/94	SP	F5	750		DHM	01/21/94	NE	
T-001/002	T-001	T-002	02/10/94	SH	F5	750	DS-060	DHM	02/10/94	DHM	
T-002/003	T-002	T-003	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-003/004	T-003	T-004	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-004/005	T-004	T-005	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-004/006	T-004	T-006	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-004/007	T-004	T-007	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-005/006	T-005	T-006	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
T-006/007	T-006	T-007	02/10/94	SH	F5	750		DHM	02/10/94	DHM	
TP-001/002	T-001	P-002	02/18/94	SH	X10	450		DHM	02/21/94	DHM	
TP-001/002	T-001	P-002	02/22/94	SH	X10	450		DHM	02/21/94	DHM	

NOTES

- (1) A seam number with a prefix of P indicates a seam between panels of the primary HDPE liner.
A seam number with a prefix of T indicates a seam between panels of the HDPE liner in the truck unloading area.
A seam number with a prefix of TP indicates a tie-in seam between truck unloading area HDPE liner panels and
and Primary HDPE liner panels.

(2) Inspector Identification:

DHM - David H. Mathis
SM - Steve Milka
SAM - Scott A. Matthees
NE - Nancy Evans

Seamer Identification:

ET - Erwin Tsosie	DW - Dwight Wilson
AB - Arnold Barker	TH - Tim Harding
SH - Steve Hewitt	RA - Raymond Ashley
GM - Grant Martin	SA - Simon Ashley
PR - Paul Rhodes	SP - Scott Prydatko

- (3) Seams with a Non-Destructive Test Date of 11/11/11 indicates that the seam was capped, so non-destructive testing of seam was not required. The cap that covered the seam was non-destructively tested.

APPENDIX N-4

DESTRUCTIVE TEST OBSERVATION SUMMARY

GOLDER CONSTRUCTION SERVICES, INC.
 PRIMARY GEOMEMBRANE LINER DESTRUCTIVE TEST OBSERVATION SUMMARY
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			DESTRUCTIVE TEST OBSERVATIONS							
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT	
			Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)	Strength (lbs/in)	Code (1)		
DS-034	12/20/93	Seam Number: P-002/003	165.0	P1	156.1	P2	145.2	P2	Pass	
		2' North of Crest of Slope	161.7	P1	150.7	P2	154.7	P2		
			163.4	P1	155.7	P2	150.8	P2		
		Seam Type: Fus (2) Repair Id: P01A	163.7	P1	156.5	P2	152.0	P2		
		Seaming Apparatus: F2 Tech: ET	159.3	P1	158.8	P2	151.1	P2		
DS-035	12/20/93	Seam Number: P-004/005	171.3	P1	158.7	P2	152.7	P2	Pass	
		43' North of Crest of Slope	163.2	P1	157.9	P2	149.9	P2		
			175.9	P1	160.1	P2	151.2	P2		
		Seam Type: Fus (2) Repair Id: P01D	167.9	P1	158.7	P2	151.8	P2		
		Seaming Apparatus: F2 Tech: ET	174.6	P1	159.5	P2	149.3	P2		
DS-036	12/20/93	Seam Number: P-007/008	173.0	P1	149.8	P2	151.8	P2	Pass	
		90' North of Crest of Slope	168.7	P1	149.6	P2	153.2	P2		
			165.9	P1	148.7	P2	153.7	P2		
		Seam Type: Fus (2) Repair Id: P01F	171.2	P1	149.5	P2	154.2	P2		
		Seaming Apparatus: F2 Tech: ET	166.6	P1	150.8	P2	151.4	P2		
DS-037	12/20/93	Seam Number: P-010/011	167.3	P1	149.0	P2	152.8	P2	Pass	
		103' North of Crest of Slope	164.6	P1	147.7	P2	152.5	P2		
			164.0	P1	147.9	P2	156.6	P2		
		Seam Type: Fus (2) Repair Id: P01G	167.7	P1	146.9	P2	154.7	P2		
		Seaming Apparatus: F3 Tech: SH	169.6	P1	149.8	P2	148.8	P2		
DS-038	12/22/93	Seam Number: P-016/017	166.7	P1	158.4	P2	104.3	F1	Fail	
		40' North of Crest of Slope	166.1	P1	156.4	P2	156.6	P2		
			166.7	P1	159.6	P2	144.4	P2		
		Seam Type: Fus (2) Repair Id: P01K	168.0	P1	158.1	F1	148.4	P2		
		Seaming Apparatus: F2 Tech: ET	170.1	P1	156.3	F1	155.2	P2		
DS-038A1	12/22/93	Seam Number: P-016/017	170.0	P1	140.3	F1	153.2	P2	Fail	
		26' North of Crest of Slope	170.0	P1	107.5	F1	158.4	P2		
			172.3	P1	128.8	F1	158.9	P2		
		Seam Type: Fus (2) Repair Id: P01Q	176.7	P1	63.9	F1	159.2	P2		
		Seaming Apparatus: F2 Tech: ET	172.4	P1	18.2	F1	155.2	P2		
DS-038A2	01/04/94	Seam Number: S-004/S10G	174.3	P1	171.0	P2	168.0	P2	Pass	
		6' North of South End of Seam	179.8	P1	162.4	P2	172.8	P2		
			177.8	P1	163.9	P2	161.9	P2		
		Seam Type: Fus (2) Repair Id: S07P	176.3	P1	167.3	P2	161.6	P2		
		Seaming Apparatus: F2 Tech: ET	178.5	P1	164.8	P2	169.7	P2		

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SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-038B1	12/22/93	Seam Number: P-016/017	166.6	P1	159.7	P2	152.1	P2	Pass
		53' North of Crest of Slope	169.1	P1	155.4	P2	157.8	P2	
			171.6	P1	150.8	P2	151.9	P2	
		Seam Type: Fus (2) Repair Id: P01R	171.8	P1	150.6	P2	156.6	P2	
		Seaming Apparatus: F2 Tech: ET	168.0	P1	148.0	P2	151.2	P2	
DS-041	01/06/94	Seam Number: P-021/022	165.6	P1	147.0	P2	145.5	P2	Pass
		11' East of Crest of Slope	165.8	P1	149.9	P2	147.3	P2	
			164.6	P1	146.9	P2	149.6	P2	
		Seam Type: Fus (2) Repair Id: P03A	159.7	P1	146.3	P2	151.1	P2	
		Seaming Apparatus: F2 Tech: DW	169.1	P1	150.3	P2	150.1	P2	
DS-042	01/07/94	Seam Number: P-024/025	168.9	P1	149.7	P2	141.1	P2	Pass
		81' East of Crest of Slope	167.6	P1	149.3	P2	143.7	P2	
			174.4	P1	151.3	P2	142.4	P2	
		Seam Type: Fus (2) Repair Id: P03B	175.2	P1	152.7	P2	141.7	P2	
		Seaming Apparatus: F2 Tech: DW	168.9	P1	152.6	P2	145.0	P2	
DS-043	01/11/94	Seam Number: P-026/028	176.7	P1	161.7	P2	145.9	P2	Pass
		2' East of Toe of Slope	172.3	P1	161.6	P2	150.2	P2	
			173.5	P1	161.8	P2	154.7	P2	
		Seam Type: Fus (2) Repair Id: P02T	172.6	P1	163.4	P2	149.6	P2	
		Seaming Apparatus: F2 Tech: DW	169.7	P1	159.0	P2	146.4	P2	
DS-044	01/13/94	Seam Number: P-033/035	158.3	P1	157.0	P2	158.3	P2	Pass
		2' South of Slope Crest	166.4	P1	157.5	P2	158.4	P2	
			171.5	P1	156.4	P2	148.9	P2	
		Seam Type: Fus (2) Repair Id: P03F	169.0	P1	152.3	P2	151.0	P2	
		Seaming Apparatus: F2 Tech: DW	165.8	P1	155.5	P2	152.7	P2	
DS-045	01/14/94	Seam Number: P-039/040	164.5	P1	144.4	P2	155.2	P2	Pass
		33' South of Crest of Slope	172.4	P1	153.5	P2	158.9	P2	
			171.1	P1	151.2	P2	153.0	P2	
		Seam Type: Fus (2) Repair Id: P03R	167.1	P1	148.4	P2	151.9	P2	
		Seaming Apparatus: F5 Tech: PR	169.0	P1	153.1	P2	152.9	P2	
DS-046	01/14/94	Seam Number: P-032/P03Q	188.6	P6	150.5	P2			Pass
		3' East of Crest of Slope	185.1	P6	136.8	P2			
			183.1	P3	141.9	P2			
		Seam Type: Ext (2) Repair Id: P03S	175.0	P6	134.0	P2			
		Seaming Apparatus: X2 Tech: ET	180.0	P6	134.6	P2			

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SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT	
			Strength	Code	Strength	Code	Strength	Code		
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)		
DS-047	01/17/94	Seam Number: P-043/044	174.8	P1	147.4	P2	147.1	P2	Pass	
		60' South of Crest of Slope	172.2	P1	152.5	P2	152.6	P2		
			171.1	P1	156.3	P2	148.7	P2		
		Seam Type: Fus (2) Repair Id: P03T	171.7	P1	154.4	P2	149.2	P2		
		Seaming Apparatus: F2 Tech: DW	174.5	P1	154.8	P2	149.3	P2		
DS-048	01/17/94	Seam Number: P-045/046	175.3	P1	147.4	P2	143.8	P2	Pass	
		85' South of Crest of Slope	171.7	P1	148.4	P2	147.7	P2		
			171.3	P1	151.5	P2	149.2	P2		
		Seam Type: Fus (2) Repair Id: P03U	171.9	P1	143.1	P2	150.5	P2		
		Seaming Apparatus: F5 Tech: SP	171.2	P1	142.5	P2	148.0	P2		
DS-049	01/18/94	Seam Number: P-054/055	173.5	P1	151.4	P2	156.4	P2	Pass	
		14' West of Crest of Slope	171.2	P1	155.2	P2	156.4	P2		
			172.8	P1	152.9	P2	157.2	P2		
		Seam Type: Fus (2) Repair Id: P03W	173.9	P1	156.2	P2	155.9	P2		
		Seaming Apparatus: F5 Tech: SP	172.9	P1	159.1	P2	159.7	P2		
DS-050	01/18/94	Seam Number: P-052/053	190.5	P1	163.4	P2	166.7	P2	Pass	
		14' South of North End of Seam	185.5	P1	165.7	P2	170.4	P2		
			186.9	P1	164.5	P2	164.2	P2		
		Seam Type: Fus (2) Repair Id: P04B	186.2	P1	165.8	P2	162.6	P2		
		Seaming Apparatus: F2 Tech: DW	187.4	P1	162.5	P2	165.8	P2		
DS-051	01/18/94	Seam Number: P-063/064	176.9	P1	161.6	P2	154.0	P2	Pass	
		3' East of Crest of Slope	176.2	P1	157.7	P2	152.4	P2		
			174.3	P1	154.3	P2	156.0	P2		
		Seam Type: Fus (2) Repair Id: P04L	175.3	P1	165.7	P2	158.5	P2		
		Seaming Apparatus: F5 Tech: SP	174.8	P1	157.6	P2	160.5	P2		
DS-052	01/19/94	Seam Number: P-050/P04S	178.3	P6	111.3	F1			Fail	
		West Side of Patch P04S	174.5	P6	133.1	P1				
			182.4	P6	108.1	F1				
		Seam Type: Ext (2) Repair Id: P04W	180.7	P6	145.9	P1				
		Seaming Apparatus: X2 Tech: ET	188.2	P6	145.9	P1				
DS-052A1	01/19/94	Seam Number: P-055/P04S	170.2	P6	139.6	P2			Pass	
		East Side of Patch P04S	177.7	P6	141.8	P2				
			180.8	P6	163.4	P2				
		Seam Type: Ext (2) Repair Id: P04X	179.3	P6	146.4	P2				
		Seaming Apparatus: X2 Tech: ET	182.6	P6	143.8	P2				

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-052B1	01/19/94	Seam Number: P-045/P03U	168.8	P6	135.4	P2			Pass
		West Side of Patch P03U	170.6	P1	140.3	P2			
			174.4	P6	135.9	P2			
		Seam Type: Ext (2) Repair Id: P05A	173.1	P6	118.7	P2			
		Seaming Apparatus: X2 Tech: ET	170.5	P1	127.0	P2			
DS-053	01/21/94	Seam Number: P-067/D69	177.6	P1	159.5	P2	161.6	P2	Pass
		56' East of West End of Seam	174.9	P1	161.7	P2	159.4	P2	
			173.9	P1	155.7	P2	154.6	P2	
		Seam Type: Fus (2) Repair Id: P05F	172.6	P1	161.1	P2	155.7	P2	
		Seaming Apparatus: F2 Tech: DW	170.6	P1	159.7	P2	157.9	P2	
DS-054	01/25/94	Seam Number: P-043/D66	173.3	P1	159.4	P2	164.4	P2	Pass
		3' West of East End of Seam	177.6	P1	153.3	P2	155.3	P2	
			179.7	P1	156.0	P2	160.6	P2	
		Seam Type: Fus (2) Repair Id: P10U	182.3	P1	157.7	P2	157.4	P2	
		Seaming Apparatus: F5 Tech: SP	183.2	P1	159.0	P2	159.2	P2	
DS-055	01/22/94	Seam Number: P-060/P06A	179.9	P1	145.6	P2	151.8	P2	Pass
		7' East of West End of Seam	176.0	P1	147.1	P2	165.4	P2	
			180.8	P1	144.8	P2	160.9	P2	
		Seam Type: Fus (2) Repair Id: P06W	182.2	P1	145.0	P2	158.0	P2	
		Seaming Apparatus: F5 Tech: SP	177.7	P1	147.5	P2	167.4	P2	
DS-056	01/24/94	Seam Number: P-008/072	178.8	P1	155.0	P2	171.9	P2	Pass
		3' East of West End of Seam	173.6	P1	153.4	P2	168.6	P2	
			174.5	P1	151.5	P2	168.1	P2	
		Seam Type: Fus (2) Repair Id: P08R	174.9	P1	154.1	P2	163.8	P2	
		Seaming Apparatus: F5 Tech: SP	170.7	P1	152.1	P2	162.6	P2	
DS-057	01/25/94	Seam Number: P-066/P05L	174.4	P6	136.4	P2			Pass
		South Side of Patch P05L	174.6	P6	136.6	P2			
			175.0	P6	159.6	P2			
		Seam Type: Ext (2) Repair Id: P10S	172.7	P6	119.9	P2			
		Seaming Apparatus: X25 Tech: TH	170.8	P6	128.1	P2			
DS-058	01/25/94	Seam Number: P-070/071/05T	176.7	P6	131.3	P2			Pass
		Intersection of P-070/071/P05T	178.2	P6	147.8	P2			
			179.0	P6	128.0	P2			
		Seam Type: Ext (2) Repair Id: P10R	178.5	P6	152.4	P2			
		Seaming Apparatus: X11 Tech: ET	176.6	P6	135.3	P2			

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			DESTRUCTIVE TEST OBSERVATIONS						
SAMPLE NUMBER	DATE OF TEST	DESTRUCTIVE SAMPLE INFORMATION	SHEAR		INSIDE TRACK PEEL		OUTSIDE TRACK PEEL		TEST RESULT
			Strength	Code	Strength	Code	Strength	Code	
			(lbs/in)	(1)	(lbs/in)	(1)	(lbs/in)	(1)	
DS-059	01/26/94	Seam Number: P-007/P08B	197.3	P6	122.9	P2			Pass
		South Side of Patch P08B	196.8	P6	131.8	P2			
			193.5	P6	150.9	P2			
		Seam Type: Ext (2) Repair Id: P12E	196.2	P6	147.9	P2			
		Seaming Apparatus: X11 Tech: ET	195.9	P6	149.9	P2			
DS-060	02/10/94	Seam Number: T-004/005	201.8	P1	191.6	P2	188.5	P2	Pass
		30' North of south end of seam	203.6	P1	190.6	P2	189.4	P2	
			206.4	P1	189.2	P2	190.4	P2	
		Seam Type: Fus (2) Repair Id: T01A	203.5	P1	190.3	P2	189.8	P2	
		Seaming Apparatus: F5 Tech: SH	207.8	P1	188.7	P2	191.1	P2	
JS-061	02/11/94	Seam Number: T-005/T01A	210.0	P1	161.8	F1			Fail
		East Side of Patch T01A	209.6	P1	93.9	F1			
			213.9	P6	50.4	F1			
		Seam Type: Ext (2) Repair Id: T01D	217.4	P6	53.9	F1			
		Seaming Apparatus: X25 Tech: SH	213.1	P6	70.5	F1			
DS-061A1	02/22/94	Seam Number:							Pass(5)
		Seam Type: Ext (2) Repair Id:							
DS-061B1	02/22/94	Seaming Apparatus: X25 Tech: SH							Pass(5)
		Seam Number:							
DS-062	02/22/93	Seam Number: TP-001/002	218.8	P6	163.1	P2			Pass
		8' East of West End of Seam	218.0	P6	165.8	P2			
			216.3	P6	156.6	P2			
		Seam Type: Ext (2) Repair Id: T01J	213.6	P6	177.1	P2			
		Seaming Apparatus: X10 Tech: SH	216.1	P6	154.6	P2			

NOTES

- 1) See Figures for illustration of mode of failure codes.
- 2) Fus - Fusion Seam
Ext - Extrusion Seam
- 3) All deficient repairs welded by extrusion welder X25 in the truck unloading area were capped. Destructive test DS-061 was performed on a repair welded by X25, and DS-061 failed. Because all welding completed by X25 in the truck unloading area was capped, "dummy" destructive test numbers DS-061A1 and DS-061B1 were designated to indicate that all deficient welding performed by X25 was capped, and DS-061 was bracketed by the capping.

APPENDIX N-5
GEOMEMBRANE REPAIR SUMMARY

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P01A	12/19/93	P-002/003	2' North of Crest of Slope	12/20/93	12/20/93	2 X 5	DHM
P01B	12/19/93	P-003/004	40' North of Crest of Slope	12/20/93	12/20/93	2 X 4	NE
P01C	12/19/93	P-003/004	South End of Seam to 7' North of Crest of Slope	12/20/93	12/20/93	3 X 22	NE
P01D	12/19/93	P-004/005	43' North of Crest of Slope	12/20/93	12/20/93	2 X 5	NE
P01E	12/19/93	P-005/006	South End of Seam to Anchor Trench Crest	12/20/93	01/04/94	2 X 12	NE
P01F	12/19/93	P-007/008	90' North of Crest of Slope	12/20/93	12/20/93	2 X 5	NE
P01G	12/19/93	P-010/011	103' North of Crest of Slope	12/20/93	12/20/93	2 X 5	DHM
P01H	12/20/93	P-007/008	63' North of Crest of Slope	12/20/93	12/20/93	2 X 3	DHM
P01J	12/20/93	P-005/006	Crest of Anchor Trench	12/20/93	01/04/94	1 X 1	NE
P01K	12/22/93	P-016/017	40' North of Crest of Slope (Capped by P01W)	12/22/93	11/11/11	2 X 5	NE
P01L	12/22/93	P-018	11' South of Crest of Slope	12/22/93	01/07/94	5 X 24	NE
P01M	12/22/93	P-017/018	11' South of Crest of Slope to Crest of Slope	12/22/93	01/05/94	2 X 14	NE
P01N	01/07/93	P-018/019	At Intersection with P-027	01/07/94	01/12/94	2 X 2	NE
P01P	12/22/93	P-016/017	Crest of Slope (Capped by P01W)	11/11/11	11/11/11		NE
P01Q	12/22/93	P-016/017	26' North of Crest of Slope (Capped by P01W)	11/11/11	11/11/11		NE
P01R	12/22/93	P-016/017	53' North of Crest of Slope (Capped by P01W)	11/11/11	11/11/11		NE
P01S	12/22/93	P-016/017	13' North of Crest of Slope (Capped by P01W)	11/11/11	11/11/11		NE
P01T	12/22/93	P-016/017	16' South of Crest of Slope (Capped by P01W)	11/11/11	11/11/11		NE
P01U	12/22/93	P-017/018	2' North of Crest of Slope	12/22/93	01/05/94	1 X 1	NE
P01W	12/22/93	P-016/017	South End of Seam to North End of Seam	01/05/94	01/05/94	3 X 83	NE
P01X	12/22/93	P-016/P01W	40' North of Crest of Slope	01/05/94	01/05/94	2 X 8	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P02A	12/22/93	P-016/P01W	5' South of Crest of Slope	01/05/94	01/05/94	1 x 1	NE
P02C	01/04/94	P-009/010	9' South of Crest of Slope	01/04/94	01/04/94	2 x 4	NE
P02D	01/04/94	P-008/009	16' South of Crest of Slope	01/04/94	01/04/94	2 x 5	NE
P02E	01/05/94	P-008	2' North of Toe of Slope, 6' West of P-007/008	01/05/94	01/11/94	1 x 1	NE
P02F	01/05/94	P-008	3' North of Toe of Slope, 11' West of P-007/008	01/05/94	01/11/94	1 x 2	NE
P02G	01/05/94	P-007/008	10' South of North End of Seam	01/22/94	01/25/94	2 x 8	NE
P02H	01/05/94	P-010/011	15' South of North End of Seam	01/25/94	01/26/94	2 x 2	NE
P02J	01/05/94	P-017/P01W	15' South of Crest of Slope	01/05/94	01/05/94	2 x 4	NE
P02K	01/05/94	P-016/P01W	P01X to North End of Seam	01/05/94	01/05/94	21	NE
P02L	01/05/94	P-019/027	14' West of Crest of Slope	01/07/94	01/12/94	2 x 8	NE
P02M	01/07/94	P-018/027	11' South of Crest of Slope	01/11/94	01/12/94	3 x 8	DHM
P02N	01/07/93	P-018/P01M	South End of Seam	01/07/94	01/12/94	2 x 2	NE
P02P	01/07/93	P-018/019	At Intersection with P-020/017	01/11/94	01/12/94	3 x 8	DHM
P02Q	01/07/93	P-016/021	At Intersection with P-017/020/P01W	01/11/94	01/12/94	2 x 7	DHM
P02R	01/07/93	P-016/021	At Intersection with P-015 (Same patch as P08Q)	01/22/94	01/25/94	2 x 6	SAM
P02S	01/10/94	P-026/028	8' West of Crest of Slope	01/11/94	01/12/94	2 x 12	NE
P02T	01/10/94	P-026/028	2' East of Toe of Slope	01/20/94	01/21/94	2 x 10	SAM
P02U	01/10/94	P-028/029	8' East of Toe of Slope	01/20/94	01/21/94	3 x 3	NE
P02W	01/10/94	P-031/032	5' West of Crest of Slope	01/11/94	01/12/94	2 x 2	DHM
P02X	01/13/94	P-035	7' West of P-032/033/035 to P-031/035/036	01/13/94	01/13/94	2 x 24	DHM
P03A	01/06/94	P-021/022	11' East of Crest of Slope	01/11/94	01/12/94	3 x 5	DHM
P03B	01/06/94	P-024/025	81' East of Crest of Slope	01/11/94	01/12/94	3 x 5	DHM

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P03C	01/06/94	P-024/025	4' East of Toe of Slope	01/22/94	01/24/94	2 x 3	NE
P03D	01/06/94	P-022/023	13' West of Crest of Slope	01/17/94	01/17/94	2 x 4	DHM
P03E	01/13/94	P-033/035	14' North of Crest of Slope	01/26/94	01/26/94	2 x 3	NE
P03F	01/13/94	P-033/035	2' South of Crest of Slope	01/15/94	01/20/94	2 x 5	NE
P03G	01/13/94	P-031/032	At Intersection With P02X	01/14/94	01/15/94	1 x 2	NE
P03H	01/13/94	P-031/036	At Intersection With P-035/P02X	01/14/94	01/15/94	4 x 6	NE
P03J	01/13/94	P-033/035	South End of Seam	01/14/94	01/14/94	1 x 1	NE
P03K	01/13/94	P-032/033	East End of Seam	01/14/94	01/15/94	4 x 5	NE
P03L	01/13/94	P02X	3' East of P03G	01/14/94	01/15/94	2 x 3	NE
P03M	01/13/94	P-031/036	19' East of West End of Seam	01/14/94	01/15/94	1 x 1	NE
P03N	01/13/94	P-030/031	At Intersection With P-036	01/14/94	01/15/94	1 x 2	NE
P03P	01/13/94	P-036/037	At Intersection With P-030	01/15/94	01/20/94	2 x 3	NE
P03Q	01/13/94	P-032/033	Entire Seam	01/14/94	01/15/94	2 x 5	NE
P03R	01/13/94	P-039/040	33' South of Crest of Slope	01/15/94	01/20/94	2 x 5	NE
P03S	01/14/94	P-032/P03Q	3' East of Crest of Slope	01/14/94	01/15/94	2 x 5	NE
P03T	01/17/94	P-043/044	60' South of Crest of Slope	01/17/94	01/17/94	2 x 5	DHM
P03U	01/17/94	P-045/046	85' South of Crest of Slope (Capped by P05A)	01/17/94	01/17/94	2 x 5	DHM
P03W	01/17/94	P-054/055	14' West of Crest of Slope	01/18/94	01/20/94	3 x 5	NE
P03X	01/17/94	P-052/053	At Intersection With P-057	01/18/94	01/20/94	2 x 2	NE
P04A	01/17/94	P-052/053	At Intersection With P-054	01/18/94	01/20/94	3 x 5	NE
P04B	01/17/94	P-052/053	14' South of North End of Seam	01/18/94	01/20/94	2 x 6	NE
P04C	01/18/94	P-050/055	8' North of South End of Seam	01/21/94	01/24/94	3 x 3	NE

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PD4D	01/18/94	P-056/058	5' East of Toe of Slope	01/20/94	01/24/94	2 x 4	SAM
PD4E	01/18/94	P-058/059	13' East of Toe of Slope	01/21/94	01/26/94	2 x 2	NE
PD4F	01/18/94	P-059/060	9' East of Toe of Slope	01/21/94	01/24/94	4 x 4	NE
PD4G	01/18/94	P-060/061	17' East to 8' West of Toe of Slope	01/20/94	01/24/94	2 x 24	DHM
PD4H	01/18/94	P-062/063	6' East of Crest of Slope	01/19/94	01/20/94	2 x 2	NE
PD4J	01/18/94	P-064/065	East End of P-065	01/18/94	01/18/94	5 x 7	DHM
PD4K	01/18/94	P-064/065	East End of Seam	01/19/94	01/20/94	2 x 6	NE
PD4L	01/18/94	P-063/064	3' East of Crest of Slope	01/19/94	01/20/94	3 x 5	NE
PD4M	01/18/94	P-001/065	9' South of Crest of Slope	01/19/94	01/20/94	3 x 6	NE
PD4N	01/18/94	P-001/065	At Intersection With P-064	01/19/94	01/20/94	3 x 5	NE
PD4P	01/18/94	P-001/064	At Intersection With P-063	01/19/94	01/20/94	2 x 3	NE
PD4Q	01/18/94	P-001/063	At Intersection With P-002/062	01/19/94	01/20/94	3 x 3	NE
PD4R	01/18/94	P-002/062	At Intersection With P-061	01/21/94	01/26/94	4 x 5	NE
PD4S	01/18/94	P-050/055	At Intersection With P-051 (Capped by PD4W,X)	01/18/94	11/11/11	2 x 7	NE
PD4T	01/18/94	P-055/056	10' East of Crest of Slope	01/18/94	01/20/94	2 x 2	NE
PD4U	01/18/94	P-063	2' North of P-063/064, Crest of Slope	01/19/94	01/20/94	1	NE
PD4W	01/19/94	P-050/PD4S	West Side of Patch PD4S (Same Patch as PD4X)	01/19/94	01/20/94	6 x 10	NE
PD4X	01/19/94	P-055/PD4S	East Side of Patch PD4S, (Same Patch as PD4W)	01/19/94	01/20/94	6 x 10	NE
P05A	01/19/94	P-045/P03U	West Side of Patch (Caps P03U)	01/20/94	01/26/94	5 x 7	DHM
P05B	01/20/94	P-067	West End of Panel	01/22/94	01/26/94	4 x 13	NE
P05C	01/20/94	P-046/047	5' North of Toe of Slope	01/20/94	01/26/94	2 x 2	DHM
P05D	01/20/94	P-042/043	4' North of Toe of Slope (Covered by P12A)	01/22/94	01/26/94	2 x 2	NE

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P05E	01/20/94	P-067/069	At Intersection With P-070	01/22/94	01/26/94	2 x 2	NE
P05F	01/20/94	P-067/069	56' East of West End of Seam	01/21/94	01/26/94	2 x 4	NE
P05G	01/20/94	P-046/047	At Intersection With P-066	01/20/94	01/25/94	2 x 2	DHM
P05H	01/20/94	P-045/046	At Intersection With P-066	01/20/94	01/25/94	2 x 2	DHM
P05J	01/20/94	P-044/045	At Intersection With P-066	01/20/94	01/25/94	2 x 2	DHM
P05K	01/20/94	P-043/044	At Intersection With P-066	01/20/94	01/25/94	2 x 2	DHM
P05L	01/20/94	P-042/066	5' West of East End of Seam	01/22/94	01/25/94	3 x 7	NE
P05M	01/20/94	P-041/042	At Intersection With P-066	01/22/94	01/25/94	2 x 2	NE
P05N	01/20/94	P-040/041	At Intersection With P-066	01/22/94	01/25/94	2 x 2	NE
P05P	01/20/94	P-039/040	East End of Seam to P10G	01/22/94	01/25/94	5 x 6	NE
P05Q	01/20/94	P-028/029	At Intersection With P-066	01/22/94	01/25/94	3 x 5	NE
P05R	01/20/94	P-037/038	At Intersection With P-029	01/20/94	01/21/94	2 x 2	NE
P05S	01/20/94	P-071/072	At Intersection With P-069	01/22/94	01/25/94	1 x 1	NE
P05T	01/20/94	P-069/070	At Intersection With P-071 (Capped by P10R)	01/22/94	11/11/11	2 x 3	NE
P05U	01/20/94	P-029/030	At Intersection With P-037	01/20/94	01/21/94	1 x 1	SAM
P05W	01/20/94	P-047/066	At Intersection With P06B	01/20/94	01/24/94	3 x 3	NE
P06A	01/20/94	P-003	North End of Panels P-003 and P-004	01/20/94	01/21/94	4 x 30	SAM
P06B	01/20/94	P-068	West End of Panel	01/26/94	01/26/94	5 x 16	NE
P06C	01/20/94	P-026/028	14' West of East End of Seam	01/20/94	01/21/94	2 x 2	DHM
P06D	01/20/94	P-072/073	At Intersection With P-069	01/22/94	01/24/94	2 x 2	NE
P06E	01/20/94	P-047/048	At Intersection With P-068	01/21/94	01/24/94	2 x 2	NE
P06F	01/20/94	P-048/049	At Intersection With P-068	01/21/94	01/24/94	3 x 5	NE

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P06G	01/20/94	P-055/056	At Intersection With P-049	01/21/94	01/24/94	3 x 3	NE
P06H	01/20/94	P-056/058	At Intersection With P-068	01/21/94	01/24/94	3 x 6	NE
P06J	01/20/94	P-058/068	At Intersection With P06B	01/21/94	01/24/94	2 x 2	NE
P06K	01/20/94	P-058/066	At Intersection With P06B	01/21/94	01/24/94	2 x 2	NE
P06L	01/20/94	P-066/067	At Intersection With P-058	01/21/94	01/24/94	2 x 2	NE
P06M	01/20/94	P-058/059	At Intersection With P-067	01/21/94	01/24/94	2 x 2	NE
P06N	01/20/94	P-067/069	At Intersection With P-059	01/21/94	01/24/94	2 x 2	NE
P06P	01/20/94	P-059/075	At Intersection With P-069	01/22/94	01/24/94	3 x 6	NE
P06Q	01/20/94	P-073/075	At Intersection With P-069 (Same patch as P07U)	01/22/94	01/24/94	3 x 6	NE
P06R	01/20/94	P-073/074	At Intersection With P-075	01/21/94	01/24/94	3 x 3	NE
P06S	01/20/94	P-059/074	At Intersection With P-075	01/21/94	01/21/94	3 x 4	NE
P06T	01/20/94	P-059/060	At Intersection With P-074	01/21/94	01/24/94	3 x 4	NE
P06U	01/20/94	P-047/068	At Intersection With P-068	01/21/94	01/24/94	2 x 2	NE
P06W	01/20/94	P-060/P06A	7' East of West End of Seam	01/21/94	01/24/94	3 x 5	NE
P06X	01/20/94	P-073/074	At Intersection With P06A	01/21/94	01/24/94	2 x 2	NE
P07A	01/20/94	P-066/067	At Intersection With P028	01/22/94	01/25/94	2 x 2	NE
P07B	01/20/94	P-028/067	At Intersection With P05B	01/22/94	01/26/94	2 x 2	NE
P07C	01/20/94	P-067/070	At Intersection With P05B	01/22/94	01/25/94	3 x 3	NE
P07D	01/20/94	P-026/070	At Intersection With P05B	01/22/94	01/25/94	2 x 2	NE
P07E	01/20/94	P-025/026	At Intersection With P-070	01/22/94	01/25/94	2 x 2	NE
P07F	01/20/94	P-070/071	At Intersection With P-025	01/22/94	01/25/94	2 x 2	NE
P07G	01/20/94	P-024/025	At Intersection With P-071	01/22/94	01/25/94	2 x 2	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P07H	01/21/94	P-012	5' East of P-012/013, 5' South of P-012/071	01/21/94	01/25/94	2 x 4	NE
P07J	01/21/94	P-060/074	At Intersection With P06A	01/21/94	01/24/94	2 x 2	NE
P07K	01/21/94	P-003/004	At Intersection With P06A	01/21/94	01/24/94	2 x 2	NE
P07L	01/21/94	P-002/003	At Intersection With P-061	01/21/94	01/24/94	2 x 2	NE
P07M	01/21/94	P-060/061	At Intersection With P-003/P06A/P04G	01/21/94	01/24/94	3 x 6	NE
P07N	01/21/94	P-074	4' North of P-074/P06A, 5' West of P-060/074	01/21/94	01/24/94	2 x 2	NE
P07P	01/21/94	P-004/005	At Intersection With P-073/P06A	01/21/94	01/24/94	2 x 5	NE
P07Q	01/21/94	P-005/006	At Intersection With P-073, NEOS to 10' South	01/22/94	01/24/94	3 x 12	NE
P07R	01/21/94	P-049/050	At Intersection With P-055	01/21/94	01/24/94	3 x 3	NE
P07S	01/22/94	P-026/028	At Intersection With P05B	01/22/94	01/25/94	4 x 4	NE
P07T	01/22/94	P-010/071	At Intersection With P-072	01/22/94	01/25/94	2 x 4	NE
P07U	01/22/94	P-069/075	At Intersection With P-073 (Same patch as P06Q)	01/22/94	01/24/94	3 x 6	NE
P07W	01/24/94	P-007/008	2' West of P-007/008/072	01/25/94	01/26/94	2 x 3	NE
P07X	01/24/94	P-010/071	3' West of P-010/071/072	01/24/94	01/25/94	2 x 2	NE
P08A	01/21/94	P-006/007	At Intersection With P-073	01/25/94	01/26/94	2 x 3	NE
P08B	01/21/94	P-072/073	At Intersection With P-007	01/25/94	01/26/94	4 x 4	NE
P08C	01/21/94	P-007/008	At Intersection With P-072	01/22/94	01/26/94	2 x 2	NE
P08D	01/21/94	P-008/009	At Intersection With P-072	01/22/94	01/25/94	1 x 2	NE
P08E	01/21/94	P-009/010	NEOS to 13' South of North End of Seam	01/22/94	01/25/94	3 x 13	NE
P08F	01/21/94	P-010/011	At Intersection With P-071	01/22/94	01/25/94	1 x 1	NE
P08G	01/21/94	P-011/012	At Intersection With P-071	01/22/94	01/25/94	3 x 4	NE
P08H	01/21/94	P-012	2' South of P-012/071, 8' West of P-011/012	01/22/94	01/25/94	2 x 2	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P08J	01/21/94	P-012	2' E of P-012/013, N End of Panel to 40' South	01/21/94	01/25/94	4 x 40	SAM
P08K	01/21/94	P-013/071	At Intersection With P-024	01/22/94	01/25/94	3 x 3	NE
P08L	01/21/94	P-023/024	At Intersection With P-013	01/22/94	01/25/94	2 x 2	NE
P08M	01/21/94	P-013/014	North End of Seam to 12' S of North End of Seam	01/21/94	01/25/94	2 x 12	NE
P08N	01/21/94	P-014/022	At Intersection With P-023	01/22/94	01/25/94	4 x 4	NE
P08P	01/21/94	P-014/015	At Intersection With P-022	01/22/94	01/25/94	3 x 3	NE
P08Q	01/21/94	P-021/022	At Intersection With P-015 (Same Patch as P02R)	01/22/94	01/25/94	2 x 6	NE
P08R	01/21/94	P-008/072	3' East of West End of Seam	01/24/94	01/25/94	3 x 6	NE
P08S	01/24/94	P-071/072	2' South of P-069/071/072	01/24/94	01/25/94	2 x 2	NE
P08T	01/24/94	P-009/072	3' East of P-009/010/072	01/24/94	01/25/94	2 x 2	NE
P08U	01/24/94	P-010/071	2' East of P-010/011/071	01/24/94	01/25/94	2 x 2	NE
P08W	01/24/94	P-071/072	2' North of P-010/071/072	01/24/94	01/25/94	2 x 2	NE
P08X	01/24/94	P-011/071	2' West of P-010/011/071	01/24/94	01/25/94	2 x 2	NE
P09A	01/24/94	P-011/071	3' East of P-011/012/071	01/24/94	01/25/94	2 x 2	NE
P09B	01/24/94	P-012/071	2' West of P-011/012/071	01/24/94	01/25/94	2 x 2	NE
P09C	01/24/94	P-012/071	1' East of P-012/071/P08J	01/24/94	01/25/94	2 x 2	NE
P09D	01/24/94	P-009/072	3' West of P-008/009/072	01/24/94	01/25/94	1 x 1	NE
P09E	01/24/94	P-013/024	2' South of P-013/024/071	01/24/94	01/25/94	2 x 2	NE
P09F	01/24/94	P-013/024	2' North of P-013/023/024	01/24/94	01/25/94	2 x 2	NE
P09G	01/24/94	P-013/023	3' North of P-013/014/023	01/24/94	01/25/94	2 x 2	NE
P09H	01/24/94	P-013/023	2' South of P-013/023/024	01/24/94	01/25/94	1 x 1	NE
P09J	01/24/94	P-015/022	2' East of P-015/021/022	01/24/94	01/25/94	2 x 2	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P09K	01/24/94	P-015/022	3' West of P-014/015/022	01/24/94	01/25/94	2 x 2	NE
P09L	01/24/94	P-024/071	2' North of P-013/024/071	01/24/94	01/25/94	2 x 2	NE
P09M	01/24/94	P-025/071	2' North of P-024/025/071	01/24/94	01/25/94	2 x 2	NE
P09N	01/24/94	P-024/071	2' South of P-024/025/071	01/24/94	01/25/94	2 x 2	NE
P09P	01/24/94	P-024/025	2' West of P-024/025/071	01/24/94	01/25/94	2 x 2	NE
P09Q	01/24/94	P-025/070	2' North of P-025/070/071	01/24/94	01/25/94	2 x 2	NE
P09R	01/24/94	P-025/071	2' South of P-025/070/071	01/24/94	01/25/94	2 x 2	NE
P09S	01/24/94	P-025/070	2' South of P-025/026/070	01/24/94	01/25/94	1 x 1	NE
P09T	01/24/94	P-024/025	2' East of P03C	01/24/94	01/25/94	2 x 2	NE
P09U	01/24/94	P-026/070	2' North of P-025/026/070	01/24/94	01/25/94	1 x 1	NE
P09W	01/24/94	P-026/070	2' South of P-026/070/P05B	01/24/94	01/25/94	2 x 2	NE
P09X	01/24/94	P-026/P05B	2' North of P-026/070/P05B	01/24/94	01/25/94	2 x 2	SAM
P10A	01/24/94	P-026/P05B	2' South of P-026/028/P05B	01/24/94	01/25/94	2 x 2	SAM
P10B	01/24/94	P-067/P05B	3' South of P-028/067/P05B	01/24/94	01/25/94	2 x 2	SAM
P10C	01/24/94	P-028/067	3' North of P-028/067/P05B	01/24/94	01/25/94	2 x 2	SAM
P10D	01/24/94	P-028/067	2' South of P-028/066/067	01/24/94	01/25/94	2 x 2	SAM
P10E	01/24/94	P-028/066	2' South of P-028/029/066	01/25/94	01/25/94	2 x 2	NE
P10F	01/24/94	P-039/066	2' North of P-029/039/066	01/25/94	01/25/94	2 x 2	NE
P10G	01/24/94	P-039/066	7' North of P-029/039/066	01/25/94	01/25/94	2 x 2	NE
P10H	01/24/94	P-040/066	2' East of P-039/040/066	01/25/94	01/25/94	2 x 2	NE
P10J	01/24/94	P-040/066	2' West of P-040/041/066	01/25/94	01/25/94	2 x 2	NE
P10K	01/24/94	P-041/066	3' East of P-040/041/066	01/25/94	01/25/94	2 x 2	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P10L	01/24/94	P-041/066	3' West of P-041/042/066	01/25/94	01/25/94	2 x 2	NE
P10M	01/24/94	P-067/070	3' East of P-067/070/P05B	01/24/94	01/25/94	2 x 2	SAM
P10N	01/24/94	P-067/P05B	4' North of P-067/070/P05B	01/24/94	01/25/94	2 x 2	SAM
P10P	01/24/94	P-067/070	3' West of P-067/069/070	01/25/94	01/26/94	2 x 2	NE
P10Q	01/24/94	P-014/023	WEOS to EEOS	01/24/94	01/25/94	3 x 16	NE
P10R	01/24/94	P-70/71/5T	Int. of P-070/071/P05T (Covers P05T)	01/25/94	01/25/94	4 x 6	NE
P10S	01/24/94	P-066/P05L	South side of P05L	01/25/94	01/25/94	2 x 4	NE
P10T	01/24/94	P-028/066	2' North of P-028/066/067	01/25/94	01/25/94	2 x 2	NE
P10U	01/25/94	P-043/066	3' West of East End of Seam	01/25/94	01/25/94	3 x 5	NE
P10V	01/25/94	P-005/073	2' East of West End of Seam	01/25/94	01/26/94	1 x 1	NE
P10X	01/25/94	P-005/073	2' West of East End of Seam	01/25/94	01/26/94	1 x 1	NE
P11A	01/25/94	P-006/073	2' West of East End of Seam	01/25/94	01/26/94	1 x 1	NE
P11B	01/25/94	P-007/072	2' East of West End of Seam	01/25/94	01/26/94	2 x 2	NE
P11C	01/25/94	P-069/073	2' West of East End of Seam	01/25/94	01/26/94	2 x 2	NE
P11D	01/25/94	P-069/075	3' North of South End of Seam	01/25/94	01/26/94	1 x 1	NE
P11E	01/25/94	P-069/075	3' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11F	01/25/94	P-059/075	2' East of West End of Seam	01/25/94	01/26/94	1 x 1	NE
P11G	01/25/94	P-059/069	3' North of South End of Seam	01/26/94	01/26/94	1 x 1	NE
P11H	01/25/94	P-059/069	2' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11J	01/25/94	P-072/073	2' South of North End of Seam	01/25/94	01/26/94	1 x 2	NE
P11K	01/25/94	P-069/073	2' East of West End of Seam	01/25/94	01/26/94	1 x 1	NE
P11L	01/25/94	P-010/011	2' South of North End of Seam	01/25/94	01/25/94	3 x 3	NE

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
P11M	01/25/94	P-059/067	2' North of South End of Seam	01/26/94	01/26/94	1 x 1	NE
P11N	01/25/94	P-059/067	2' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11P	01/25/94	P-058/067	2' North of South End of Seam	01/26/94	01/26/94	1 x 1	NE
P11Q	01/25/94	P-058/067	2' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11R	01/25/94	P-058/066	2' North of South End of Seam	01/26/94	01/26/94	1 x 1	NE
P11S	01/25/94	P-058/066	2' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11T	01/25/94	P-066/P06B	2' North of South End of Seam	01/26/94	01/26/94	1 x 2	NE
P11U	01/25/94	P-066/P06B	2' South of North End of Seam	01/26/94	01/26/94	1 x 1	NE
P11W	01/25/94	P-059/075	2' West of East End of Seam	01/25/94	01/26/94	1 x 1	NE
P12A	01/25/94	P-042/043	3' North of Toe of Slope (Caps P05D)	01/26/94	01/26/94	4 x 4	NE
P12B	01/25/94	P-042/043	3' North of South End of Seam	01/26/94	01/26/94	1 x 2	NE
P12C	01/25/94	P-069/072	2' East of West End of Seam	01/25/94	01/26/94	1 x 2	NE
P12D	01/25/94	P-069/072	2' West of East End of Seam	01/25/94	01/26/94	1 x 1	NE
P12E	01/26/94	P-007/P08B	South Side of Patch P08B	01/26/94	01/26/94	3 x 6	NE
P12F	01/27/94	P-059	9' South of P-058/059, 6' West of E End of Panel	01/27/94	01/28/94	5 x 8	DHM
T001D	02/20/94	T-005/T01A	East Side of Patch	02/11/94	02/11/94	2 x 5	DHM
T01A	02/20/94	T-004/005	30' North of South End of Seam (Capped by T01G)	02/11/94	02/11/94	2 x 6	DHM
T01B	02/20/94	T-005/006	At Intersection With T-004 (Capped by T01F)	02/11/94	02/11/94	2 x 4	DHM
T01C	02/20/94	T-006/007	At Intersection With T-004 (Capped by T01E)	02/11/94	02/11/94	3 x 4	DHM
T01D	02/10/94	T-005/T01A	East Side of Patch T01A	02/11/94	02/11/94	3 x 4	DHM
T01E	02/10/94	T-006/007	At Intersection With T-004 (Caps T01C)	02/17/94	02/17/94	4 x 5	DHM
T01F	02/10/94	T-005/006	At Intersection With T-004 (Caps T01B)	02/18/94	02/18/94	3 x 5	DHM

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REPAIR NUMBER (1)	DATE LOCATED	SEAM or PANEL	APPROXIMATE REPAIR LOCATION	DATE REPAIRED (2)	DATE TESTED (2)	SIZE (ft) (3)	REPAIR MONITOR (4)
T01G	02/10/94	T-004/005	At Intersection With T-004 (Caps T01A)	02/18/94	02/18/94	3 x 7	DHM
T01H	02/21/94	TP-001/002	At Intersection With P-001/002	02/21/94	02/21/94	4 x 34	DHM
T01J	02/22/94	T-001/T01K	8' West of East End of Seam	02/22/94	02/22/94	2 x 5	DHM
T01K	02/22/94	TP-001/002	West End of Seam to 24' South	02/22/94	02/22/94	2 x 24	DHM

NOTES:

- (1) A repair number beginning with the letter "P" indicates a repair on the Primary HDPE liner.
 A repair number beginning with the letter "T" indicates a repair on the HDPE liner in the truck unloading area.
- (2) A repair date and/or test date of 11/11/11 indicates a repair which was capped.
- (3) A repair with no size indicates a repair which was capped.
 A repair with only one size dimension indicates a grind and weld repair.
- (4) See Weld Observation Summary for monitor identification.

APPENDIX O
TOP COURSE MOISTURE-DENSITY TESTS

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF TOP COURSE MOISTURE-DENSITY TESTS
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TOP COURSE

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TEST NUMBER (1,2)	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES				PASS or FAIL	NOTES
		NORTH COORDINATE	WEST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
TC-006	03/02/94	43991.5	78607.9	1	134.2	4.2	132.9	5.2	95.1		Pass	N/A
TC-007	03/02/94	43986.2	78683.2	1	134.0	4.5	133.5	4.9	95.5		Pass	N/A
TC-008	03/02/94	43986.1	78861.4	1	134.3	4.2	133.6	4.7	95.6		Pass	N/A
TC-009	03/02/94	44182.9	78282.6	1	137.7	3.3	136.7	4.0	97.8		Pass	N/A
TC-010	03/02/94	44357.9	78312.3	1	135.4	2.8	133.7	4.1	95.6		Pass	N/A
TC-011	03/02/94	44389.6	78424.7	1	135.3	3.4	133.5	4.8	95.5		Pass	N/A
TC-012	03/02/94	44388.5	78572.8	1	134.5	3.4	133.7	4.0	95.6		Pass	N/A
TC-013	03/02/94	44379.8	78732.3	1	134.9	3.3	133.7	4.2	95.6		Pass	N/A
TC-014	03/02/94	44376.5	78846.5	1	135.7	4.2	135.9	4.0	97.2		Pass	N/A
TC-015	03/02/94	44171.7	78867.5	1	135.7	4.2	135.9	4.0	97.2		Pass	N/A
TC-016	03/07/94	43950.5	78249.5	1	135.3	6.8	144.5	N/A	103.4		Pass	N/A
TC-017	03/07/94	43944.2	78358.9	1	133.2	6.1	141.4	N/A	101.1		Pass	N/A
TC-018	03/07/94	43948.0	78175.7	1	137.2	7.2	147.1	N/A	105.2		Pass	N/A
TC-019	03/11/94	44050.9	78400.5	1	134.9	5.3	133.1	6.7	95.2		Pass	N/A
TC-020	03/11/94	43983.1	78356.2	1	135.8	4.9	133.6	6.1	95.6		Pass	N/A
TC-021	03/11/94	44057.5	78295.1	1	134.8	7.4	135.1	7.2	96.6		Pass	N/A
TC-022	03/23/94	44111.6	78598.1	1	135.7	3.0	133.1	5.0	95.2		Pass	N/A
TC-023	03/23/94	44083.5	78529.0	1	135.8	4.3	133.5	6.1	95.5		Pass	N/A
TC-024	03/23/94	44083.7	78500.3	1	137.8	4.6	135.9	6.0	97.2		Pass	N/A

NOTES

- (1) Test numbers TC-001 through TC-005 were assigned to laboratory tested samples of top course material.
(2) See General Fill test no. GF-055RB for the rubber balloon test performed on 03/02/94.
See General Fill test no. GF-056RB for the rubber balloon test performed on 03/07/94.
See General Fill test no. GF-057RB for the rubber balloon test performed on 03/11/94.
See General Fill test no. GF-058RB for the rubber balloon test performed on 03/23/94.

APPENDIX P
ASPHALT PAVEMENT

APPENDIX P-1

LABORATORY TESTS AND FIELD DENSITY TESTS

**INTERMOUNTAIN
MATERIALS
TESTING**

• Materials Testing • Construction Inspection • Project Consultation •

BOISE AREA 7445 Lemhi St. • Boise, ID 83709 (208) 376-8203 • FAX (208) 376-8201
TRI-CITIES AREA 927 Columbia Drive SE, Ste. A • Richland, WA 99352 (208) 753-0857 • FAX (208) 710-1091
POCATELLO AREA 4460 Kings Way, #3 • Chubbuck, ID 83202 (208) 237-3400 • FAX (208) 237-3449

REPORT DATE: 5/5/94

SHEET 1

MAY 11 1994

SAMPLE NO. 942922.

PROJECT: RMW Landfill

Golder Associates

REPORT TO: Golder Associates
 4104 148th Avenue NE
 Redmond, Wa. 98052
 Attn: Cliff Knitter

Invoice No.: 2-940322
 File No.: 93-167

Material Source: Acme Materials & Construction
 Date sampled: 3/16/94
 Sampled by: Wiley Yeakey (IMT)
 Date received: 3/16/94

TEST RESULTS

Material Description: Asphaltic Concrete
 Location Sampled: Acme Plant

Sieve Analysis

Standards: ASTM C136 & C117

Sieve Size	Percent Passing	WSDOT Spec's Sec. 9-03.8 (6) Class B
3/4".....	100	100
1/2".....	98	90-100
3/8".....	88	75-90
1/4".....	66	55-75
No. 4.....	56	
No. 10.....	34	30-42
No. 20.....	24	
No. 40.....	17	11-24
No. 80.....	8	
No. 200.....	4.2	3-7

Extraction Test

Standards: ASTM D2172

Pct Asphalt, Mix = 5.0

Marshall Specific Gravity

Specific Gravity 2.31
 Unit Weight, pcf 144.2

Reviewed by:

Lew A. Beck

• Materials Testing • Construction Inspection • Project Consultation •

BOISE AREA 7446 Lemhi St. • Boise, ID 83709 (208) 376-8203 • FAX (208) 376-8201	TRI-CITIES AREA 927 Columbia Drive SE, Ste. A • Richland, WA 99352 (509) 735-8467 • FAX (509) 735-1391	POCATELLO AREA 4460 Kings Way, #3 • Chubbuck, ID 83202 (208) 237-3400 • FAX (208) 237-3449
---	--	--

REPORT TO: Golder Associates DATE: 3/16/94
 4104 148th Ave, NE FILE NUMBER: 93-167
 Redmond, Wa. 98052 SHEET: 1 of 1
 ATTN: Cliff Knitter INVOICE: 2-940322

PROJECT: RMW Landfill, Richland, Wa.

SAMPLE IDENTIFICATION

Summarized below are the results of Asphaltic Concrete density tests performed on the above referenced project at the location shown below. Unless otherwise note, our personnel utilized the nuclear densometer method of testing in accordance with ASTM D2922.

The project specifications require a minimum in-place density of 93 percent of the Marshall density as determined by ASTM D1559.

The test results are as follows:

TEST RESULTS

Test Date	Lab No.	Wet Density pcf	Marshall Density pcf	Percent of Marshall Obtained
<u>1st Lift</u>				
3-16-94	942900	145.0	144.2	100+
Location: 30' East & 40' South of Northwest corner				
3-16-94	942901	148.5	144.2	100+
Location: 40' South & 50' West of Northeast corner				
3-16-94	942902	146.5	144.2	100+
Location: 10' West of East side, centerline of road				
3-16-94	943903	145.5	144.2	100+
Location: 75' North & 80' East of Southwest corner				
<u>Top Lift</u>				
3-16-94	943904	142.5	144.2	98.6
Location: 20' East & 75' North of Southwest corner				
3-16-94	943905	145.3	144.2	100+
Location: 30' East & 30' south of Northwest corner				
3-16-94	943906	146.0	144.2	100+
Location: 30' South & 40' West of Northeast corner				
3-16-94	943907	143.6	144.2	99.0
Location: 70' North & 50' West of Southwest corner				

Reviewed by

Lew A. Beck

INTERMOUNTAIN MATERIALS TESTING

• Materials Testing • Construction Inspection • Project Consultation •

BOISE AREA 7448 Lemhi St. • Boise, ID 83709 (208) 378-8203 • FAX (208) 378-8201
TRI-CITIES AREA 927 Columbia Drive SE, Ste. A • Richland, WA 99352 (509) 735-8467 • FAX (509) 735-1391
POCATELLO AREA 4460 Kings Way, #3 • Chubbuck, ID 83201 (208) 237-3400 • FAX (208) 237-3449

REPORT DATE: 5/12/94

SHEET 1

SAMPLE NO. 945327

PROJECT: RMW Landfill

REPORT TO: Golder Associates
 4104 148th Avenue, NE
 Redmond, Wa. 98052
 Attn: Cliff Knitter

Invoice No.: 2-940435
 File No.: 93-167

Material Source: Acme Materials & Construction
 Date sampled: 5/5/94
 Sampled by: Wiley Yeakey (TMT)
 Date received: 5/5/94

TEST RESULTS

Material Description: Asphaltic Concrete
 Location Sampled: From truck @ asphalt plant

Sieve Analysis

Standards: ASTM C136 7 C117

Sieve Size	Percent Passing	WSDOT Spec's Sec. 9-03.8 (6) Class B
3/4".....	100	100
1/2".....	98	90-100
3/8".....	88	75-90
1/4".....	69	55-75
No. 4.....	58	
No. 10.....	37	30-42
No. 20.....	25	
No. 40.....	18	11-24
No. 80.....	8	
No. 200.....	4.2	3-7

Extraction Test

Standards: ASTM D2172

Pct Asphalt, Mix = 5.5

Marshall Specific Gravity

Specific Gravity 2.34
 Unit Weight, pcf 146.0

Reviewed by: _____

INTERMOUNTAIN MATERIALS TESTING

• Materials Testing • Construction Inspection • Project Consultation •

BOISE AREA
7448 Lemhi St. • Boise, ID 83709
(208) 378-8203 • FAX (208) 378-8201

TRI-CITIES AREA
927 Columbia Drive SE, Ste. A • Richland, WA 99352
(509) 735-8467 • FAX (509) 735-1391

POCATELLO AREA
4460 Kings Way, #3 • Chubbuck, ID 83201
(208) 237-3400 • FAX (208) 237-3449

REPORT DATE: 5/12/94

SHEET 1

SAMPLE NO. 945327

PROJECT: RMW Landfill

REPORT TO: Golder Associates
4104 148th Avenue, NE
Redmond, Wa. 98052
Attn: Cliff Knitter

Invoice No.: 2-940435
File No.: 93-167

Material Source: Acme Materials & Construction
Date sampled: 5/5/94
Sampled by: Wiley Yeakey (TMT)
Date received: 5/5/94

TEST RESULTS

Material Description: Asphaltic Concrete
Location Sampled: From truck @ asphalt plant

Sieve Analysis

Standards: ASTM C136 7 C117

Sieve Size	Percent Passing	WSDOT Spec's Sec. 9-03.8 (6) Class B
3/4".....	100	100
1/2".....	98	90-100
3/8".....	88	75-90
1/4".....	69	55-75
No. 4.....	58	
No. 10.....	37	30-42
No. 20.....	25	
No. 40.....	18	11-24
No. 80.....	8	
No. 200.....	4.2	3-7

Extraction Test

Standards: ASTM D2172

Pct Asphalt, Mix = 5.5

Marshall Specific Gravity

Specific Gravity 2.34
Unit Weight, pcf 146.0

Reviewed by: _____

**SUMMARY OF ASPHALT DENSITY TESTS
PERFORMED ON MAY 5, 1994**

Project W-025

GCS Project No. 933-1354

TEST NO.	LOCATION	WET DENSITY lb/cf	MAXIMUM DENSITY lb/cf	PERCENT COMPACTION (%)	SPECIFIED MINIMUM COMPACTION (%)
A-1	5' E of W edge of asphalt 47' S of N edge of asphalt	146.	145.9	100.3	93.0
A-2	4' E of W edge of asphalt 70' S of N edge of asphalt	138.	145.9	94.7	93.0
A-3	55' N of S edge of asphalt 45' E of W edge of asphalt	139.	145.9	95.3	93.0
A-4	50' N of S edge of asphalt 20' E of W edge of asphalt	138.	145.9	94.7	93.0

FIELD MONITORING REPORT

PROJECT NUMBER: 933-1354 PAGE 1 OF 2
 OWNER: DOE PROJECT TITLE: DOE/INDO COE/WA
 LOCATION: Hanford Reservation CONTRACTOR: Del Mar

DATE 5-5-94 S M T W T F S

THE FOLLOWING WAS NOTED:

On site at 8:30 am. Met with Kaiser, Peyton Rackley and Anne personnel. Pavina activity was agreed upon after talking with GCS' Scott Matthews by phone.

Anne prepared the asphalt surface by ^{measuring} ~~the~~ ^{the} loose dirt & rocks off the area of the already placed asphalt. A tacking compound was then applied to the old asphalt by brooms and a sprayer. Asphalt was placed on the tacking compound and spread with regard to water flow directions. A small vibratory roller was used for compaction purposes. The roller made approximately 5 passes over the fresh asphalt. Periodic density tests were conducted during this operation to see if the required density (93%) had been achieved. The western most edge was not rolled as much as the rest due to breakage of the edge. Eric Erpenbeck would like to see topsoil or some kind of fill material placed at this edge to protect it from breakage. On the edge of northern most edge of previously placed asphalt a curb was molded. This curb extend approximately 100' (E to W) and 1 1/2' wide and 4" high. A hand spreader was used to manipulate the asphalt while a flat type hand compactor was used for compaction. No density tests were conducted on the curb due to the shape. See diagram on next page.

After Anne completed compacting asphalt, a water drainage test was run. Drainage of the water went to the ramp within the cell as intended. Those attending; Eric Erpenbeck - Westinghouse Hanford Company, Peyton Rackley - Kaiser Inc., Hanford and Jerry Hershey - Dept. of Ecology were all satisfied with the job. Coating still needs to be applied to surface.

SUBMITTED BY GCS

Cont.

MONITOR

NANCY EVANS

GOLDER CONSTRUCTION SERVICES, INC.

FIELD MONITORING REPORT

PROJECT NUMBER: 933-1354 PAGE 2 OF 2
 OWNER: DOE PROJECT TITLE: DOE/NDO COA/WA
 LOCATION: Hanford Reservation CONTRACTOR: Del Hur

DATE 5-5-94 S M T W T F S

THE FOLLOWING WAS NOTED:

Nuclear gauge was recalibrated after failing standard count.

Numerous density tests were conducted during operation, but only four final density tests were recorded.

All tests were $\geq 93\%$ compaction of Marshall 145.9.

Checked the insulation on the tank. Everything looked correct except for 1 check valve did not have insulation covering it. Eric was also slightly concern about insulation residue on edge of slider on water meter. Eric wants the flow meter problem resolved. He also wants to know why there is increasing amounts of water in secondary liner. Most likely heening squeezed from admix. He will monitor the depth.

SUBMITTED BY GCS

[Signature]
MONITOR

GCS FORM: FM

NE 1002

GOLDER CONSTRUCTION SERVICES, INC.

TROXLER MODEL 3440, SERIAL NO.: 14375 SHEET NO. 1 of 2

STANDARD COUNT: DENSITY 3232 0.3%P MOISTURE 698 1.1%P

WEATHER: Sunny 75°

REQUIRED COMPACTION (%): 93%

FIELD ENGINEER: NE

TEST NUMBER	A-1	A-2	average	NS	NS	NS	average
GENERAL TEST LOCATION	5'E of edge 47.5' of N edge	4'E of W edge 70' S of N edge					
I.D. NUMBER							
NORTH COORD.	NS	EW	ave	EW	NS	NS	
EAST COORD.							
ELEVATION							
BEARING (TO TEST)							
DISTANCE							
MODE & DEPTH							
WET DENSITY (PCF)	141.6	141.7	152.8	149.1	146.3	138.2	140.7
DRY DENSITY (PCF)	97.1	97.1	104.7	102.2	100.3	94.7	96.4
% MOISTURE	4.4	3.6	3.5	3.8	3.5	3.5	3.5
% COMPACTION	97.1	97.1	104.7	102.2	100.3	94.7	96.4
OPTIMUM MOISTURE (%)							
MAX. DENSITY (PCF)	145.9						
POCKET PEN. (TSF)							

Figure
NUCLEAR FIELD DENSITY/MOISTURE TEST DATA

Project: DOE/NDO CNA/NIA
 Project No.: 933-1354 3.0 Date: 5-5-74 Tested By: 712 Approved By: 8400
 Golden Associates
 8731167/34831

933-1354

TROXLER MODEL 3440, SERIAL NO.: 14375
 STANDARD COUNT: DENSITY 3232 MOISTURE 0.3%P
 WEATHER: Sunny 75°
 REQUIRED COMPACTION (%): 93%
 FIELD ENGINEER: NE

SHEET NO. 2 of 2

TEST NUMBER	A-3	A-4
GENERAL TEST LOCATION	55' N of 5' edge 45' E of W edge	50' N of 5' edge 20' E of W edge
I.D. NUMBER		
NORTH COORD.	NS	NS
EAST COORD.	EW	EW
ELEVATION		
BEARING (TO TEST)		
DISTANCE		
MODE & DEPTH		
WET DENSITY (PCF)	138.0	137.8
DRY DENSITY (PCF)	140.9	140.7
% MOISTURE	4.1	4.3
% COMPACTION	94.6	94.4
OPTIMUM MOISTURE (%)	94.1	93.0
MAX. DENSITY (PCF)	145.9	146.4
POCKET PEN. (TSF)		

Figure

NUCLEAR FIELD DENSITY/MOISTURE TEST DATA

Project DOE/NDO COA/WA
 Project No. 933-1354-220 Date 5-5-77 Tested By 212 Approved By Adams
 © Golder Associates

4731167/2-1631

APPENDIX P-2

DESIGN ENGINEER'S MEMO REGARDING TOLERANCES

MEMORANDUM

TO: Scott Matthees, GCS Redmond

April 17, 1994

FR: Frank Shuri, GCS Redmond *FS*

RE: PROJECT W-025 LANDFILL, TRUCK UNLOADING AREA PAVEMENT ELEVATION,
Job No. 933-1360

As we discussed at the project site on April 14, 1994, the surface of the asphalt pavement in the truck unloading area is generally high. The difference between the actual and specified elevations exceeds the allowable tolerance of 0.5 inches in many cases. This is not a problem in itself, because if the base course was at the correct elevation, as indicated by the contractor's survey, the thickness of the asphalt is greater than required.

The problem occurs where the elevation of the asphalt surface would cause water to drain to areas other than the landfill. This could potentially allow contaminated material to enter the environment. Reviewing the as-built data, uncontrolled drainage could occur on the northeast and west sides of the truck unloading area. Acceptable remedies include raising the elevation of the asphalt, installing a continuous curb, or other methods that might be proposed by the contractor. Any remedy must ensure that all water falling on the truck unloading area drains into the landfill.

APPENDIX Q
CONCRETE

September 2, 1993

Certificate of Conformance
MB-VR Standard
Master Builders Air-Entraining Admixture for Concrete

Lot#: 207708V3

TO WHOM IT MAY CONCERN:

I, Brian E. Caine, Manager, Chemistry Laboratory for Master Builders, Inc., Cleveland, Ohio, certify:

That MB-VR Standard (Master Builders Neutralized Vinsol Resin Solution) is an aqueous solution of Vinsol resin that has been neutralized with sodium hydroxide, the ratio of sodium hydroxide to Vinsol resin is one part to six parts, with a nominal 13 percent by weight residue when dried at 105°C; and

That no calcium chloride or chloride based ingredient is used in the manufacture of MB-VR Standard; and

That MB-VR Standard, based on the chlorides originating from all the ingredients used in its manufacture, contributes less than 0.000068 percent (0.68 ppm) chloride ions by weight of the cement when used at the rate of one (1) fluid ounce per 100 pounds of cement; and

That MB-VR Standard meets the requirements of ASTM C 260-86 and Corps of Engineers' CRD-C 13-86, the Standard Specifications for Air-Entraining Admixtures for Concrete, and AASHTO M154-87I, the Interim Specification for Air-Entraining Admixtures for Concrete.

Brian E. Caine
Manager, Chemistry Laboratory
Admixture Research & Development

National Ready Mixed Concrete Association

Certificate of Conformance for Concrete Production Facilities

THIS IS TO CERTIFY THAT

Plant No. 2, Richland, Washington
Acme Materials and Construction

has been inspected by the undersigned registered professional engineer for conformance with requirements of the "Check List for Ready Mixed Concrete Production Facilities." As of the inspection date, the facilities met requirements for production by,

Truck Mixing with Automatic Batching

and Recording of Cement, Aggregate, and Water

Carl A. Ward

(signature of P.E.)

November 24, 1992

(inspection date)

December 5, 1994

(certificate expiration date)

This company will maintain these facilities in compliance with the Check List requirements and will correct promptly any deficiencies which develop.

[Signature] *Operations Dept.*

(signature and title of company's principal executive)

NOTICE: The Check List indicates only that plant facilities are satisfactory for the production of concrete when properly operated. Conformance of the concrete itself with specification requirements must be verified by usual inspection methods in accordance with sales agreements.

© 1965, 1992

NATIONAL READY MIXED CONCRETE ASSOCIATION
900 Spring Street • Silver Spring, Maryland
Printed in U.S.A.

INTERMOUNTAIN MATERIALS TESTING, INC.

7446 Lemhi St., Boise, Idaho 83709
1718 West A St., Pasco, Washington 99801

fax: (208) 376-8201 tel: (208) 376-8203
fax: (509) 547-1225 tel: (509) 547-1121

Materials Testing

Construction Inspection
CONCRETE CYLINDER TEST REPORT

Project Consultation

Report to: Golder Construction Services
4104 148th Avenue N.E.
Redmond, Wa. 98052
Attn: Cliff Knitter

Report No...
Date.....10/26/93
File No.....93-167
Invoice No..7930979

Project: RHU Land Disposal Facility
Contractor: Delhur Industries
Structure: Slab
Location: Leachate Tank Pad

Golder Associates

MATERIALS AND MIX DATA

Reported by Acme Materials & Const
Mix No.6441
Sacks/CY....5
Cement.....Ashgrove I&II
Admixtures..AEA

Conc Supplier..... Acme Materials & Cons
Method of Mixing.... Central
Agg Source..... Acme Pit
Water Source..... well

Specifications

Slump, in... 4
Air Cont, %

Required strength, psi

7 day....
28 day.... 3000

FIELD TEST DATA

Slump, in... 4 (ASTM C-143)
Air Cont, % 4.5 (ASTM C-231)
Unit Wt, pcf NA (ASTM C-138)
Conc Temp, °F 60 (ASTM C-1064)
Air Temp, °F 41

Truck No.5116
Ticket No.309189
Time Batched.....2:15 PM
No. CY represented...6.0
Water added, gal.....0

Concrete Sampled (ASTM C-172),
tested, & Cylinders Cast (ASTM C-31)
Date Cast.. 10/27/93
Time .. 4:50 PM
By .. Dustin Beck (IMT)

Cylinder Curing (ASTM C-31)
Field Cure, days.....1
Temp Range, °F.....
Lab cure from:
Date Received.....10/28/93

LABORATORY TEST DATA (ASTM C-39)

Sample No...

Cylinder ID	Cylinder Diam (inches)	X-Sec Area (sq in)	Total Load (lbs)	Fracture Type	Date Tested	Age Tested (days)	Comp Str (psi)
93792-1		0.00			H	0	0
93792-2	6.01	28.37	65000	cone	11/3/93	7	2290
93792-3	6.01	28.37	112500	cone	11/24/93	28	3970
93792-4	6.01	28.37	112000	cone	11/24/93	28	3950

cc: Acme Materials & Const.

Reviewed by:

INTERMOUNTAIN MATERIALS TESTING, INC.

7446 Lemhi St., Boise, Idaho 83709
1718 West A St., Pasco, Washington 99301

fax: (208) 376-8201 tel: (208) 376-8203
fax: (509) 547-1225 tel: (509) 547-1121

Materials Testing

CONCRETE CYLINDER TEST REPORT

Project Consultation

Report to: Golder Construction Services
4104 148th Avenue N.E.
Redmond, Wa. 98052
Attn: Cliff Knitter

Report No...
Date.....10/26/93
File No.....93-167
Invoice No..1930979

Project: RHU Land Disposal Facility
Contractor: Delhur Industries
Structure: Walls
Location: Leachate Tank Pit Walls

Golder Associates

MATERIALS AND MIX DATA

Reported by Acme Materials & Const
Mix No.6441
Sacks/CY....5
Cement.....Ashgrove I&II
Admixtures..AEA

Conc Supplier..... Acme Materials & Cons
Method of Mixing.... Central
Agg Source..... Acme Pit
Water Source..... well

Specifications
Slump, in... 4
Air Cont, %

Required strength, psi
7 day....
28 day.... 3000

FIELD TEST DATA

Slump, in... 3.75 (ASTM C-143)
Air Cont, % 4.7 (ASTM C-231)
Unit Wt, pcf NA (ASTM C-138)
Conc Temp, °F 66 (ASTM C-1064)
Air Temp, °F 61

Truck No.171
Ticket No.309339
Time Batched.....12:18 PM
No. CY represented...8.0
Water added, gal.....2*

Concrete Sampled (ASTM C-172),
tested, & Cylinders Cast (ASTM C-31)
Date Cast.. 10/29/93
Time .. 2:05 PM
By .. Dustin Beck (IMT)

Cylinder Curing (ASTM C-31)
Field Cure, days.....1
@ Temp Range, °F.....
Lab cure from:
Date Received.....10/30/93

LABORATORY TEST DATA (ASTM C-39)

Sample No...

Cylinder ID	Cylinder Diam (inches)	X-Sec Area (sq in)	Total Load (lbs)	Fracture Type	Date Tested	Age Tested (days)	Comp Str (psi)
93793-1		0.00			H	0	0
93793-2	6.01	28.37	89500	cone	11/5/93	7	3150
93793-3	6.01	28.37	144000	cone	11/29/93	31	5080
93793-4	6.01	28.37	145500	cone	11/29/93	31	5130

*Water was added after test was taken

cc: Acme Materials & Const.

Reviewed by:

INTERMOUNTAIN MATERIALS TESTING, INC.

7446 Lemhi St., Boise, Idaho 83708
1718 West A St., Pasco, Washington 99801

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fax: (509) 547-1225 tel: (509) 547-1121

Materials Testing

Construction Inspection
CONCRETE CYLINDER TEST REPORT

Project Consultation

Report to: Golder Construction Services
4104 148th Avenue N.E.
Redmond, Wa. 98052
Attn: Cliff Knitter

Report No...
Date.....12/1/93
File No.....93-167
Invoice No..T931098

Project: RMU Land Disposal Facility
Contractor: Delhur Industries
Structure: Stairs & Floor Slab
Location: Tank pad stairs & control bldg. slab

MATERIALS AND MIX DATA

Golder Associates

Reported by Acme Materials & Const
Mix No.6452
Sacks/CY.....5.5
Cement.....Ashgrove I&II
Admixtures..AEA

Conc Supplier..... Acme Materials & Const
Method of Mixing.... Central
Agg Source..... Acme Pit
Water Source..... well

Specifications
Slump, in...
Air Cont, %

Required strength, psi
7 day....
28 day.... 4000

FIELD TEST DATA

Slump, in... 4.5 (ASTM C-143)
Air Cont, % 7.0 (ASTM C-231)
Unit Wt, pcf NA (ASTM C-138)
Conc Temp, °F 61 (ASTM C-1064)
Air Temp, °F 46

Truck No.198
Ticket No.310808
Time Batched.....11:23 AM
No. CY represented...5.0
Water added, gal.....3

Concrete Sampled (ASTM C-172),
tested, & Cylinders Cast (ASTM C-31)
Date Cast.. 12/1/93
Time .. 12:55 PM
By .. Dustin Beck (IMT)

Cylinder Curing (ASTM C-31)
Field Cure, days.....1
Q Temp Range, °F.....60-80
Lab cure from:
Date Received.....12/2/93

LABORATORY TEST DATA (ASTM C-39)

Sample No...

Cylinder ID	Cylinder Diam (inches)	X-Sec Area (sq in)	Total Load (lbs)	Fracture Type	Date Tested	Age Tested (days)	Comp Str (psi)
93892-1	6.01	28.37	113500	cone	12/8/93	7	4000
93892-2	6.01	28.37	118500	cone	12/8/93	7	4180
93892-3	6.01	28.37	171500	cone	12/29/93	28	6050
93892-4	6.01	28.37	173000	cone	12/29/93	28	6100

cc: Acme Materials & Construction

Reviewed by:

INTERMOUNTAIN MATERIALS TESTING, INC.

7446 Lemhi St., Boise, Idaho 83709
1718 West A St., Pasco, Washington 99301

fax: (208) 376-8201 tel: (208) 376-8203
fax: (509) 547-1225 tel: (509) 547-1121

Materials Testing

Construction Inspection
CONCRETE CYLINDER TEST REPORT

Project Consultation

Report to: Golder Associates, Inc.
4104 148th Avenue N.E.
Redmond, Wa. 98052
Attn: Cliff Knitter

Report No...
Date.....2/10/94
File No.....93-167
Invoice No..2-940126

Project: RMU Land Disposal Facility Golder Associates
Contractor: Delhur Industries
Structure: Slab & Curb
Location: NR

MATERIALS AND MIX DATA

Reported by Acme Materials & Const
Mix No.6441
Sacks/CY....5.5
Cement.....Ashgrove I&II
Admixtures..AEA

Conc Supplier..... Acme Materials & Const
Method of Mixing.... Central
Agg Source..... Acme Pit
Water Source..... well

Specifications
Slump, in...
Air Cont, %

Required strength, psi
7 day....
28 day.... 3000

FIELD TEST DATA

Slump, in... 2.75 (ASTM C-143)
Air Cont, % 4.3 (ASTM C-231)
Unit Wt, pcf NA (ASTM C-138)
Conc Temp, °F 60 (ASTM C-1064)
Air Temp, °F 44

Truck No.5116
Ticket No.323791
Time Batched.....9:24 AM
No. CY represented...5.5
Water added, gal.....4

Concrete Sampled (ASTM C-172),
tested, & Cylinders Cast (ASTM C-31)
Date Cast.. 2/10/94
Time .. 11:15 AM
By .. Dustin Beck (IMT)

Cylinder Curing (ASTM C-31)
Field Cure, days.....1
Temp Range, °F.....60-80
Lab cure from:
Date Received.....2/11/94

LABORATORY TEST DATA (ASTM C-39)

Sample No...

Cylinder ID	Cylinder Dia (inches)	X-Sec Area (sq in)	Total Load (lbs)	Fracture Type	Date Tested	Age Tested (days)	Comp Str (psi)
94081-1	6.01	28.37	89000	cone	2/17/94	7	3140
94081-2	6.01	28.37	113500	cone	2/24/94	14	4000
94081-3	6.01	28.37	137000	cone	3/10/94	28	4830
94081-4	6.01	28.37	139000	cone	3/10/94	28	4900

cc: Acme Materials & Construction

Reviewed by:

INTERMOUNTAIN MATERIALS TESTING, INC.

7446 Lemhi St., Boise, Idaho 83709
1718 West A St., Pasco, Washington 99301

fax: (208) 376-8201 tel: (208) 376-8203
fax: (509) 547-1225 tel: (509) 547-1121

Materials Testing

CONCRETE Construction Inspection Report

Project Consultation

Report to: Golder Associates, Inc.
4104 148th Avenue N.E.
Redmond, Wa. 98052
Attn: Cliff Knitter

Report No...
Date.....2/14/94
File No.....93-167
Invoice No..2-940141

Project: RHW Landfill Disposal Facility
Contractor: Delhur Industries
Structure: Wall
Location: Slope Riser Crest wall

MATERIALS AND MIX DATA

Reported by Acme Materials & Const
Mix No.6441
Sacks/CY....5.5
Cement.....Ashgrove I&II
Admixtures..AEA

Conc Supplier..... Acme Materials & Cons
Method of Mixing.... Central
Agg Source..... Acme Pit
Water Source..... well

Specifications

Slump, in...

Air Cont, %

Required strength, psi

7 day....

28 day.... 3000

FIELD TEST DATA

Slump, in... 4.25 (ASTM C-143)
Air Cont, % 5.2 (ASTM C-231)
Unit Wt, pcf NA (ASTM C-138)
Conc Temp, °F 59 (ASTM C-1064)
Air Temp, °F 48

Truck No.5116
Ticket No.323965
Time Batched.....3:10 PM
No. CY represented...1.0
Water added, gal.....0

Concrete Sampled (ASTM C-172),
tested, & Cylinders Cast (ASTM C-31)
Date Cast.. 2/14/94
Time .. 4:35 PM
By .. Dustin Beck (IMT)

Cylinder Curing (ASTM C-31)
Field Cure, days.....1
Temp Range, °F.....60-80
Lab cure from:
Date Received.....2/15/94

LABORATORY TEST DATA (ASTM C-39)

Sample No...

Cylinder ID	Cylinder Diam (inches)	X-Sec Area (sq in)	Total Load (lbs)	Fracture Type	Date Tested	Age Tested (days)	Comp Str (psi)
94087-1	6.01	28.37	60000	cone	2/21/94	7	2110
94087-2	6.01	28.37	77500	cone	2/28/94	14	2730
94087-3	6.01	28.37	105000	cone	3/14/94	28	3700
94087-4	6.01	28.37	105500	cone	3/14/94	28	3720

cc: Acme Materials & Construction

Reviewed by:

Lew A. Beck

APPENDIX R

LEACHATE TEMPORARY STORAGE TANK

APPENDIX R-1

MANUFACTURER'S QC DOCUMENTATION

FORM U-1A MANUFACTURERS' DATA REPORT FOR PRESSURE VESSELS
(Alternate Form for Single Chamber, Completely Shop-Fabricated Vessels Only)
as required by the provisions of the ASME Code rules, Section VIII, Division 1

1. Manufactured and certified by QUALITY TANK & CONSTRUCTION CO. 16911 SE. 362ND DR., SANDY, OR 97055
(name and address of manufacturer)

2. Manufactured for PILCHUCK MECHANICAL, INC., 256 SW 43RD ST. STE.C, RENTON, WA 98055
(name and address of purchaser)

3. Location of Installation HANFORD NUCLEAR RESERVATION, WA
(name and address)

4. Type: HORIZ 2974 - 2974-930-0333 344 1993
(horiz. or vert. tank) (mfr's. serial no.) (CRN) (drawing no.) (plate Bd. no.) (year)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction and workmanship conform to ASME Code, Section VIII, Division 1: 1992
(ASME Code) (Code Case no.) (special service per UG-120(c))

6. Shell: SA-36 0.3125 0 7'-11.315" 25'-0"
(mat'l. spec. no., grade) (nom. thickness in in.) (corr. allow. in.) (dia. ID (ft. & in.)) (length overall (ft. & in.))

7. Seams: DBL BUTT NONE 70 - DBL BUTT NONE 3
(long. welded, coll. singl. lap, butt) (RT (spot or full)) (left. (ft.)) (HT temp. (°F)) (time (hr.)) (grain (welded, coll. singl. lap, butt)) (RT (spot, partial, or full)) (no. of courses)

8. Heads: (a) SA-516-70 (b) SA-516-70
(mat'l. spec. no., grade) (mat'l. spec. no., grade)

Location (top, bottom, ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Spherical Radius	Flat Diameter	Side to Pressure (convex or concave)
(a) END	0.2734	0	90"	6X					CONCAVE
(b) END	0.2734	0	90"	6X					CONCAVE

If removable, bolts used (describe other fastenings):

9. MAWP: 25 at max. temp. 650 Min design metal temp. -20 at 25 Hydro. 25 test pressure 38
(PSI) (°F) (°F) (PSI)

10. Nozzles, inspection and safety valve openings:

Purpose (inlet, outlet, drain, etc.)	No.	Dia. or Size	Type	Mat'l.	Nom. Thickness	Reinforcement Mat'l.	How Attached	Location
INLET	1	4	ISOEFSO	SA533E	STD	NONE	WELD	SHELL
VERT	1	4	THDSTUB	SA533E	STD	NONE	WELD	SHELL
LEVEL GAGE	3	1.5	SCDCPLG	SA105	3000#	NONE	WELD	SHELL
LEVEL SWITCH	1	0.75	SCDCPLG	SA105	3000#	NONE	WELD	SHELL

11. Supports: Skirt NO Lugs 2 Legs - Other (2) SADDLES Attached WELD TO SHELL
(yes or no) (no) (no) (yes or no) (where & how)

12. Remarks: Manufacturers' Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:

9.) NO IMPACT TEST REQ'D.: UG-20(f)

10.) PROTECTION FROM OVER PRESSURING PROVIDED FOR IN PIPING.

10. CONT.) INSPECTION, 2, 14"x16", ELLIPT M.H., SA516-70, 0.75", NONE, WELD, SHELL

SPACE, 2, 1", SCDCPLG, SA-105, 3000#, NONE, WELD, HEAD

OUTLET/DRAIN, 1, 1" STUB, SA533E STD NONE WELD, SHELL

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1 "U" Certificate of Authorization no. 2085 expires 11/15, 1994
Date 11/9/93 Name QUALITY TANK & CONSTRUCTION CO. Signed Pat M. Rahman
(date of cert. not later than mfr's name and certifying stamp) (signature)

CERTIFICATE OF SHOP INSPECTION

Vessel constructed by QUALITY TANK & CONSTRUCTION CO. at SANDY, OR
I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and the state or province of OREGON and employed by THE HARTFORD STEAM BOILER INSPECTION & INSURANCE CO.
of HARTFORD, CT have inspected the component described in this Manufacturers' Data Report on 11/05, 1993 and state that, to the best of my knowledge and belief, the manufacturer has constructed this pressure vessel in accordance with the ASME Code Section VIII, Division 1. By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in the Manufacturers' Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.
Date 11/9, 1993 Signed James A. B. [Signature] Commissions 5233
(signature of inspector) (mat'l. Bd. inspec. endorsement) (state, prov. and no.)

APPENDIX R-2

REGISTERED PROFESSIONAL ENGINEER'S STATEMENT

APPENDIX R-2

ENGINEERS STATEMENT ABOUT LEACHATE STORAGE TANK

This Appendix presents the results of our review of the design of the Leachate Storage Tank. The review was performed in general accordance with the requirements of WAC 173-303-640 3(a). The review consisted of a review of the tank and foundation design, discussions with the Tank designers Quality Tank & Construction (QTC), and an assessment of the suitability of the design. The overall design and function of the Leachate Storage Tank was reviewed as depicted on Golder Associates, Inc. (GAI) Design Drawing H-2-131585, dated 4/2/90 and Drawing H-2-131585 by QTC dated 8/26/93. The GAI drawing showed the overall design concept while the QTC drawing showed the detailed design of the tank structure.

Our comments on the design include:

- The tank foundation is supported on naturally occurring eolian sand which is more than adequate to support the light bearing loads of the tank. The tank foundation has an appropriate allowable bearing pressure and an adequate depth for frost penetration.
- The tank was pressure tested to 25 psi without leaking and will not be pressurized in actual service.
- QTC has a certification from the American Society of Mechanical Engineers (ASME) to design and construct pressure vessels. The structural design was completed by QTC in accordance with the ASME Code, Section VIII, Division 1. Based on our review, their design meets the intent of the GAI design and the requirements of the ASME Code for these types of tanks.
- An HDPE lined concrete collection basin is located under the tank such that the entire volume of the tank could be stored in the very unlikely case of a tank failure or the need to drain the tank.
- The tank is above ground and will not be in contact with any soil. It will contain liquid leachate from the adjacent landfill and has been epoxy coated. Based on 9090 testing of a simulated leachate, the leachate will contain primarily metallic salts. We contacted the

epoxy supplier and confirmed that the epoxy used to coat the tank is highly resistant to the type of leachate anticipated.

- The construction of the tank foundations and tank installation was subjected to full CQA monitoring by GCS.

Based on this review the tank design meets the design requirements of the project and is suitable for storing the anticipated leachate. The review and the Appendix section was prepared by:

GOLDER ASSOCIATES INC.

Robert L. Plum, PE
Principal

APPENDIX R-3
SELF PRIMING PUMP TESTING

SUBJECT <i>PRESSURE TEST - DISCHARGE PIPE FOR SELF PRIMING PUMP</i>		
Job No. <i>933-1354</i>	Made by <i>Jam</i>	Date <i>3-15-94</i>
Ref.	Checked	Sheet <i>1</i> of <i>1</i>
	Reviewed	

*TESTING INCLUDES 3" Ø HDPE PIPE (SELF
PRIMING PUMP DISCHARGE PIPE) FROM
SELF PRIMING PUMP TO VALVE ON
TANK SIDE OF CREST WALL.*

<u>TIME</u>	<u>EVENT</u>
<i>1100</i>	<i>PILCHUCK MECHANICAL INSTALLED BLANKS ON EACH END OF PIPE TO BE TESTED. PIPE WAS FILLED W/ H₂O.</i>
<i>1130</i>	<i>PILCHUCK PRESSURIZED PIPE TO 51.5 PSI. VERY MINOR LEAK @ BLANK END NEAR CREST WALL, SO PILCHUCK TIGHTENED CONNECTION. PRESSURE DID NOT DROP BELOW 50 PSI, SO TEST CONTINUED.</i>
<i>1300</i>	<i>50 PSI READING. TEST ENDED.</i>
	<i>NO LEAKS WERE OBSERVED AFTER INITIALLY TIGHTENING BLANK FITTING @ 1130 HRS, SO TEST IS O.K.</i>

APPENDIX R-4
LEACHATE PIPING PRESSURE TESTING

SUBJECT *PIPING SYSTEM PRESSURE TEST*Job No. *933-1354*Made by *JAM*Date *3-4-94*

Ref.

Checked

Sheet *1* of *1*

Reviewed

TESTING INCLUDES PIPING & VALVES FROM VALVES @ CREST WALL TO VALVES ON TOP OF TANK TO TRANSFER PUMP TO END OF 4" ϕ STAINLESS STEEL DISCHARGE PIPE & INCLUDES STAINLESS SUCTION PIPE BETWEEN TANK & TRANSFER PUMP. (CHECKS REMOVED FROM VALVES ON TOP OF TANK). (BLANKS INSTALLED IN LANDFILL SIDE OF VALVES @ CREST WALL, & BLANK INSTALLED BENEATH VALVE ON TOP OF TANK. — BLANKS INSTALLED TO ISOLATE PIPING SYSTEM. BLANK ALSO INSTALLED BETWEEN TANK & PIPE ON BOTTOM OF TANK).

TIME	EVENT
1400	PILCHUCK MECH. FILLED PIPES W/ H ₂ O.
1415	PIPING SYSTEM PRESSURIZED TO 39.5 PSI. SOME MINOR LEAKS @ VALVES. VALVES TIGHTENED & LEAKS STOPPED.
1430	RE-PRESSURIZE PIPING TO 39.5 PSI CHECKED FOR LEAKS DURING TEST. NO LEAKS OBSERVED.
1545	MANUALLY CLOSED & OPENED VALVE NEAR CREST WALL, THEN ENDED TEST.

SUMMARY - RAN TEST @ 39.5 PSI FOR 1 HR 15 MIN.
NO LEAKS OBSERVED.. TEST O.K.

APPENDIX R-5
CONTAINMENT BASIN LEAK TEST

SUBJECT <u>CONTAINMENT BASIN LEAK TEST</u>		
Job No. <u>933-1354</u>	Made by <u>Ham</u>	Date <u>12-4-93</u>
Ref.	Checked	Sheet <u>1</u> of <u>1</u>
	Reviewed	

12-4-93

CALCULATED DEPTH OF H₂O REQUIRED IN LEACHATE
TEMPORARY STORAGE TANK CONTAINMENT BASIN.
H₂O QUANTITY SHOULD BE ≥ CAPACITY OF FULL TANK.
TANK CAPACITY = 10,000 GAL.

CONTAINMENT BASIN DIMENSIONS = 12' WIDE x 35' LONG
SO:

$$12' \times 35' \times X' = 10,000 \text{ GAL} / 7.48 \text{ GAL/FT}^3 = 1,336.9 \text{ FT}^3$$

$$12' \times 35' \times X = 1336.9 \text{ FT}^3$$

$$X = 3.18 \text{ FT}$$

H₂O IN BASIN MUST BE ≥ 3.18' DEEP

ADVISED DELHUR TO FILL BASIN ≥ 3 FT 4 IN. DEEP

DELHUR FILLED BASIN ~ 3' 5" DEEP

12-5-93

USED SPI MODEL 31-414 CALIPER

CALIPER MOUNTED ON STEEL ROD.

FILED A POINT ON THE END OF A NAIL, & ATTACHED
NAIL TO END OF ROD TO CREATE A POINT
GANGE.

CALIPER READS IN INCREMENTS OF 0.1 mm ON DIAL GANGE.

$$0.1 \text{ mm} \times \frac{1 \text{ INCH}}{25.4 \text{ mm}} = 0.003937 \text{ INCHES}$$

SO GANGE READS TO ACCURACY OF ~ 0.004 INCHES.

ESTABLISHED A REFERENCE POINT ON THE TANK
SADDLE SUPPORT, & MEASURED DISTANCE
FROM REFERENCE POINT TO WATER SURFACE.

MEASUREMENTS

<u>DATE</u>	<u>TIME</u>	<u>DISTANCE FROM REF. MARK TO H₂O SURFACE</u>
12-5-94	1300	27.4 mm
12-6-94	0700	27.4 mm
12-7-94	1230-1300	27.4 mm

NO CHANGE IN H₂O LEVEL DURING 48 HR TEST.

DELHUR REMOVED H₂O FROM CONTAINMENT BASIN.

MATTHEES & MATHIS (BOTH GCS) WALKED ON HDPE LINER
IN BASIN COULD FEEL NO SIGNS OF PUDDLED H₂O
BENEATH LINER — NO LEAKS DETECTED.

APPENDIX S

ELECTRICAL DESIGN ENGINEERS OBSERVATIONS DURING ATPS

SPARLING

720 OLIVE WAY - SUITE 1101
SEATTLE, WA 98101-1853
FAX 206-667-0654
PHONE 206-667-0655

Project Observation
Report

Project: Non Drag Off Facility
Richland, Washington

Location: Hanford Reservation

Contractor:

Client: Frank Shuri, Golder Associates

Date: April 18, 1994

Date Observed: April 14, 1994

Sparling Representative: Rowe Moyle

Page: 1 of 2

This report presents opinions formed as a result of our observation of the Contractor's activities. Contractor to comply with the Contract Documents throughout the duration of the Project irrespective of the presence of the Sparling Representative. The presence of our field representative will be for the purpose of providing observation. Our services do not include supervision or direction of the actual work of the Contractor, his employees or agents. Neither the presence of our representative nor the observation by our firm shall excuse the Contractor in any way for defects discovered in his work. This report does not authorize any work which will increase construction cost.

Project Site was visited by Rowe Moyle on April 14, 1994. Acceptance testing procedures and project electrical work were observed as noted below.

People Present: Scott Matthees, Golder Construction Services
Eric Erpenbeck, Westinghouse Hanford
Frank Shuri, Golder Associates
Mike Brown, Golder Associates
Rowe Moyle, Sparling
Joe Gonzalez, Electrical Contractor
Jack McGee, Westinghouse Hanford
Larry Fly, Westinghouse Hanford
Kathy Busching, Westinghouse Hanford
Cliff Knitter, Golder Associates

1. The question whether of normally open and normally closed contacts should be used for contacts CR2, CR4 and CR6 was reviewed. It was determined that the primary transducer and secondary transducer produce a 4 to 20 milliamp signal which is processed into on/off signals for coils to CR2, CR4 and CR6. It was described by the Electrical Contractor that the outputs from the process controller for the 4 to 20 milliamp transducers energize the CR2 and CR6 relay coils. The coils are not energized when a low sump condition exists. This would indicate that a normally closed contact would be appropriate. The low level switch, Item FS2, is a normally closed float switch. This would indicate that a normally closed contact in the control circuit for the motor is appropriate.
2. Frank Shuri indicated that the control wiring allowed contacts CR7A at position 17, 21 and 25 have been rewired so that in the manual position the wiring goes through the high tank relay rather than bypassing it. A second mechanical tank float switch has been wired in parallel with a storage tank float high level switch No. FS3, equipment schedule item No. 32.
3. The ATP testing procedure was observed and all items functioned in accordance with the testing requirements.

Non Drag Off Facility - Richland, Washington

Page 2 of 2 April 15, 1994

- a. Heat trace thermostat operation was verified and line currents were measured.
- b. Control cabinet relay positions were observed to operate in expected mode.
- c. Water level sensors were calibrated.
- d. GFI receptacle was tested.
- e. Lighting fixtures were tested and operated properly.
- f. Pump motors were tested and operated properly. All the over-load relays were observed to be set in accordance with the nameplate ratings of the motors.

Following work was observed to be incomplete or not in compliance with the project contract drawings:

- A. Control panel MS-3 has a hub conduit fitting opening in the top of the enclosure that is not sealed off. Remove hub fitting and provide knock-out seal fitting.
- B. Enclosure for motor starter MS2 has an opening at the top of the panel sealed with duct tape. Remove duct tape and provide metal sealing fitting.
- C. Heat trace at vicinity of upstream water meter at the head end valve manifold has been damaged. The outer jacket has been abraded and shall be repaired or replaced.
- D. Control panel C: Provide nameplate on panel indicating all sources of power per specification 16100, paragraph 2.5. Label shall indicate source of control power and space heater power.
- E. Most electrical enclosure interiors were dusty. Vacuum, seal all openings and keep enclosure doors closed tightly to prevent entry of more dust.

Eric Erpenbeck indicated that as-built drawings of the control schematics will be provided to the A/E team for review and comment. Eric is looking for the A/E team to verify that the record drawings do indicate the as-built condition as best we can determine.

Copies to: Mike Brown, Golder Associates
Scott Mathees, Golder Construction Services

kpzhan
459200ndagpor

APPENDIX T
CQA VERIFICATION SURVEYS

APPENDIX T-1

SUBGRADE

DEGERS SURVEYING COORDINATE LIST OF NON-DRAWN SUBGRADE POINTS (FIELD ASBUILT)
 0-18-93 Page 1

MATCH STRING :
 SELECT ENTIRE FILE
 LIST COORDINATES

	<u>GOLDER</u> <u>POINT #</u>	<u>R.S.I.</u> <u>PT#</u>	NORTH	EAST	ELEV
CONTROL POINTS	ZW 14	414	44501.090	-78194.990	685.71
	REBAR	417	44347.803	-78582.660	701.75
	SHLD 602	500	44346.323	-78752.975	707.99
	SHLD 603	501	44343.875	-78727.580	706.60
	SHLD 610	502	44339.361	-78677.200	703.82
	SHLD 618	503	44336.230	-78642.602	701.86
	SHLD 614	504	44337.668	-78602.011	701.38
	SHLD 611	505	44339.594	-78551.902	700.71
	SHLD 607	506	44341.392	-78501.880	700.13
	SHLD 608	507	44341.443	-78476.815	699.52
	SHLD 615	508	44338.829	-78426.473	697.35
	SHLD 619	509	44337.136	-78391.460	695.93
	SHLD 620	510	44329.195	-78368.733	695.96
	SHLD 623	511	44307.158	-78359.431	695.78
	SHLD 626	512	44274.963	-78359.228	695.88
	SHLD 643	513	44225.178	-78359.188	696.01
	SHLD 661	514	44175.089	-78358.975	696.06
	SHLD 686	515	44124.746	-78359.035	696.07
	SHLD 716 704	516	44072.634	-78359.072	696.20
	SHLD 716	517	44070.768	-78368.595	696.92
	SHLD 743	518	44036.566	-78431.580	696.02
	SHLD 729	519	44034.319	-78480.401	697.85
	SHLD 727	520	44036.257	-78505.528	697.97
	SHLD 725	521	44037.797	-78529.736	697.96
	SHLD 731	522	44032.760	-78531.058	700.90
	SHLD 733	523	44027.799	-78631.542	703.79
	SHLD 736	524	44022.681	-78682.163	706.90
	SHLD 739	525	44019.127	-78732.500	709.30
	SHLD 740	526	44017.837	-78757.704	710.37
	SHLD 741	527	44016.316	-78789.154	711.33
	SHLD 724	528	44045.381	-78817.875	711.35
	SHLD 701	529	44109.821	-78817.693	711.94
	SHLD 666	530	44150.845	-78817.693	711.85
	SHLD 649	531	44200.914	-78817.669	711.95
	SHLD 627	532	44250.694	-78817.652	711.37
	SHLD 624	533	44301.050	-78817.698	711.91
	SHLD 622	534	44318.029	-78817.636	712.01
	SHLD 604	535	44342.571	-78806.015	710.75
	SHLD 601	536	44348.852	-78783.088	709.67
	TOE RAMP 720	537	44060.808	-78474.441	698.87
	TOE RAMP 714	538	44072.589	-78509.794	688.94
	TOE RAMP 746	539	44080.125	-78533.128	684.00
	TOE RAMP 697	540	44107.543	-78616.218	676.98
	TOE RAMP 691	541	44118.626	-78649.817	674.20
	TOE SLOPE 748	542	44124.308	-78683.422	673.44

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SUBGRADE POINTS (FIELD ASBUILT)
10 18 93 Page 2

TOE SLOPE 650	543	44201.487	-78697.823	672.09
TOE SLOPE 639	544	44230.496	-78691.912	672.65
TOE SLOPE 633	545	44245.163	-78670.103	672.32
TOE SLOPE 638	546	44245.017	-78644.568	671.64
TOE SLOPE 630	547	44245.165	-78594.851	670.47
TOE SLOPE 635	548	44245.293	-78494.483	667.90
TOE SLOPE 629	549	44245.166	-78476.682	667.54
TOE SLOPE 679	550	44154.467	-78476.499	667.55
TOE SLOPE 677	551	44154.558	-78496.523	668.00
TOE SLOPE 671	552	44154.513	-78529.427	668.90
TOE SLOPE 670	553	44154.604	-78554.138	669.45
TOE SLOPE 669	554	44154.502	-78579.197	670.15
SHLD RAMP 680	555	44143.685	-78630.156	674.84
SHLD RAMP 682	556	44132.360	-78595.077	677.74
SHLD RAMP 688	557	44120.821	-78559.209	681.14
SHLD RAMP 696	558	44108.987	-78524.106	683.76
SHLD RAMP 706	559	44093.251	-78476.916	687.95
SHLD RAMP 712	560	44081.548	-78441.434	690.97
SHLD RAMP 717	561	44073.906	-78417.448	692.97
S SLOPE 336 OG	562	44050.894	-78479.395	692.32
S SLOPE 334	563	44052.789	-78504.436	692.28
S SLOPE 333	564	44054.817	-78529.242	692.31
S SLOPE 332	565	44056.732	-78554.100	692.20
S SLOPE 331	566	44058.693	-78579.105	692.34
S SLOPE 320 OG	567	44060.368	-78604.082	692.38
S SLOPE 328	568	44062.322	-78628.832	692.26
S SLOPE 327 OG	569	44064.037	-78653.847	692.18
312 → S SLOPE 332 OG	570	44065.950	-78679.036	692.28
S SLOPE 320 OG	571	44067.742	-78703.871	692.19
S SLOPE 318 OG	572	44069.917	-78728.681	692.36
316 OG	573	44070.040	-78731.221	692.37
313	574	44078.144	-78752.265	692.83
348 OG	575	44044.677	-78730.818	700.4
349 OG	576	44043.002	-78705.746	700.40
350 OG	577	44041.103	-78680.854	700.44
352 OG	578	44039.195	-78655.841	700.65
353 OG	579	44037.495	-78630.836	700.46
354 OG	580	44035.428	-78606.122	700.49
307 OG	581	44085.232	-78602.193	683.93
305 OG	582	44087.114	-78627.305	683.99
304 OG	583	44089.023	-78652.009	683.83
303 OG	584	44091.152	-78676.911	683.78
299 OG	585	44093.039	-78706.305	683.96
295	586	44100.820	-78764.574	694.23
277	587	44125.675	-78789.546	702.49
257? → 256	588	44150.757	-78788.885	702.15
220	589	44200.765	-78789.503	702.49
199	590	44225.832	-78789.669	702.53
RE-SHOT PAGE 5 OK. → 190	591	44250.955	-78789.554	702.68
166	592	44275.780	-78789.541	702.68

LOGS SURVEYING COORDINATE LIST OF NON-DRAW-OFF SUBGRADE POINTS (FIELD ASBUILT)
10-18-93 Page 3

W SLOPE	144	593	44299.532	-78789.564	702.57
N SLOPE	127	594	44319.026	-78750.793	698.89
N SLOPE	127	595	44318.851	-78750.748	698.67
N SLOPE	125	596	44320.917	-78725.941	698.87
	124	597	44322.675	-78700.976	698.89
N SLOPE	121	598	44326.476	-78651.141	698.91
N SLOPE	118	599	44330.225	-78601.338	698.90
	114	600	44335.835	-78526.382	698.91
N SLOPE	132	601	44319.644	-78407.406	690.46
	130	602	44316.498	-78449.784	690.55
N SLOPE	134	603	44312.754	-78499.770	690.52
136	→	36	604	44309.064	690.54
138	→	38	605	44307.152	690.57
141	→	41	606	44303.527	690.58
145	→	45	607	44299.779	690.57
N SLOPE	149	608	44295.771	-78725.911	690.58
W SLOPE	168	609	44276.158	-78764.500	694.16
	212	610	44200.672	-78764.227	694.01
	236	611	44175.861	-78764.627	694.20
W SLOPE	284	612	44106.331	-78751.924	690.00
	255	613	44151.007	-78739.459	685.70
	237	614	44175.885	-78739.539	685.87
	218	615	44200.686	-78739.642	685.91
	201	616	44225.698	-78739.639	685.92
W SLOPE	193	617	44252.944	-78739.520	685.85
N SLOPE	173	618	44269.435	-78727.251	684.42
N SLOPE	163	619	44284.103	-78713.424	686.40
171	→	N SLOPE 177	620	44272.956	682.16
		N SLOPE 170	621	44274.680	682.20
		N SLOPE 164	622	44278.570	682.20
			623	44282.271	682.18
		N SLOPE 155	624	44285.987	682.19
		N SLOPE 151	625	44289.692	682.08
		N SLOPE 148	626	44292.824	682.21
		N SLOPE 152	627	44286.189	682.63
			628	44271.678	684.95
			629	44249.848	684.97
			630	44224.994	684.93
			631	44175.095	684.92
			632	44149.956	684.91
E SLOPE	280	633	44128.233	-78392.123	684.90
	290	634	44097.195	-78423.038	685.23
	264	635	44123.954	-78448.031	676.98
	279	636	44126.096	-78473.898	677.00
RAMP SLOPE	274	637	44127.792	-78498.751	677.03
RAMP SLOPE	270	638	44131.704	-78546.424	676.82
SUMP	656	639	44173.676	-78454.791	664.02
SUMP	647	640	44207.867	-78454.856	664.08
N SLOPE	184	641	44265.868	-78457.540	673.87
N SLOPE	178	642	44264.851	-78471.035	673.92

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SUBGRADE POINTS (FIELD ASBUILT)
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N SLOPE	181	643	44261.080	-78520.806	673.89
N SLOPE	182	644	44257.195	-78545.790	673.89
N SLOPE	183	645	44257.362	-78570.807	673.88
N SLOPE	185	646	44255.480	-78595.677	673.90
	188	647	44251.916	-78645.471	673.98
BOTTOM	222	648	44201.285	-78679.270	671.43
BOTTOM	221	649	44201.614	-78654.342	670.74
BOTTOM	211	650	44225.625	-78654.127	671.53
BOTTOM	223	651	44201.439	-78629.538	670.22
BOTTOM	246	652	44175.900	-78629.498	670.83
BOTTOM	244	653	44175.904	-78579.358	669.62
BOTTOM	225	654	44201.169	-78579.342	668.96
BOTTOM	208	655	44225.802	-78579.377	669.58
BOTTOM	207	656	44225.764	-78554.311	668.97
BOTTOM	226	657	44201.139	-78554.354	668.34
BOTTOM	243	658	44175.802	-78554.317	668.97
SUMP	750	659	44201.124	-78505.363	667.12
SUMP	229	660	44200.921	-78479.276	664.85
SUMP	749	661	44200.762	-78452.763	663.04
	232	662	44200.802	-78441.985	666.64
	231	663	44200.776	-78416.706	675.04
SUMP	233	664	44200.756	-78392.259	683.35
	653	665	44200.813	-78359.266	694.36
	347	666	44044.846	-78788.273	704.75
	315	667	44071.217	-78739.664	702.60
	311	668	44083.113	-78777.160	698.39
	329	669	44061.856	-78770.111	698.67
	345	670	44046.894	-78756.044	700.65
	335	671	44058.438	-78743.750	696.54
	313	672	44078.120	-78752.208	692.82
	296	673	44094.548	-78764.451	694.17
	284	674	44106.317	-78751.763	689.99
	300	675	44094.710	-78734.157	686.80
	306	676	44081.723	-78718.640	688.01
	299	677	44093.144	-78706.356	683.93
288 →	298	678	44111.632	-78716.311	680.78
	269	679	44140.989	-78714.648	677.53
	273	680	44121.624	-78705.503	677.17
	291	681	44104.754	-78693.662	679.73
683 →	600	682	44131.682	-78694.827	673.57
	664	683	44153.049	-78701.719	673.18
	254	684	44150.882	-78714.520	677.55
	187	685	44252.320	-78708.965	678.29
	173	686	44269.297	-78727.230	684.40
	154	687	44286.217	-78745.684	690.52
	168	688	44276.158	-78764.499	694.15
	159	689	44287.661	-78777.074	698.38
	142	690	44303.204	-78764.014	696.65
N SLOPE	119	691	44333.941	-78766.918	704.25
	126	692	44320.255	-78782.208	702.76

ROGERS SURVEYING COORDINATE LIST OF NON-DRAW-OFF SUBGRADE POINTS (FIELD ASBUILT)
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144	693	44279.499	-78789.484	702.55
129	694	44316.778	-78808.520	708.93
113	695	44337.300	-78800.687	708.80
166	696	44275.861	-78789.569	702.69
190	697	44250.988	-78789.492	702.52
199	698	44225.730	-78789.655	702.53
220	699	44200.672	-78789.511	702.51
235	700	44175.801	-78789.615	702.41
257	701	44150.888	-78789.564	702.44
277	702	44125.754	-78789.586	702.47
294	703	44100.812	-78789.670	702.35
314	704	44075.935	-78789.506	702.51
716	705	44070.706	-78368.641	695.94
RAMP SLOPE	706	44073.472	-78400.334	692.74
301	707	44095.197	-78391.279	688.34
289	708	44113.429	-78408.333	682.67
262	709	44110.565	-78435.528	681.04
271	710	44131.694	-78425.340	677.02
262	711	44150.267	-78442.251	671.34
263	712	44139.488	-78462.109	672.24
663	713	44164.769	-78456.227	666.77
249	714	44174.523	-78417.232	676.63
214	715	44224.947	-78392.125	684.92
194	716	44249.924	-78392.170	684.96
620	717	44329.150	-78368.763	695.93
139	718	44304.470	-78371.874	688.27
152	719	44286.129	-78408.912	682.58
172	720	44267.824	-78425.725	676.88
189	721	44249.573	-78442.985	671.25
640	722	44234.635	-78458.384	666.75
2W 15	723	44001.030	-78195.001	696.44

APPENDIX T-2
TOP OF SECONDARY SOIL LINER

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SECONDARY ADMIX POINTS
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SELECT POINTS BY NUMBER

POINT # [,THRU POINT #] : 1015,1320

POINT # [,THRU POINT #] :

LIST COORDINATES

GOLDER PT#	RSI PT#	NORTH	EAST	ELEV
OG 1126	1015	44320.28	-78782.07	706.20
OG 1125	1016	44320.91	-78725.91	702.18
OG 1124	1017	44322.99	-78700.84	702.24
OG 1122	1018	44324.85	-78675.97	702.27
OG 1121	1019	44326.60	-78651.23	702.23
OG 1142	1020	44303.39	-78764.01	700.11
OG 1154	1021	44286.31	-78745.65	693.94
OG 1146	1022	44297.76	-78698.97	693.93
OG 1145	1023	44299.85	-78674.12	693.92
OG 1143	1024	44301.60	-78649.06	693.79
OG 1141	1025	44303.58	-78624.30	693.87
OG 1140	1026	44305.30	-78599.37	693.90
OG 1138	1027	44307.26	-78574.41	693.88
OG 1136	1028	44309.22	-78549.51	693.92
OG 1135	1029	44310.99	-78524.55	693.88
OG 1134	1030	44312.91	-78499.57	693.91
OG 1131	1031	44314.73	-78474.77	693.94
OG 1130	1032	44316.57	-78449.91	693.90
OG 1128	1033	44318.09	-78425.06	693.92
OG 1132	1034	44319.58	-78407.48	693.86
OG 1139	1035	44304.31	-78391.77	691.62
OG 1152	1036	44286.04	-78408.79	685.99
OG 1137	1037	44306.28	-78419.86	689.69
OG 1148	1038	44292.75	-78432.62	685.59
OG 1150	1039	44291.70	-78447.91	685.52
OG 1151	1040	44289.84	-78472.72	685.59
OG 1153	1041	44288.01	-78497.66	685.57
OG 1155	1042	44286.08	-78522.58	685.59
OG 1157	1043	44284.29	-78547.52	685.59
OG 1160	1044	44282.41	-78572.56	685.59
OG 1164	1045	44278.65	-78622.34	685.53
OG 1165	1046	44276.73	-78647.24	685.55
OG 1173	1047	44269.39	-78727.25	687.83
OG 1187	1048	44252.25	-78709.01	681.70
OG 1197	1049	44229.69	-78714.73	681.01
OG 1202	1050	44225.88	-78714.74	680.97
OG 1217	1051	44200.73	-78714.83	680.97
OG 1238	1052	44175.71	-78714.75	680.93
OG 1254	1053	44150.83	-78714.86	680.90
OG 1269	1054	44140.92	-78714.69	680.87
OG 1278	1055	44117.80	-78739.68	689.30
OG 1275	1056	44125.85	-78739.74	689.36
OG 1255	1057	44150.86	-78739.69	689.38
OG 1237	1058	44175.88	-78739.79	689.27

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SECONDARY ADMIX POINTS
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OG 1218	1059	44200.96	-78739.55	689.18
OG 1201	1060	44225.76	-78739.75	689.27
OG 1192	1061	44250.80	-78739.84	689.37
OG 1193	1062	44252.90	-78739.68	689.32
OG 1176	1063	44264.48	-78752.31	693.39
OG 1168	1064	44276.13	-78764.72	697.63
OG 1191	1065	44250.81	-78764.75	697.52
OG 1200	1066	44225.80	-78764.70	697.54
OG 1219	1067	44200.78	-78764.76	697.64
OG 1236	1068	44175.76	-78764.71	697.64
OG 1256	1069	44150.79	-78764.80	697.68
OG 1276	1070	44125.93	-78764.71	697.69
OG 1295	1071	44100.85	-78764.69	697.67
OG 1296	1072	44094.58	-78764.55	697.66
OG 1311	1073	44082.94	-78777.19	701.80
OG 1315	1074	44071.45	-78789.60	706.00
OG 1314	1075	44075.81	-78789.52	705.99
OG 1294	1076	44100.87	-78789.64	706.04
OG 1277	1077	44125.69	-78789.82	705.98
OG 1257	1078	44150.83	-78789.67	706.05
OG 1235	1079	44175.92	-78789.75	706.01
OG 1220	1080	44200.76	-78789.66	705.97
OG 1199	1081	44226.01	-78789.75	705.92
OG 1190	1082	44250.76	-78789.81	705.94
OG 1166	1083	44276.04	-78789.88	705.93
OG 1144	1084	44299.38	-78789.71	705.94
OG 1345	1085	44046.73	-78756.13	704.02
OG 1348	1086	44044.83	-78730.55	704.02
OG 1349	1087	44042.95	-78705.45	704.09
OG 1350	1088	44041.03	-78680.85	704.10
OG 1352	1089	44039.11	-78655.84	704.10
OG 1353	1090	44037.14	-78630.85	704.05
OG 1336	1091	44050.79	-78479.49	695.78
OG 1334	1092	44052.88	-78504.21	695.74
OG 1333	1093	44054.70	-78529.29	695.70
OG 1332	1094	44056.54	-78554.18	695.78
OG 1331	1095	44058.37	-78579.12	695.77
OG 1330	1096	44060.35	-78603.93	695.65
OG 1328	1097	44062.14	-78628.98	695.72
OG 1327	1098	44064.00	-78653.89	695.80
OG 1322	1099	44065.92	-78678.83	695.72
OG 1320	1100	44067.72	-78704.02	695.71
OG 1318	1101	44069.64	-78728.86	695.80
OG 1316	1102	44069.98	-78731.15	695.67
OG 1299	1103	44093.14	-78706.33	687.36
OG 1302	1104	44092.79	-78701.93	687.37
OG 1303	1105	44090.95	-78677.11	687.39
OG 1304	1106	44088.93	-78652.14	687.36
OG 1305	1107	44087.12	-78627.16	687.43
OG 1307	1108	44085.31	-78602.26	687.37

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SECONDARY ADMIX POINTS
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OG 1309	1109	44083.32	-78577.23	687.34
OG 1283	1110	44115.86	-78675.22	679.06
OG 1261	1111	44116.34	-78681.28	679.12
OG 1180	1112	44261.31	-78688.58	681.54
OG 1188	1113	44252.00	-78645.38	677.33
OG 1186	1114	44253.71	-78620.39	677.25
OG 1185	1115	44255.45	-78595.63	677.18
OG 1183	1116	44257.37	-78570.76	677.19
OG 1182	1117	44259.24	-78545.70	677.23
OG 1178	1118	44264.77	-78471.02	677.18
OG 1161	1119	44279.36	-78444.89	681.43
OG 1150	1120	44291.46	-78447.82	685.57
OG 1152	1121	44286.00	-78408.79	685.99
OG 1156	1122	44287.86	-78376.88	693.24
OG 1169	1123	44271.64	-78392.12	688.21
OG 1144 1194	1124	44249.92	-78392.14	688.29
OG 1214	1125	44225.01	-78392.13	688.31
OG 1233	1126	44200.71	-78392.21	688.31
OG 1250	1127	44175.09	-78392.13	688.39
OG 1259	1128	44149.82	-78392.13	688.36
OG 1280	1129	44128.27	-78392.17	688.33
OG 1286	1130	44111.94	-78377.12	693.36
OG 1267	1131	44141.79	-78404.61	684.23
OG 1260	1132	44155.21	-78417.25	680.03
OG 1252	1133	44168.72	-78429.57	675.93
OG 1249	1134	44174.97	-78417.16	680.03
OG 1231	1135	44200.75	-78417.11	679.96
OG 1213	1136	44224.93	-78416.90	679.98
OG 1295 1195	1137	44244.58	-78417.18	679.92
OG 1175	1138	44258.20	-78404.67	684.10
OG 1172	1139	44267.87	-78425.76	680.23
OG 1189	1140	44249.33	-78442.46	674.49
OG 1215	1141	44217.63	-78442.21	671.59
BOT 1212	1142	44225.85	-78679.21	675.33
BOT 1211	1143	44225.85	-78654.20	674.63
BOT 1210	1144	44225.76	-78629.39	673.96
BOT 1209	1145	44225.78	-78604.36	673.36
BOT 1208	1146	44225.73	-78579.22	672.89
BOT 1207	1147	44225.74	-78554.38	672.12
BOT 1206	1148	44225.70	-78529.30	671.60
BOT 1205	1149	44225.76	-78504.32	670.90
BOT 1204	1150	44225.74	-78479.27	670.29
BOT 1229	1151	44200.86	-78479.32	668.20
BOT 1750	1152	44200.86	-78504.65	670.39
BOT 1227	1153	44201.10	-78529.08	671.03
BOT 1226	1154	44201.16	-78554.30	671.50
BOT 1225	1155	44201.25	-78579.30	672.17
BOT 1224	1156	44201.33	-78604.35	672.85
BOT 1223	1157	44201.41	-78629.28	673.44
BOT 1221	1158	44201.43	-78654.27	674.17

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BOT	1222	1159	44201.64	-78679.12	674.79
BOT	1247	1160	44175.57	-78679.21	675.29
BOT	1248	1161	44176.02	-78654.29	674.69
BOT	1246	1162	44175.72	-78629.33	674.13
BOT	1245	1163	44175.74	-78604.30	673.50
BOT	1244	1164	44175.77	-78579.27	672.89
BOT	1243	1165	44175.74	-78554.38	672.23
BOT	1242	1166	44175.91	-78529.31	671.69
BOT	1241	1167	44175.69	-78504.18	670.87
BOT	1240	1168	44175.76	-78479.33	670.43
BOT	1239	1169	44175.63	-78454.29	669.72
OG	1683	1170	44132.05	-78694.28	676.89
OG	1273	1171	44121.64	-78705.22	680.63
OG	1288	1172	44111.48	-78716.19	684.17
OG	1300	1173	44094.80	-78734.18	690.16
OG	1313	1174	44078.09	-78752.35	696.18
OG	1329	1175	44061.51	-78770.44	702.25
OG	1347	1176	44044.80	-78788.53	708.17
TOE	1632	1177	44244.37	-78670.76	675.60
TOE	1633	1178	44244.51	-78669.79	675.64
TOE	1638	1179	44244.46	-78644.53	674.94
TOE	1634	1180	44244.66	-78619.66	674.38
TOE	1630	1181	44244.55	-78594.66	673.69
TOE	1631	1182	44244.54	-78569.91	673.12
TOE	1637	1183	44244.75	-78544.73	672.51
TOE	1636	1184	44244.77	-78519.64	671.85
TOE	1635	1185	44244.87	-78494.67	671.24
TOE	1629	1186	44244.66	-78477.25	670.79
TOE	1640	1187	44234.06	-78456.91	670.06
TOE	1215	1188	44217.47	-78442.19	671.58
* TOE	1203	1189	44225.76	-78454.25	670.17
* TOE	1644	1190	44221.81	-78450.65	670.43
* OG	1232	1191	44200.80	-78442.23	670.98
* OG	1658	1192	44179.44	-78450.23	670.24
TOE	1239	1193	44175.56	-78454.33	669.74
TOE	1663	1194	44165.58	-78456.58	670.12
TOE	1679	1195	44155.11	-78477.03	670.75
TOE	1677	1196	44155.01	-78496.79	671.23
TOE	1672	1197	44154.96	-78504.45	671.56
TOE	1676	1198	44155.13	-78521.68	671.97
TOE	1671	1199	44154.98	-78529.34	672.16
TOE	1675	1200	44154.70	-78545.02	672.58
TOE	1670	1201	44155.03	-78554.34	672.76
TOE	1670 1674	1202	44155.00	-78568.50	673.13
TOE	1669	1203	44154.87	-78579.26	673.43
TOE	1673	1204	44154.92	-78596.85	673.87
TOE	1668	1205	44154.89	-78604.31	674.03
TOE	1667	1206	44154.97	-78629.00	674.52
TOE	1747	1207	44155.01	-78653.06	675.12
TOE	1660	1208	44175.97	-78699.31	675.90
* TOE	1203	Marked	C0.55	=	669.62
* TOE	1644	Marked	C1.00	=	669.44
* OG	1232	Marked	F0.55	=	671.53
* OG	1658	Marked	C0.80	=	669.44

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TOE 1650	1209	44200.87	-78697.32	675.17
OG 1265	1210	44135.07	-78598.27	680.28
OG 1268	1211	44132.85	-78570.02	680.46
OG 1270	1212	44131.29	-78546.96	680.34
OG 1272	1213	44129.47	-78523.63	680.35
OG 1274	1214	44127.42	-78498.64	680.38
OG 1279	1215	44125.69	-78473.86	680.39
OG 1264	1216	44123.68	-78448.06	680.39
2W-15	1217	44001.00	-78195.02	696.65
OG 1290	1218	44096.92	-78423.13	688.76
OG 1298	1219	44098.82	-78450.74	688.70
OG 1293	1220	44100.80	-78475.75	688.75
OG 1292	1221	44102.55	-78500.64	688.69
TOE 1347 1346	1222	44045.23	-78426.95	698.19
TOE 1723	1223	44043.61	-78440.49	697.18
TOE 1722	1224	44047.49	-78452.54	696.26
TOE 1721	1225	44051.38	-78464.32	695.26
TOE 1720	1226	44055.22	-78476.22	694.24
TOE 1719	1227	44059.21	-78488.17	693.11
TOE 1718	1228	44063.09	-78500.05	692.23
TOE 1714	1229	44067.05	-78511.85	691.23
TOE 1713	1230	44071.18	-78523.68	690.13
TOE 1746	1231	44074.69	-78534.91	689.32
TOE 1711	1232	44078.61	-78546.88	688.30
TOE 1709	1233	44082.28	-78558.73	687.22
TOE 1707	1234	44086.30	-78570.66	686.26
TOE 1705	1235	44090.18	-78582.44	685.17
TOE 1702	1236	44094.13	-78594.45	684.21
TOE 1699	1237	44098.09	-78606.13	683.21
TOE 1697	1238	44102.03	-78617.96	682.18
TOE 1695	1239	44105.87	-78629.97	681.24
TOE 1693	1240	44109.70	-78641.69	680.23
TOE 1690	1241	44115.76	-78660.29	678.76
TOE 1689	1242	44121.12	-78676.07	677.32
OG 1301	1243	44095.25	-78391.71	691.69
OG 1289	1244	44113.53	-78408.46	686.13
OG 1271	1245	44131.86	-78425.39	680.45
OG 1262	1246	44150.16	-78442.34	674.75
SHLDR 1725	1247	44044.28	-78529.81	699.22
SHLDR 1727	1248	44042.69	-78504.97	699.13
SHLDR 1729	1249	44040.79	-78480.13	699.07
SHLDR 1743	1250	44036.98	-78431.21	699.22
SHLDR 1321	1251	44066.73	-78395.01	698.20
SHLDR 1716	1252	44076.13	-78373.59	697.68
SHLDR 1704	1253	44099.54	-78365.54	697.16
SHLDR 1686	1254	44124.85	-78365.55	697.11
SHLDR 1678	1255	44150.07	-78365.51	697.14
SHLDR 1661	1256	44174.95	-78365.61	697.18
SHLDR 1653	1257	44200.68	-78365.70	697.21
SHLDR 1643	1258	44224.98	-78365.52	697.07

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SECONDARY ADMIX POINTS
 11-18-93

Page 6

SHLDR 1628	1259	44249.84	-78365.59	697.05
SHLDR 1626	1260	44274.82	-78365.64	697.12
SHLDR 1623	1261	44300.12	-78365.72	697.12
SHLDR 1620	1262	44324.02	-78373.62	697.70
SHLDR 1619	1263	44330.82	-78397.17	697.42
SHLDR 1615	1264	44332.47	-78425.64	698.58
SHLDR 1612	1265	44333.66	-78450.94	699.63
SHLDR 1608	1266	44334.92	-78476.24	700.60
SHLDR 1606	1267	44335.59	-78487.11	701.17
SHLDR 1607	1268	44334.83	-78501.11	701.33
SHLDR 1609	1269	44334.12	-78526.23	701.72
SHLDR 1611	1270	44332.96	-78551.22	702.02
SHLDR 1613	1271	44332.13	-78576.36	702.35
SHLDR 1614	1272	44331.24	-78601.36	702.68
SHLDR 1617	1273	44330.32	-78626.37	702.98
SHLDR 1618	1274	44329.50	-78642.67	703.15
SHLDR 1610	1275	44332.80	-78676.80	705.03
SHLDR 1605	1276	44335.12	-78701.93	706.39
SHLDR 1603	1277	44337.32	-78727.13	707.78
SHLDR 1602	1278	44339.57	-78752.39	709.18
SHLDR 1601	1279	44341.58	-78775.11	710.44
SHLDR 1604	1280	44336.71	-78799.98	711.99
SHLDR 1621	1281	44319.23	-78811.09	713.05
SHLDR 1624	1282	44301.01	-78811.26	713.09
SHLDR 1625	1283	44276.00	-78811.27	713.13
SHLDR 1627	1284	44250.97	-78811.15	713.03
SHLDR 1641	1285	44225.87	-78811.39	713.07
SHLDR 1649	1286	44200.86	-78811.31	713.11
SHLDR 1659	1287	44175.85	-78811.30	713.07
SHLDR 1666	1288	44150.97	-78811.31	713.10
SHLDR 1685	1289	44126.10	-78811.47	713.00
SHLDR 1701	1290	44100.95	-78811.20	713.03
SHLDR 1715	1291	44075.91	-78811.37	713.06
SHLDR 1724	1292	44051.55	-78811.23	713.17
SHLDR 1735	1293	44032.04	-78802.43	712.87
SHLDR 1742	1294	44023.08	-78781.59	712.35
SHLDR 1740	1295	44024.40	-78757.28	711.47
SHLDR 1739	1296	44025.73	-78732.12	710.39
SHLDR 1738	1297	44027.01	-78707.06	709.34
SHLDR 1736	1298	44029.14	-78681.64	708.01
SHLDR 1734	1299	44031.88	-78656.34	706.45
SHLDR 1733	1300	44034.36	-78631.23	705.13
SHLDR 1732	1301	44036.90	-78606.13	703.56
SHLDR 1731	1302	44039.52	-78580.59	701.99
SHLDR 1728	1303	44041.87	-78555.44	700.72
SHLDR RAMR 1710	1304	44079.76	-78455.06	695.20
SHLDR RAMP 1708	1305	44083.81	-78466.82	694.22
SHLDR RAMP 1706	1306	44087.60	-78478.83	693.24
SHLDR RAMP 1703	1307	44091.66	-78490.64	692.24
SHLDR RAMP 1700	1308	44095.39	-78502.47	691.25

ROGERS SURVEYING COORDINATE LIST OF NON-DRAG-OFF SECONDARY ADMIX POINTS
11-18-93

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SHLDR RAMP 1698	1309	44099.49	-78514.33	690.22
SHLDR RAMP 1696	1310	44103.03	-78525.55	689.32
SHLDR RAMP 1694	1311	44106.93	-78537.41	688.27
SHLDR RAMP 1692	1312	44110.93	-78549.31	687.28
SHLDR RAMP 1688	1313	44114.73	-78561.31	686.24
SHLDR RAMP 1687	1314	44118.74	-78573.10	685.21
SHLDR RAMP 1684	1315	44122.76	-78584.83	684.32
SHLDR RAMP 1682	1316	44126.60	-78596.74	683.31
SHLDR RAMP 1681	1317	44130.33	-78608.96	682.27
SHLDR RAMP 1745	1318	44134.44	-78620.83	681.29
SHLDR RAMP 1680	1319	44138.18	-78632.59	680.24
SHLDR RAMP 1665	1320	44139.60	-78636.19	679.95

APPENDIX T-3
TOP OF SECONDARY GRAVEL

3.12

Results of Survey 01/14/94

SECONDARY GRAVEL LAYER CQA SURVEY

LIST POINTS POINT	NORTHING	EASTING	ELEVATION	DESCR	GLDZ REF. No.
800	44125.81	-78677.44	679.24	5689	
801	44150.85	-78679.25	678.62	5748	
802	44175.69	-78679.35	677.98	5247	
803	44201.56	-78679.42	677.38	5222	
804	44225.84	-78679.28	677.98	5212	
805	44250.81	-78629.50	677.34	5634	
806	44225.90	-78629.38	676.73	5210	
807	44201.44	-78629.39	676.11	5223	
808	44175.78	-78629.52	676.77	5246	
809	44150.79	-78579.30	676.11	5669	
810	44175.82	-78579.35	675.48	5224	
811	44201.30	-78579.40	674.87	5225	
812	44225.85	-78579.41	675.48	5208	
813	44250.74	-78579.59	676.11	5631	
814	44225.88	-78529.34	674.28	5206	
815	44201.16	-78529.35	673.70	5227	
816	44175.86	-78529.36	674.28	5242	
817	44150.87	-78529.36	674.90	5671	
818	44150.88	-78479.44	673.60	5679	
819	44175.90	-78479.29	673.01	5240	
820	44225.87	-78479.37	673.06	5204	
821	44250.81	-78479.40	673.58	5629	
822	44225.90	-78454.39	672.36	5203	
823	44207.50	-78453.26	669.78	5653	
824	44194.25	-78453.09	669.77	5654	
825	44175.84	-78454.36	672.39	5239	
826	44265.06	-78811.00	713.23	LINER	
827	44311.03	-78811.94	713.12	LINER	
828	44333.40	-78906.49	712.73	LINER	
829	44341.28	-78783.79	711.11	LINER	
830	44319.98	-78784.32	706.63	LINER	
831	44308.38	-78772.52	702.65	LINER	
832	44280.11	-78739.71	692.04	LINER	
833	44259.78	-78718.85	684.80	LINER	
834	44338.48	-78738.51	708.51	LINER	
835	44333.80	-78692.97	705.75	LINER	
836	44330.57	-78647.08	703.58	LINER	
837	44332.23	-78578.59	702.48	LINER	
838	44336.34	-78486.71	701.05	LINER	
839	44331.21	-78418.15	698.03	LINER	
840	44320.34	-78373.52	697.31	LINER	
841	44297.46	-78365.92	697.05	LINER	
842	44298.44	-78397.71	689.83	LINER	
843	44277.99	-78420.13	682.98	LINER	
844	44228.33	-78365.37	697.26	LINER	
845	44160.13	-78365.96	697.30	LINER	
846	44114.08	-78365.68	697.21	LINER	
847	44091.32	-78368.16	697.45	LINER	
848	44069.64	-78387.68	697.94	LINER	
849	44092.58	-78398.18	691.81	LINER	
850	44115.93	-78415.93	684.78	LINER	
851	44162.77	-78436.85	674.32	LINER	
852	44231.05	-78436.70	673.86	LINER	
853	44267.13	-78488.60	678.34	LINER	
854	44269.26	-78579.89	681.36	LINER	
855	44265.03	-78648.66	681.69	LINER	
856	44001.20	-78195.02	696.38	2WIS	

SURVEY OF
HDPE LINER
SEAMS FOR
GCS AS-BUILT
PANEL LAYOUT
DRAWING

APPENDIX T-4

TOP OF PRIMARY SOIL LINER

CQA SURVEY OF PRIMARY ADMIX SURFACE
PERFORMED BY ROGERS SURVEYING, INC. ON 01-20-94

Rogers Point No.	Easting	Northing	Elevation	Grid Point No.	
1	1	1	1	1	
417	-78582.6	44347.80	701.75	2	14
414	-78194.9	44501.09	685.71	2	14
500	-78679.4	44125.81	679.235	5689	
501	-78679.2	44150.85	678.624	5748	
502	-78679.3	44175.69	677.979	5247	
503	-78679.4	44201.56	677.384	5222	
504	-78679.2	44225.84	677.982	5212	
505	-78629.4	44250.80	677.338	5634	
506	-78629.3	44225.89	676.73	5210	
507	-78629.3	44201.43	676.108	5223	
508	-78629.5	44175.78	676.77	5246	
509	-78579.2	44150.78	676.106	5669	
510	-78579.3	44175.81	675.479	5224	
511	-78579.4	44201.29	674.865	5225	
512	-78579.4	44225.85	675.483	5208	
513	-78579.5	44250.73	676.113	5631	
514	-78529.3	44225.87	674.281	5206	
515	-78529.3	44201.16	673.703	5227	
516	-78529.3	44175.85	674.282	5242	
517	-78529.3	44150.86	674.895	5671	
518	-78479.4	44150.88	673.596	5679	
519	-78479.2	44175.89	673.009	5240	
520	-78479.3	44225.87	673.057	5204	
521	-78479.4	44250.81	673.576	5629	
522	-78454.3	44225.9	672.361	5203	
523	-78453.2	44207.50	669.776	5653	
524	-78453.0	44194.24	669.765	5654	
525	-78454.3	44175.83	672.388	5239	

APPENDIX T-5
TOP OF PRIMARY GRAVEL

ROGERS SURVEYING INC.

6272994

P.02

LIST SECTIONS AT STATION 1, THRU STATION] :

JOB : 34693

TIME: 15:26

DATE: 02-01-1994

Page 1

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1, 5000.000000, 5000.000000, 100.000000, START
415, 44001.200000,-78195.020000, 696.400000, POS KI 0415
416, 44022.346000,-78643.533000, 707.140000, STN TP 0416
417, 44001.200742,-78195.035733, 696.342610, POS KI 0415
418, 44225.956448,-78454.376982, 673.434731, 3203
419, 44225.838345,-78479.539619, 674.066666, 3204
420, 44226.029956,-78504.419063, 674.686239, 3205
421, 44225.939067,-78529.281184, 675.282473, 3206
422, 44225.775989,-78554.378653, 675.905875, 3207
423, 44225.691925,-78579.286507, 676.565987, 3208
424, 44225.821057,-78604.430132, 677.170886, 3209
425, 44225.842297,-78629.420578, 677.799621, 3210
426, 44225.809373,-78654.362688, 678.430682, 3211
427, 44225.693550,-78679.288490, 679.017406, 3212
428, 44201.022923,-78454.439585, 672.803929, 3228
429, 44201.112143,-78479.362431, 673.417299, 3229
430, 44200.982148,-78504.494211, 674.046661, 3750
431, 44201.154649,-78529.364997, 674.692456, 3227
432, 44201.128861,-78554.393475, 675.353295, 3226
433, 44201.138484,-78579.324721, 675.945820, 3225
434, 44201.344635,-78604.105219, 676.538443, 3224
435, 44201.288336,-78629.445960, 677.195650, 3223
436, 44201.487075,-78654.309687, 677.807620, 3221
437, 44201.761552,-78679.395026, 678.415684, 3222
438, 44175.794521,-78679.378423, 679.084823, 3247
439, 44175.790701,-78654.355188, 678.450352, 3248
440, 44175.618406,-78629.458573, 677.853209, 3246
441, 44175.760035,-78604.486426, 677.215131, 3245
442, 44175.730339,-78579.359876, 676.592517, 3244
443, 44175.919948,-78554.291761, 675.953137, 3243
444, 44175.828587,-78529.377486, 675.338240, 3242
445, 44175.925910,-78504.416888, 674.687904, 3241
446, 44175.940216,-78479.298839, 674.059857, 3240
447, 44175.859345,-78454.422255, 673.456538, 3239
448, 44001.303933,-78195.052142, 696.406852, 415

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APPENDIX T-6

TOP OF OPERATIONS LAYER

ROGERS SURVEYING INC.

6272994

P.02

LIST POINTS	NORTHING	EASTING	ELEVATION	GOLDER REF.#
1000	44326.687	-78401.309	700.746	4615
1001	44329.941	-78450.737	701.684	4610
1002	44331.749	-78501.204	703.607	4605
1003	44329.133	-78576.299	704.557	4611
1004	44327.359	-78626.421	705.293	4615
1005	44332.284	-78701.794	708.815	4604
1006	44338.196	-78771.666	712.503	4600
1007	44318.994	-78750.915	705.577	4127
1008	44293.843	-78724.054	696.603	4149
1009	44299.722	-78674.394	697.260	4145
1010	44303.433	-78624.489	697.328	4141
1011	44307.055	-78574.598	697.230	4138
1012	44310.840	-78524.756	697.315	4135
1013	44316.658	-78449.956	697.293	4130
1014	44306.976	-78419.579	693.451	4137
1015	44291.678	-78448.056	688.961	4150
1016	44287.931	-78497.983	688.978	4153
1017	44284.251	-78547.851	688.976	4157
1018	44280.481	-78597.786	688.981	4162
1019	44276.567	-78647.639	688.937	4165
1020	44268.904	-78697.053	687.625	4174
1021	44255.529	-78682.628	682.981	4623
1022	44255.451	-78620.846	681.395	4626
1023	44255.556	-78570.759	680.154	4628
1024	44261.110	-78520.943	680.656	4181
1025	44256.903	-78470.535	678.082	4184
1026	44225.837	-78454.413	676.785	4203
1027	44225.834	-78504.427	677.771	4205
1028	44225.839	-78554.393	679.018	4207
1029	44225.813	-78604.347	680.257	4209
1030	44225.794	-78654.401	681.509	4211
1031	44225.734	-78710.015	682.905	4638
1032	44225.716	-78714.692	684.288	4202
1033	44201.687	-78708.079	682.239	4642
1034	44201.415	-78679.256	681.491	4222
1035	44201.452	-78629.449	680.261	4223
1036	44201.282	-78579.412	679.006	4225
1037	44201.149	-78529.470	677.766	4227
1038	44200.949	-78479.420	676.800	4229
1039	44200.956	-78437.300	676.804	4232
1040	44176.944	-78437.276	676.786	4251
1041	44175.901	-78479.450	677.131	4240
1042	44175.848	-78529.402	678.399	4242
1043	44175.825	-78579.429	679.647	4244
1044	44175.877	-78629.388	680.924	4246
1045	44175.810	-78679.344	682.145	4247
1046	44175.834	-78710.112	682.925	4646
1047	44142.708	-78712.673	683.806	4650
1048	44150.759	-78679.377	682.765	4258
1049	44144.198	-78597.924	680.896	4662
1050	44144.251	-78545.928	679.608	4654
1051	44144.328	-78497.629	678.324	4664
1052	44154.861	-78446.587	676.838	4648
1053	44129.535	-78423.072	684.506	4271
1054	44149.742	-78411.974	685.045	4260
1055	44175.046	-78417.196	683.275	4249
1056	44225.141	-78417.233	683.310	4213
1057	44270.613	-78423.356	684.511	4172
1058	44288.923	-78406.322	690.168	4152
1059	44267.234	-78396.605	690.245	4175
1060	44225.184	-78392.288	691.568	4214
1061	44200.856	-78392.169	691.665	4233

933-1354

T-6-1

		ROGERS SURVEYING INC.	6272994
1064	44111.222	-78406.036	690.214 4289 ✓
1065	44092.894	-78388.946	695.864 4301 ✓
1066	44103.346	-78368.922	699.340 4683 ✓
1067	44150.161	-78368.938	699.370 4651 ✓
1068	44200.845	-78369.104	699.395 4643 ✓
1069	44250.129	-78369.071	699.374 4634 ✓
1070	44296.636	-78369.223	699.380 4620 ✓
1071	44318.727	-78378.692	699.362 4617 ✓
1072	44026.531	-78778.022	714.616 4725 ✓
1073	44032.274	-78801.789	715.365 4720 ✓
1074	44075.860	-78808.061	715.409 4152 <i>wrong</i> 4700
1075	44125.784	-78808.180	715.416 4669 ✓
1076	44175.719	-78808.155	715.383 4645 ✓
1077	44225.706	-78808.084	715.400 4637 ✓
1078	44275.683	-78808.186	715.406 4621 ✓
1079	44316.250	-78808.089	715.347 4618 ✓
1080	44337.248	-78800.752	715.440 4113 ✓
1081	44320.240	-78782.454	709.328 4126 ✓
1082	44275.689	-78789.677	709.295 4166 ✓
1083	44225.659	-78789.565	709.270 4199 ✓
1084	44175.739	-78789.683	709.252 4235 ✓
1085	44125.721	-78789.604	709.274 4277 ✓
1086	44075.770	-78785.503	707.879 4315 ✓
1087	44061.728	-78770.564	705.398 4329 ✓
1088	44052.206	-78750.743	705.271 4335 ✓
1089	44044.861	-78730.671	707.262 4348 ✓
1090	44040.994	-78680.831	707.235 4350 ✓
1091	44034.555	-78656.220	708.840 4719 ✓
1092	44037.031	-78630.948	707.418 4718 ✓
1093	44044.718	-78555.147	702.935 4715 ✓
1094	44047.234	-78504.825	700.918 4712 ✓
1095	44047.789	-78450.996	699.996 4710 ✓
1096	44051.123	-78479.439	698.953 4336 ✓
1097	44054.770	-78529.298	699.009 4333 ✓
1098	44058.573	-78579.190	698.917 4331 ✓
1099	44062.179	-78629.020	698.946 4328 ✓
1100	44066.030	-78678.883	698.950 4322 ✓
1101	44073.117	-78728.564	698.058 4316 ✓
1102	44078.530	-78752.672	699.385 4313 ✓
1103	44100.820	-78759.051	699.023 4296 ✓
1104	44150.887	-78764.579	700.946 4256 ✓
1105	44200.808	-78764.802	700.976 4219 ✓
1106	44250.724	-78764.719	700.873 4191 ✓
1107	44275.785	-78764.376	700.852 4168 ✓
1108	44286.140	-78745.745	697.100 4154 ✓
1109	44269.222	-78727.161	690.974 4173 ✓
1110	44250.785	-78737.372	691.812 4193 ✓
1111	44200.626	-78739.616	692.601 4218 ✓
1112	44150.768	-78739.676	692.606 4255 ✓
1113	44115.706	-78743.311	693.747 4284 ✓
1114	44095.400	-78734.754	693.381 4300 ✓
1115	44085.887	-78715.011	693.192 4306 ✓
1116	44102.819	-78697.341	687.150 4291 ✓
1117	44225.657	-78714.740	684.300 4202 ✓
1118	44200.839	-78714.769	684.305 4217 ✓
1119	44175.648	-78714.664	684.260 4238 ✓
1120	44142.686	-78712.699	683.829 4650 ✓
1121	44122.063	-78706.640	684.138 4672 ✓
1122	44112.644	-78685.308	683.855 4677 ✓
1123	44112.648	-78675.474	683.620 4675 ✓
1124	44112.660	-78648.626	682.951 4676 ✓
1125	44049.087	-78454.455	699.051 4709 ✓
1126	44057.006	-78479.037	696.939 4706 ✓
1127	44073.015	-78527.875	692.847 4702 ✓

1129	44087.229	-78627.153	690.615 4305✓
1130	44089.092	-78652.097	690.586 4304✓
1131	44090.959	-78677.006	690.548 4303✓
1132	44092.840	-78701.923	690.579 4302✓
1133	44102.820	-78697.293	687.172 4291✓
1134	44112.641	-78685.251	683.873 4677✓
1135	44112.635	-78648.679	682.947 4676✓
1136	44110.946	-78643.540	683.135 4658✓
1137	44105.193	-78625.890	684.664 4681✓
1138	44097.156	-78601.380	686.685 4687✓
1139	44047.910	-78450.812	699.428 4710✓
1140	44081.425	-78378.435	699.327 4697✓
1141	44073.458	-78401.109	699.141 4701✓
1142	44079.677	-78452.250	698.415 4696✓
1143	44087.725	-78476.695	696.323 4692✓
1144	44095.858	-78501.209	694.280 4688✓
1145	44103.892	-78525.670	692.212 4682✓
1146	44095.838	-78501.233	694.280 4688✓
1147	44103.886	-78525.617	692.217 4682✓
1148	44111.727	-78548.324	690.284 4678✓
1149	44118.772	-78571.174	688.380 4673✓
1150	44128.013	-78598.997	685.998 4668✓
1151	44139.462	-78634.086	683.065 4666✓
1152	44135.253	-78598.440	683.586 4265✓
1153	44133.112	-78570.023	683.624 4268✓
1154	44131.390	-78546.863	683.648 4270✓
1155	44129.685	-78523.774	683.646 4272✓
1156	44127.759	-78498.793	683.645 4274✓
1157	44125.951	-78473.886	683.646 4279✓
1158	44121.574	-78445.862	684.365 4282✓
1159	44139.906	-78462.809	678.710 4264✓
1160	44103.309	-78428.838	689.988 4290✓
1161	44084.938	-78411.806	695.573 4308✓
1162	44099.041	-78450.839	691.913 4298✓
1163	44101.015	-78475.798	691.904 4293✓
1164	44102.772	-78500.729	691.914 4292✓
1165	44001.205	-78195.024	696.438 SW 15

APPENDIX U

REPORT: SOIL LINER TEST FILL AND SDRI TEST

REPORT TO
UNITED STATES DEPARTMENT
OF ENERGY
ON
CONSTRUCTION QUALITY ASSURANCE OBSERVATION AND
TESTING, SOIL LINER TEST FILL AND SDRI TEST
RADIOACTIVE MIXED WASTE LAND DISPOSAL FACILITY
NON-DRAG-OFF, PROJECT W-025

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May 13, 1994

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May 13, 1994

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1. INTRODUCTION

Golder Construction Services, Inc. (GCS) has performed quality assurance observation and testing for the construction of a soil liner test fill and the installation of a sealed double-ring infiltrometer (SDRI) at DOE's Radioactive Mixed Waste Land Disposal Facility, Non Drag Off, located in the 200 West area of the Hanford Reservation, near Richland, Washington. This report provides a summary of the observation and testing results associated with test fill construction and the SDRI installation.

1.1 Purpose

A soil liner test pad was built prior to the construction of the landfill to demonstrate that the contractor's equipment and construction methods could install a soil liner that meets the project specifications. Therefore, the contractor used the same soil liner materials, equipment, and methods to construct the test fill as were proposed for construction of the landfill.

Evaluation of the test fill permeability included testing of relatively undisturbed samples of the compacted soil liner and a large-scale permeability test using a sealed double-ring infiltrometer (SDRI).

1.2 Scope of Services

The scope of GCS's services consisted of the observation and testing of the test fill, observation of the infiltrometer installation, and evaluation of the infiltrometer data. GCS started providing full-time observation services for the construction of the test fill on October 5, 1993. Monitoring of the SDRI took place from October 8, 1993 to February 9, 1994.

1.3 Project Specifications

The work was performed in accordance with the following documents:

- Material Specifications and Construction Requirements for the Radioactive Mixed Waste Land Disposal Facility, Non-Drag-Off, Project W-025, Revision 2, prepared for the U.S. Department of Energy-Richland Operations Office, Contract No. DE-AC06-89RL11615 by Golder Associates Inc., dated May 26, 1993.
- Construction Quality Assurance Plan for Project W-025, Radioactive Mixed Waste (RMW) Land Disposal Facility - Non-Drag-Off, Revision 3, prepared for the U.S. Department of Energy-Richland Operations Office, Contract No. DE-AC06-89RL11615 by Golder Associates Inc., dated May 21, 1993.

2. TEST FILL CONSTRUCTION PROCEDURES

The test fill for the Non-Drag-Off Land Disposal Facility was constructed by Delhur Industries, of Port Angeles, Washington, using the same equipment, procedures, and key personnel that they proposed to use during the placement and compaction of the soil liner for Non-Drag-Off. The test fill was constructed approximately 300 feet south of the Non-Drag-Off truck staging area.

2.1 Admix Preparation and Testing

The test fill was constructed using onsite eolian sand admixed with approximately twelve percent by dry weight of powdered bentonite. The bentonite was obtained from American Colloid Company, of Upton, Wyoming. Eolian sand, bentonite, and water were mixed in Delhur's pugmill. Small batches of the admixture were produced to calibrate the feed rate of the water, with a target moisture content of 19.5 percent.

Prior to production of the admix for the test fill, a sample of a small batch of the admix material produced by Delhur was obtained for laboratory testing, as was a sample of the eolian sand which was used in the admixture. The bentonite used in the admixture had previously been tested by GCS personnel. The results of the sieve and hydrometer tests (ASTM D 422) performed on the admix and sand samples, combined with the previous information gained from tests on the bentonite, indicated that the sample of admix contained a bentonite content of 12.9 percent, meeting the specification's requirement of a bentonite content of 11 percent to 14 percent. A Standard Proctor moisture-density test (ASTM D 698) was also performed on the sample of admix. The results of this test indicated a maximum dry density of 108.2 lbs/ft³, and an optimum moisture content of 17.5 percent. A summary of these laboratory tests is presented in Table U-2.

2.2 Test Fill Construction and Testing

On October 5, 1993, Delhur stripped, scarified, moisture conditioned, and compacted the subgrade for the test fill. GCS personnel performed 5 nuclear moisture-density tests on the compacted subgrade. The results of these tests indicated that the subgrade at each test location had been compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557. See Appendix U-1 for a summary of test results.

Delhur produced the admix for the test fill on October 5, 1993. The admix was stockpiled near the test fill location, and was allowed to hydrate until placement and compaction activities began on the following day.

On October 6, 1993, Delhur constructed a test fill with the admixture. GCS personnel performed CQA observation and testing during the construction of the test fill. The soil liner material was placed in the test fill using a Caterpillar 988 Front-End Loader and spread to approximately 8- to 10-inch thick loose lifts using a Caterpillar D-5 dozer

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equipped with low ground pressure (LGP) tracks. The loose lifts were then compacted to approximately 6-inch thick lifts using a Caterpillar 825-C padfoot compactor. The final lift was rolled with a RayGo Rascal 410A smooth-drum vibratory compactor. See Table U-1 for an equipment summary.

During the placement and compaction of the admix, GCS personnel performed density and moisture tests using a Troxler Model 3440 nuclear density gauge (ASTM D 2922 and ASTM D 3017, respectively). See Appendix U-1 for a summary of moisture-density test results.

Oven dried moisture tests were performed on a sample of material from each test location. Both a microwave oven (ASTM D 4643) and a conventional oven (ASTM D 2216) were used to determine the moisture content of each sample. The conventional oven moisture test result was used as the actual moisture content for each test sample, but the moisture content data determined by the two ovens was used to develop a correlation between the two methods in order to allow the use of the microwave oven during construction of the landfill. The microwave oven allows a relatively quick moisture content determination as opposed to the overnight turn-around time required for the conventional oven.

In addition to the moisture-density tests performed using the nuclear gauge, one side-by-side nuclear density test (ASTM D 2922) and rubber balloon density test (ASTM D 2167) were performed on each lift of material placed in the test fill. The rubber balloon density tests were performed to confirm the accuracy of the nuclear gauge. There was good agreement between the test results determined using the rubber balloon and nuclear test methods.

During the placement and compaction of the first two lifts of admix in the test fill, at least six density tests were performed for every two, one-way passes of the compactor. The compactor made a total of six, one-way passes on each of the first two lifts of material. Nineteen moisture-density tests were performed on the first lift, and eighteen moisture-density tests were performed on the second lift. The high frequency of testing was performed on the first two lifts of the test fill to determine the optimum number of passes by the compactor to achieve the required compaction and kneading of the soil liner material.

The results of the observation and testing on the first two lifts indicated that two, one-way passes with the compactor could achieve the compaction required by the specifications, but the material did not appear to be adequately kneaded, an important consideration for layer bonding and permeability. Four, one-way passes by the compactor increased the density of the material, yielded more consistent test results, and appeared to adequately knead the material. Six, one-way passes with the compactor increased the density slightly, but did not appear to be significant enough to warrant the use of this many passes by the compactor. Therefore, four, one-way passes by the compactor was determined to provide the desired end product.

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Six moisture-density tests were performed after four, one-way passes of the compactor on the third lift of material placed, and three moisture-density tests were performed after four one-way passes of the compactor on the 4th, 5th, and 6th lifts of material placed for the test fill. A rubber balloon moisture-density test was performed on each lift of the test fill as previously noted.

Following the completion of the test fill construction, two test pits were excavated through the full thickness of the test fill to allow examination of the lifts for layer bonding. GCS personnel observed the walls of the test pits to determine the adequacy of the layer bonding between the compacted lifts of material. The lifts of compacted material were not distinguishable in the test pits. Close examination of the walls of the test pits indicated that the lifts of material had been adequately kneaded together, and the three foot thick test fill appeared to be monolithic.

In the southwest corner of the test fill, Delhur removed, then replaced with the same soil and recompact the top three lifts of the test fill to demonstrate their method of removing and replacing soil liner material, should the event arise that "out-of-spec" material is placed during the construction of the landfill. GCS personnel performed a moisture-density test on each lift of the replaced material, and the test results indicated that the material had been adequately compacted. Following the completion of construction and testing activities, the surface of the test fill was back-dragged by the D-5 dozer, and then statically rolled with a Ray Go 410A smooth-drum vibratory roller.

The results of the moisture-density tests indicated that the soil liner had been compacted to at least 90 percent of the maximum dry density as determined by ASTM D 698 and that most of the soil liner had been placed and compacted at a moisture content of one to five percent above the optimum moisture content as determined by ASTM D 698. A few of the moisture tests on material sampled at the density test locations indicated moisture contents slightly below the specified moisture content (the specifications require one to five percent above optimum moisture content). The moisture-density results are summarized in Table U-3, and the moisture-density test data are presented in Appendix U-1. The approximate moisture-density test locations are shown in Figures U-2 and U-3.

Shelby tube samples of the compacted soil liner were obtained from each lift of the test fill. Flexible-wall permeability tests (ASTM D 5084) were performed on these samples in Golder Associates soils laboratory, located in Redmond, Washington. Holes remaining in the soil liner (after the removal of the Shelby tube samples) were backfilled and recompact by hand. A Shelby tube sample was obtained from one of these repaired areas and a permeability test was performed to determine whether the soil had been adequately recompact to achieve the permeability required by the specifications. In addition to the permeability tests performed on Shelby tube samples from the test fill, a permeability test was also performed on a laboratory-recompact sample of the soil liner. A summary of the permeability test results is presented in Table U-4. The approximate Shelby tube sample locations are shown in Figure U-4.

3. INFILTROMETER INSTALLATION AND TEST PROCEDURES

A sealed double-ring infiltrometer (SDRI) test program was performed to evaluate the in-situ permeability of the twelve percent bentonite/sand admix over a relatively large area. The specific objectives of the SDRI test program included:

- An evaluation of the permeability of the placed soil;
- A comparison of the large-scale in-situ permeability test results with the laboratory permeability test results performed on undisturbed Shelby tube samples of the placed and compacted admix.

3.1 Infiltrometer Installation Procedure

The SDRI was assembled and installed by Delhur and GCS personnel upon completion of the test fill construction. The SDRI components were supplied by Trautwein Soil Testing Equipment of Houston, Texas. The SDRI consisted of a 12 foot by 12 foot, square, outer ring, a 5 foot by 5 foot, square, inner ring, and nine soil tensiometers. A schematic of the SDRI is shown in Figure U-1. The SDRI was installed in accordance with ASTM D 5093 using the following sequence:

- The surface the test fill was graded using a Caterpillar D-5 dozer and statically rolled using a Ray Go 410A vibratory, smooth-drum roller;
- A four-inch wide by eighteen-inch deep trench for the outer ring was excavated using a Ditch-witch excavator;
- A two-inch wide by four-inch deep trench for the inner ring was excavated using a chain saw and hand labor;
- The outer ring was assembled and sealed in-place with Volclay bentonite grout;
- The inner ring was sealed in-place with Volclay bentonite grout;
- The nine soil tensiometers were installed to depths of six, twelve, and eighteen inches between the inner and outer rings;
- The inner ring was leak tested for 60 minutes by siphoning approximately 15 gallons of water into the inner ring;
- The outer ring was slowly filled with water to depth of one foot and examined for leaks; and
- The fittings, hoses, and water bags were then installed and the infiltration test started.

The SDRI was installed on October 7, 1993. Water leaked out of the outer ring of the SDRI in the southwest corner of the trench, where a fairly dry batch of Volclay grout had been placed. The dry grout was removed and replaced, the outer ring of the SDRI was refilled with water, and the SDRI permeability test was started on October 8, 1993.

3.2 Infiltrometer Test Procedures

The SDRI test was completed in accordance with ASTM D 5093. Monitoring of the SDRI consisted of the following tasks:

- Weighing and Changing the Flexible Bag - The amount of water infiltration in the inner ring is determined by the water loss in the flexible bag which is connected to the inner ring. Initially the volume loss from the bag was measured twice a day. During the later stages of the test, the bag was measured at less frequent intervals of up to 7 days. Bag weights were recorded before attachment to and after detachment from the inner ring of the SDRI. The difference between these two weights was the infiltration for that time period.
- Monitoring the Tensiometers - The tensiometers are used to monitor the progression of the wetting front. Readings of the tensiometers were recorded each time the flexible bags were changed.
- Recording Water Temperature - Water temperature was recorded each time the flexible bags were changed.
- Swell Survey - The SDRI was checked for vertical swell of the inner ring due to the potential swelling of the soil liner. This was accomplished by surveying the elevation of each corner of the inner ring relative to a benchmark. No swelling of the soil liner was recorded.

4. TEST FILL PERMEABILITY RESULTS

4.1 Laboratory Test Results

The results of the permeability tests on the Shelby tube samples from the test fill indicated an average permeability of 5×10^{-8} cm/s, and have demonstrated that the twelve percent bentonite/sand admix will achieve a permeability of less than or equal to 1×10^{-7} cm/s when the soil liner is placed and compacted in accordance with the project specifications for moisture content and compaction.

The permeability test on the Shelby tube sample from the first lift of the test fill indicated a hydraulic conductivity slightly greater than 1×10^{-7} cm/s. The apparent reason for the difference in permeabilities between this sample and samples from subsequent lifts of the test fill is that the first lift was contaminated by subgrade material. The contamination likely occurred due to a combination of the weight of the Caterpillar 825-C compactor, the six- to seven-inch length of the pegs for the padfoot compactor, and the thickness of the first lift of material (10 inches loose, 6 inches compacted). The pegs of the compactor likely forced admix into the subgrade, displacing the subgrade sand, and pushing the subgrade sand upward between the pegs of the compactor.

Golder's laboratory manager indicated that the Shelby tube sample from the first lift did not appear to have the cohesive quality that the rest of the samples displayed. Atterberg limits tests performed on this sample of material and a sample from the Shelby tube taken in the second lift of the test fill showed that the sample from the first lift was significantly less plastic, suggesting a higher sand content.

To demonstrate that a first lift of material could be placed and compacted to achieve the required permeability, and to demonstrate that contamination of this lift could be minimized or eliminated, Delhur constructed a second test fill. The second test fill was only one lift thick, because Delhur had already demonstrated that subsequent lifts could be placed and compacted to achieve the required permeability. Delhur increased the first lift loose thickness from ten inches to twelve inches for the second test fill, and used the same equipment to compact the material as was used on the first test fill. Four, one-way passes with the compactor were used to compact the soil. The compacted thickness of the second test fill was eight to nine inches. GCS personnel performed two moisture-density tests on the subgrade prior to the construction of the second test fill, and performed four moisture-density tests and one side-by-side rubber balloon moisture-density test on the admix in the second test fill. A Shelby tube sample was obtained from the second test fill. The permeability test result on this sample was 5×10^{-8} cm/s, meeting the specification's permeability requirement and is consistent with the results of the permeability tests performed on lifts 2 through 6 from the first test fill.

In addition to the permeability tests performed on the Shelby tube samples, a permeability test was performed on a laboratory-recompacted sample of the soil liner material. The results of this test are indicated a permeability comparable to that indicated

by the tests on samples from lifts two through six in the first test fill. The results of the permeability tests on the Shelby tube samples and the recompacted sample are presented in Table U-4.

4.2 SDRI Test Results

The SDRI was monitored on a daily basis when it was initially installed. Daily readings include the water level in the outer ring, the amount of water infiltration in the inner ring, the water temperature, and the tensiometer readings. A swell survey was incorporated to check the inner ring of SDRI for vertical swell due to the potential swelling of the admix. No swelling of the admix was detected. The SDRI test was run for 124 days.

The depth of the wetting front was not detected by the shallowest of the tensiometers which were installed at a six-inch depth, as evidenced by the soil suction indicated by the vacuum readings on the gauges, so the depth of the wetting front was less than six inches. In order to determine the depth of the wetting front, samples of the soil liner material were collected at one-inch intervals to a depth of six-inches. The oven-dried moisture contents of these samples were determined and compared to moisture contents measured during construction. The moisture contents of the samples from the 0- to 1-inch interval, 1- to 2-inch interval, and the 2- to 3-inch interval were significantly greater than those measured during construction (greater than three standard deviations above the mean value). The moisture content of the sample from the 3- to 4-inch interval was slightly higher than the range of moisture content measured during construction. Therefore, the depth to the wetting front was conservatively determined to be 3.5 inches. The final moisture contents of the test fill are shown in Appendix U-2.

The permeability of the test fill based on the data from the SDRI test was determined based on the following relationship:

$$K = I/i \quad \text{where,} \quad \begin{array}{l} K = \text{Permeability} \\ I = \text{Infiltration Rate} \\ i = \text{Hydraulic Gradient} \end{array}$$

The SDRI test results are summarized in Appendix U-2. Infiltration rates of 1×10^{-6} to 2×10^{-8} cm/s were measured during the duration of the test. The highest infiltration rates were measured during the first week of the test. The cumulative infiltration rate for the 124 day duration of the test was 6×10^{-8} cm/s.

The hydraulic gradient was determined by the following relationship:

$$i = (D + h)/D \quad \text{where,} \quad \begin{array}{l} i = \text{Hydraulic Gradient} \\ D = \text{Depth to the Wetting Front} \\ h = \text{Depth of Ponded Water} \end{array}$$

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The depth of ponded water throughout the SDRI test was twelve inches. The depth of the wetting front was measured directly from the test fill based on the soil moisture contents and was determined to be 3.5 inches.

Based on the data from the SDRI test, the calculated permeability of the test fill, using the cumulative infiltration rate over the 124-day test period, was 1.4×10^{-8} cm/s. This represents a conservative estimate of the test fill permeability because, the cumulative infiltration rate and not the final infiltration rate (3×10^{-8} cm/s) was used and we did not include soil suction, as measured by the tensiometers, in the determination of the hydraulic gradient.

5. CONCLUSION

The proposed material and placement and compaction procedures should result in a uniform soil liner that meets the performance specifications for Non-Drag-Off. The first lift of the admix should be increased to a twelve-inch loose lift thickness, and should be compacted by four passes of the 825-C compactor. The construction of the second test fill demonstrated that this procedure could achieve the required compaction and permeability of the soil liner. The placement and compaction of the first lift should be monitored closely, especially on the slopes of the excavation so that the soil liner material is not contaminated by incorporation of the subgrade material. The contractor is planning on placing the material in a downhill direction. In the event that contamination of the first lift occurs, the contractor will be required to remove and replace the contaminated material, and will be required to change his procedures, possibly placing the material in an uphill direction.

Subsequent lifts of the soil liner should be placed in maximum loose-lift thicknesses of ten inches or less, and the compacted thickness of these lifts should not exceed six inches. If the compacted lift thicknesses exceed six inches, the contractor will be required to decrease the loose-lift thicknesses of these lifts from ten inches to eight inches. A total of six lifts must be placed and compacted. Four passes of the 825-C compactor should be used to compact each lift.

The contractor should adjust the water feed rate for the pug mill as necessary to compensate for drying of the admix material. The target moisture content of the first test fill was approximately 19.5 percent, and drying of the admix was apparent as the construction of the test fill proceeded.

TABLES

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TABLE U-1

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TEST FILL - SDRI EQUIPMENT SUMMARY

EQUIPMENT	FUNCTION
Pug Mill (Owner Fabricated)	Admixing of natural soils with bentonite
Caterpillar 988 Front-End Loader	Hauling admix from stockpile to test fill
Caterpillar D-5 LPG Dozer	Spreading admix on test fill lifts
Caterpillar 825-C Tamping Foot Compactor	Compacting admix lifts of test fill
RayGo Rascal 410A Smooth Drum Vibratory Compactor	Final surface prep for final lift of test fill
Water Truck	Moisture conditioning of subgrade
Troxler 3440 Nuclear Moisture-Density Gauge	Moisture-density testing of the compactive effort applied to the subgrade and each lift of the test fill
Rubber Balloon Density Apparatus	Correlation of the nuclear moisture-density gauge
Travtwein Sealed Double-Ring Infiltrometer (SDRI) (12'x12' outer ring, 5'x5' inner ring)	In-situ permeability testing of the test fill compacted admix

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TABLE U-2

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SOIL-BENTONITE ADMIX LABORATORY TESTING SUMMARY
(Admix Produced By Pug Mill)

BENTONITE PROPERTIES					
Property	Lab Result	Specification	API Specification		
Free Swell	25 ml	25 ml	24 ml minimum		
Wet Screen	2.6%	N/A	4% maximum		
Moisture	7.3%	N/A	N/A		
Filtrate	15 ml	N/A	15 ml maximum		
Marsh Funnel	69 s				
API Spec = American Petroleum Institute Specification for 91 Barrel yield Bentonite:					
ADMIX PROPERTIES					
Sample	Soil Description	Maximum Dry	Optimum	Percent	Percent
TXS-1	Sand for Admix	N/A	N/A	20.2%	2.0%
TX-1	Pug Mill	108.2 pcf	17.5%	30.5%	10.4%

CALCULATIONS:

Given: 30.5 percent of the Admix (A) passes the #200 Sieve.
20.2 percent of the sand (S) passes the #200 sieve.

Assume: 100 percent of the bentonite (B) passes the #200 Sieve.

Find: The percentage of the sand and bentonite components of the admixture based on the dry weights of the materials.

Solution: Based on the percentages of the components (A, S, and B) passing the #200 Sieve, the percentages of sand and bentonite in the admix can be determined as follows:

$$(B \times \% \text{ passing } \#200) + (S \times \% \text{ passing } \#200) = (A \times \% \text{ passing } \#200)$$

$$(B \times 100) + (S \times 20.2) = (A \times 30.5) = 100B + 20.2S = 30.5A$$

A = 100 percent of the Admix; and
Bentonite (B) + Sand (S) = 100 percent of the Admix
So $B + S = 100$; and $S = 100 - B$

Therefore:

$$100B + (20.2 \times (100 - B)) = 100 \times 30.5$$

$$100B + 2020 - 20.2B = 3050$$

$$B = 12.91$$

Answer: The bentonite comprises 12.91 percent of the admix.

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TABLE U-3

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TEST FILL MOISTURE-DENSITY TEST SUMMARY

Lift Number	Number of Tests Performed	Number of Passes with Compactor	Average Percent Compaction (1)	Average Moisture Content (%) (2)
1	7	2	93.7	19.4
1	6	4	94.7	19.1
1	6	6	96.6	19.1
2	6	2	95.1	19.2
2	6	4	96.7	19.1
2	6	6	97.0	18.9
3	6	4	95.2	19.2
4	3	4	97.0	18.5
5	3	4	96.3	18.9
6	3	4	96.9	18.5
Second Test Fill Constructed on October 20, 1993 (One Lift, 12 Inch Loose Lift Thickness)				
1	4	4	92.6	22.2

- Notes: 1. Percent of maximum dry density as determined by ASTM D 698.
 2. Percent moisture content as determined by ASTM D 2216.

May 13, 1994

TABLE U-4

933-1354

TEST FILL SHELBY TUBE SAMPLE TEST RESULTS

Sample No.	Lift	No. of Compactor Passes	Moisture Content (%)	Percent Over Optimum Moisture Content	Dry Density (pcf)	Percent Compaction	Perm (cm/s)	LL	PL	PI
TX-1	N/A	N/A	20.0	2.5	102.9	95.1	6×10^{-4}	N/A	N/A	N/A
TF-18	1	6	19.0	1.5	103.4	95.5	1×10^{-3}	25	24	1
TF-33	2	6	19.0	1.5	103.4	95.6	6×10^{-4}	45	21	24
TF38	3	4	19.0	1.5	102.8	95.0	5×10^{-4}	N/A	N/A	N/A
TF-46	4	4	18.7	1.2	105.4	97.4	4×10^{-4}	N/A	N/A	N/A
TF-49	5	4	19.2	1.7	102.4	95.9	5×10^{-4}	N/A	N/A	N/A
TF-49A	5	4	19.3	1.8	104.5	96.6	4×10^{-4}	N/A	N/A	N/A
TF-50	6	4	18.8	1.3	105.1	97.6	3×10^{-4}	N/A	N/A	N/A
TF2-2	1	4	22.0	4.5	100.7	93.1	5×10^{-4}	N/A	N/A	N/A

- Notes: 1. Sample TX-1 is a recompact laboratory sample.
 2. Sample TF2-2 shelly tube taken from second test fill, one lift thick.

FIGURES

FIGURE U-1
INFILTRMETER SCHEMATIC
DOE/NDOWA

Golder Construction Services

Explanation

- + Approximate Subgrade Moisture-Density Test Location
- ▣ Approximate Lift 1 Moisture-Density Test Location
- Approximate Lift 2 Moisture-Density Test Location
- Approximate Lift 3 Moisture-Density Test Location
- ◆ Approximate Lift 4 Moisture-Density Test Location
- ▲ Approximate Lift 5 Moisture-Density Test Location
- Approximate Lift 6 Moisture-Density Test Location

FIGURE U-2
TEST FILL MOISTURE-DENSITY TEST LOCATIONS
DOE/NDO r /WA

Explanation

+ Approximate Subgrade Moisture-Density Test Location

⊞ Approximate Liff 1 Moisture-Density Test Location

FIGURE U-3
TEST FILL No. 2 MOISTURE-DENSITY TEST LOCATIONS
DOE/NDO CQA/WA

Golder Associates

933-1354

U-22

APPENDIX U-1
SUMMARY OF MOISTURE-DENSITY TESTING

GOLDER CONSTRUCTION SERVICES INC.
SUMMARY OF SOIL LINER MOISTURE-DENSITY TESTS
DEPARTMENT OF ENERGY
NON-DRAG OFF LANDFILL FACILITY
HANFORD NUCLEAR RESERVATION
SECONDARY SOIL LINER
TEST FILL

933-1354

05/12/94

Page 1

TEST NUMBER	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED TEST VALUES					NOTES
		NORTH	EAST	LIFT	DRY	FIELD	DRY	LAB	PERCENT	PASS		
		COORDINATE	COORDINATE	No.	DENS. (pcf)	MOIST (%)	DENSITY (pcf)	MOIST (%)	COMPACTION	or FAIL		
TF-001	10/06/93	37.9	7.0	1	105.7	17.9	n/a	19.8	96.1	Pass	n/a	
TF-002	10/06/93	13.8	11.6	1	103.2	19.1	n/a	19.5	95.1	Pass	n/a	
TF-003	10/06/93	9.0	21.2	1	98.9	19.7	n/a	20.2	91.0	Pass	n/a	
TF-004	10/06/93	15.6	39.1	1	101.4	19.3	n/a	19.5	93.7	Pass	n/a	
TF-005	10/06/93	31.5	23.6	1	100.0	18.0	n/a	18.2	92.3	Pass	n/a	
TF-006	10/06/93	47.3	12.7	1	99.4	18.6	n/a	19.1	91.5	Pass	n/a	
TF-007	10/06/93	42.0	41.1	1	104.6	18.8	n/a	19.3	96.3	Pass	n/a	
TF-008	10/06/93	29.8	5.8	1	103.7	18.6	n/a	18.8	95.7	Pass	n/a	
TF-009	10/06/93	4.2	9.1	1	103.6	16.8	n/a	19.2	93.7	Pass	n/a	
TF-010	10/06/93	4.1	60.2	1	100.8	19.5	n/a	19.7	93.0	Pass	n/a	
TF-011	10/06/93	14.9	28.7	1	102.7	17.2	n/a	19.1	93.4	Pass	n/a	
TF-012	10/06/93	38.8	15.4	1	102.6	16.8	n/a	19.0	93.1	Pass	n/a	
TF-013	10/06/93	42.7	33.6	1	108.3	17.5	n/a	18.7	99.0	Pass	n/a	
TF-014	10/06/93	46.9	13.6	1	102.4	16.4	n/a	19.4	92.3	Pass	n/a	
TF-015	10/06/93	36.6	64.9	1	106.9	18.7	n/a	19.1	98.5	Pass	n/a	
TF-016	10/06/93	17.6	3.7	1	104.8	18.8	n/a	18.9	96.8	Pass	n/a	
TF-017	10/06/93	7.2	15.4	1	105.5	18.9	n/a	19.0	97.5	Pass	n/a	
TF-018	10/06/93	14.6	37.8	1	103.5	18.9	n/a	19.0	95.5	Pass	SHELBY	
TF-019	10/06/93	30.7	27.0	1	107.4	17.2	n/a	19.1	97.7	Pass	n/a	
TF-019RB	10/06/93	30.7	27.0	1	107.1	n/a	n/a	19.1	99.0	Pass	n/a	
TF-020	10/06/93	42.0	42.5	2	102.2	19.2	n/a	19.5	94.2	Pass	n/a	
TF-021	10/06/93	41.1	29.9	2	103.4	18.9	n/a	19.5	95.1	Pass	n/a	
TF-022	10/06/93	19.9	26.3	2	103.4	18.0	n/a	19.2	94.7	Pass	n/a	
TF-023	10/06/93	17.6	14.8	2	101.8	19.1	n/a	18.9	94.3	Pass	n/a	
TF-024	10/06/93	30.9	11.0	2	104.1	19.0	n/a	19.2	96.1	Pass	n/a	
TF-025	10/06/93	12.8	38.8	2	104.6	18.4	n/a	19.0	96.1	Pass	n/a	
TF-026	10/06/93	43.1	42.8	2	105.9	18.6	n/a	19.7	97.0	Pass	n/a	
TF-027	10/06/93	61.8	23.2	2	104.0	19.5	n/a	18.8	96.6	Pass	n/a	
TF-028	10/06/93	27.1	10.4	2	104.3	19.0	n/a	19.3	96.1	Pass	n/a	
TF-029	10/06/93	10.9	15.6	2	105.2	18.4	n/a	19.2	96.6	Pass	n/a	
TF-030	10/06/93	15.1	31.3	2	107.6	17.5	n/a	19.1	98.2	Pass	n/a	
TF-031	10/06/93	7.8	39.6	2	102.2	20.1	n/a	18.6	95.7	Pass	n/a	
TF-032	10/06/93	25.3	39.0	2	104.4	19.5	n/a	19.2	96.8	Pass	n/a	
TF-033	10/06/93	32.0	28.6	2	103.3	19.2	n/a	19.0	95.6	Pass	SHELBY	
TF-034	10/06/93	20.3	26.6	2	107.2	18.1	n/a	18.5	98.7	Pass	n/a	
TF-035	10/06/93	40.0	8.4	2	105.7	16.8	n/a	18.5	96.2	Pass	n/a	
TF-036	10/06/93	13.9	13.0	2	106.3	17.8	n/a	19.1	97.2	Pass	n/a	

WHC-SD-W025-RPT-001, Rev. 0

GOLDER CONSTRUCTION SERVICES INC.

SUMMARY OF SOIL LINER MOISTURE-DENSITY TESTS

DEPARTMENT OF ENERGY

NON-DRAG OFF LANDFILL FACILITY

HANFORD NUCLEAR RESERVATION

SECONDARY SOIL LINER

TEST FILL

933-1354

05/12/94

Page 2

TEST NUMBER	DATE	TEST LOCATION INFORMATION			TROXLER		LABORATORY CALCULATED				PASS or FAIL	NOTES
		NORTH COORDINATE	EAST COORDINATE	LIFT No.	DRY DENS. (pcf)	FIELD MOIST (%)	DRY DENSITY (pcf)	LAB MOIST (%)	PERCENT COMPACTION			
TF-037	10/06/93	8.0	35.0	2	106.2	18.1	n/a	19.0	97.4	Pass	n/a	
TF-037RB	10/06/93	8.0	35.0	2	105.0	n/a	n/a	19.0	97.0	Pass	n/a	
TF-038	10/06/93	39.5	25.1	3	103.7	18.0	n/a	19.0	95.0	Pass	SHELBY	
TF-039	10/06/93	27.9	9.4	3	103.8	18.8	n/a	19.9	95.1	Pass	n/a	
TF-040	10/06/93	4.1	15.5	3	104.6	18.3	n/a	19.3	95.8	Pass	n/a	
TF-041	10/06/93	17.6	21.8	3	104.5	18.7	n/a	19.9	95.6	Pass	n/a	
TF-042	10/06/93	13.4	43.2	3	104.2	18.8	n/a	19.3	95.8	Pass	n/a	
TF-043	10/06/93	28.4	42.1	3	104.2	17.6	n/a	18.0	95.9	Pass	n/a	
TF-043RB	10/06/93	28.4	42.1	3	101.4	n/a	n/a	18.0	93.8	Pass	n/a	
TF-044	10/06/93	30.6	39.7	4	105.5	17.0	n/a	18.8	96.1	Pass	n/a	
TF-045	10/06/93	23.0	19.3	4	106.1	17.5	n/a	18.1	97.5	Pass	n/a	
TF-046	10/06/93	12.8	11.2	4	104.8	18.5	n/a	18.7	96.7	Pass	SHELBY	
TF-046RB	10/06/93	12.8	11.2	4	105.4	n/a	n/a	18.7	97.4	Pass	n/a	
TF-047	10/06/93	18.1	35.8	5	106.4	17.6	n/a	18.8	97.4	Pass	n/a	
TF-048	10/06/93	16.4	17.6	5	105.6	17.6	n/a	18.6	96.8	Pass	n/a	
TF-049	10/06/93	40.4	11.5	5	104.4	18.5	n/a	19.2	95.9	Pass	SHELBY	
TF-049R	10/06/93	40.4	11.5	5	105.3	18.4	n/a	19.3	96.6	Pass	SHELBY	
TF-049RB	10/06/93	40.4	11.5	5	102.4	n/a	n/a	19.2	94.7	Pass	n/a	
TF-050	10/06/93	8.9	31.0	6	105.2	18.6	n/a	18.8	97.1	Pass	SHELBY	
TF-051	10/06/93	9.3	7.6	6	104.8	18.4	n/a	19.0	96.4	Pass	n/a	
TF-052	10/06/93	56.2	19.0	6	105.5	17.9	n/a	17.7	97.6	Pass	n/a	
TF-052RB	10/06/93	56.2	19.0	6	105.1	n/a	n/a	17.7	97.1	Pass	n/a	
TF-053	10/07/93	29.4	17.3	4	105.9	17.9	n/a	19.0	96.9	Pass	n/a	
TF-054	10/07/93	27.8	24.1	5	105.6	18.4	n/a	18.6	97.5	Pass	n/a	
TF-055	10/07/93	23.1	7.7	6	106.2	18.2	n/a	19.2	97.3	Pass	n/a	
TF-055RB	10/07/93	23.1	7.7	6	105.5	n/a	n/a	19.2	97.5	Pass	n/a	
TF2-1	10/20/93	535.9	514.1	1	100.5	21.9	n/a	22.3	91.9	Pass	n/a	
TF2-2	10/20/93	517.6	514.8	1	101.8	20.8	n/a	22.0	92.4	Pass	n/a	
TF2-3	10/20/93	508.7	545.0	1	101.1	20.7	n/a	22.2	91.7	Pass	n/a	
TF2-3RB	10/20/93	508.7	545.0	1	98.8	n/a	n/a	22.2	90.6	Pass	n/a	
TF2-4	10/20/93	532.7	540.0	1	101.6	21.8	n/a	22.4	92.8	Pass	n/a	
TF2SG-1	10/20/93	504.0	543.1	n/a	103.5	5.2	n/a	7.0	93.4	Pass	n/a	
TF2SG-2	10/20/93	517.5	519.7	n/a	102.2	4.4	n/a	8.4	90.4	Pass	n/a	
TSG-01	10/04/93	33.7	16.3	n/a	108.3	12.5	n/a	13.9	98.1	Pass	n/a	
TSG-02	10/04/93	36.1	40.2	n/a	109.8	13.7	n/a	16.8	98.1	Pass	n/a	
TSG-03	10/04/93	12.3	39.7	n/a	103.3	11.5	n/a	13.4	93.2	Pass	n/a	
TSG-04	10/04/93	8.3	7.2	n/a	105.5	10.4	n/a	10.1	97.1	Pass	n/a	
TSG-05	10/04/93	24.6	17.2	n/a	106.1	11.7	n/a	13.1	96.2	Pass	n/a	
TSG-05RB	10/04/93	24.6	17.2	n/a	105.6	n/a	n/a	13.1	96.9	Pass	n/a	

NOTES

- (1) Test numbers with prefixes of TSG indicate density tests on the subgrade of the first test fill.
- (2) Test numbers with prefixes of TF2SG indicate density tests on the subgrade of the second test fill.
- (3) Test numbers with prefixes of TF indicate density tests on the soil liner in the first test fill.
- (4) Test numbers with prefixes of TF2 indicate density tests on the soil liner in the second test fill.
- (5) Test numbers with suffixes of RB indicate rubber balloon density tests.
- (3) Test numbers with suffixes of R indicate a recompacted perm test location.

APPENDIX U-2
SDRI TEST INFORMATION

U-2.i

NON-DRAG-OFF SDRI TEST RESULTS

Project W-025

GCS Project No. 933-1354

DATE	INTERVAL TIME (s)	CUMULATIVE TIME (s)	CUMULATIVE DAYS	INTERVAL FLOW (ml)	CUMULATIVE FLOW (ml)	INTERVAL INFILTRATION (cm/s)
08 Oct 93	6360	6360	0.07	187	187	1.27E-06
08 Oct 93	11640	18000	0.21	4	191	1.48E-08
09 Oct 93	58800	76800	0.89	786	977	5.76E-07
09 Oct 93	27900	104700	1.21	77	1054	1.19E-07
10 Oct 93	98220	202920	2.35	247	1301	1.08E-07
11 Oct 93	52260	255180	2.95	158	1459	1.30E-07
12 Oct 93	87300	342480	3.96	335	1794	1.65E-07
13 Oct 93	100380	442860	5.13	275	2069	1.18E-07
14 Oct 93	71100	513960	5.95	295	2364	1.79E-07
15 Oct 93	85920	599880	6.94	166	2530	8.32E-08
17 Oct 93	169800	769680	8.91	269	2799	6.82E-08
18 Oct 93	86040	855720	9.90	130	2929	6.51E-08
19 Oct 93	97020	952740	11.03	361	3290	1.60E-07
20 Oct 93	84060	1036800	12.00	140	3430	7.17E-08
21 Oct 93	79560	1116360	12.92	261	3691	1.41E-07
22 Oct 93	91680	1208040	13.98	180	3871	8.45E-08
22 Oct 93	16740	1224780	14.18	36	3907	9.26E-08
25 Oct 93	249720	1474500	17.07	544	4451	9.38E-08
26 Oct 93	82020	1556520	18.02	356	4807	1.87E-07
27 Oct 93	77100	1633620	18.91	101	4908	5.64E-08
28 Oct 93	92580	1726200	19.98	93	5001	4.33E-08
29 Oct 93	80820	1807020	20.91	160	5161	8.52E-08
30 Oct 93	95820	1902840	22.02	132	5293	5.93E-08
31 Oct 93	86280	1989120	23.02	107	5400	5.34E-08
01 Nov 93	92580	2081700	24.09	568	5968	2.64E-07
02 Nov 93	81060	2162760	25.03	107	6075	5.68E-08
03 Nov 93	89160	2251920	26.06	126	6201	6.08E-08
04 Nov 93	77400	2329320	26.96	226	6427	1.26E-07
05 Nov 93	94380	2423700	28.05	157	6584	7.16E-08
08 Nov 93	256140	2679840	31.02	538	7122	9.04E-08
09 Nov 93	86340	2766180	32.02	100	7222	4.99E-08
10 Nov 93	96180	2862360	33.13	110	7332	4.92E-08
13 Nov 93	244680	3107040	35.96	245	7577	4.31E-08
16 Nov 93	278820	3385860	39.19	552	8129	8.52E-08
19 Nov 93	244140	3630000	42.01	329	8458	5.80E-08
22 Nov 93	265260	3895260	45.08	177	8635	2.87E-08
24 Nov 93	174600	4069860	47.10	215	8850	5.30E-08
29 Nov 93	420360	4490220	51.97	361	9211	3.70E-08
03 Dec 93	369000	4859220	56.24	430	9641	5.02E-08

933-1354

U-2-1

NON-DRAG-OFF SDRI TEST RESULTS

Project W-025

GCS Project No. 933-1354

DATE	INTERVAL TIME (s)	CUMULATIVE TIME (s)	CUMULATIVE DAYS	INTERVAL FLOW (ml)	CUMULATIVE FLOW (ml)	INTERVAL INFILTRATION (cm/s)
07 Dec 93	329700	5188920	60.06	421	10062	5.50E-08
11 Dec 93	344760	5533680	64.05	440	10502	5.49E-08
15 Dec 93	353040	5886720	68.13	313	10815	3.82E-08
19 Dec 93	350100	6236820	72.19	576	11391	7.08E-08
22 Dec 93	249300	6486120	75.07	157	11548	2.71E-08
29 Dec 93	591300	7077420	81.91	429	11977	3.12E-08
04 Jan 94	532200	7609620	88.07	191	12168	1.55E-08
11 Jan 94	612600	8222220	95.16	546	12714	3.84E-08
19 Jan 94	684900	8907120	103.09	717	13431	4.51E-08
27 Jan 94	689400	9596520	111.07	721	14152	4.50E-08
04 Feb 94	682200	10278720	118.97	523	14675	3.30E-08
09 Feb 94	451800	10730520	124.20	299	14974	2.85E-08

NON-DRAG-OFF SDRI TEST
CUMULATIVE INFILTRATION VS TIME

NON-DRAG-OFF SDRI TEST
PERMEABILITY VS. TIME

DRAWINGS

p of Slope

Explanation

- ◆ 15H Repair Number and Approximate Repair Location (repairs shown as dots are not to scale; the lengths of the repairs shown as bold lines are to scale)
- 01A Repair Number, Destructive Sample Number and Approximate Sample Location (not to scale)
- S-001 Secondary Panel Number and Approximate Location of Panel

SECONDARY HDPE GEOMEMBRANE LINER AS-BUILT
DOE/NDO/WA

SHEET S1

Golder Construction Services

pe

Explanation

15H Repair Number and Approximate Repair Location (repairs shown as dots are not to scale; the lengths of the repairs shown as bold lines are to scale)

01A Repair Number, Destructive Sample Number and Approximate Sample Location (not to scale)

001 Primary Panel Number and Approximate Location of Panel

Truck Staging Area Panels

WORLD SYSTEMS INC.

INTERNAL LAYOUT

= BILL OF MATERIALS ITEM NO.

ETL 508 LISTED INDUSTRIAL CONTROL EQUIPMENT

EMS INC.

36 (206) 775-5696

INGTON

DESIGN: V. WILSON
DRAWING: V. WILSON

PUMP CONTROL PANEL
PANEL LAYOUT AND SCHEDULE
HANFORD RMW LAND DISPOSAL FACILITY

DATE: 11/03/93
DRAWING NO.: 3225001
SHEET: 51

12/27/93	AS BUILT	A-VW			
	V-11				
		REVISIONS			

TECHNICAL SYS
2303 196TH SW #B LYNNWOOD, WA

HANFORD, WAS

CP-42
CP-43
CP-44

NOTES: - DENOTES BILL OF MATERIALS ITEM NO.
 - DENOTES FIELD TERMINAL
--- - DENOTES FIELD WIRING

TEMS INC.
(206) 775-5696

NGTON

DESIGN V. WILSON
DRAWN V. WILSON
JRT
ELECTRIC

PUMP CONTROL
WIRING DIAGRAM
HANFORD RMW LAND DISPOSAL FACILITY

DATE 11/03/93
DRAWING NO. 3225003
SHEET E3

Item	Qty	Tag	Mfr. Part	Description
1	1		A-36H30BLP	ENCLOSURE, NEMA 3,4,12,13 SI
2	1		A-30P30	EQUIPMENT MOUNTING PANEL,
3	1		9001SK11BH13	2-POSITION SELECTOR SWITCH
4	1		9001KN745BP	BLACK LEGEND PLATE; WHITE L
5	4		9001KN760BP	BLACK LEGEND PLATE; WHITE L
6	4		9001KSS43BH13	3-POSITION SELECTOR SWITCH;
7				
8	11		9001KXTA1RH1	PILOT LIGHT; 120 VAC TRANSFOR
9	3		9001KXTA1AH1	PILOT LIGHT; 120 VAC TRANSFOR
10	1		HKP-HH	FUSE HOLDER
11	1		ABC-3	TIME-LAG SMALL DIMENSION FU
12	1		TSI-BRACKET	FUSE BRACKET
13	1		5800-I	TWO OUTLET RECEPTACLE, 125V
14	1		4A238	ELECTRICAL STEEL BOX FOR ITEM
15	1		884	24 HOUR / 7DAY TIMESWITCH, 120
16	1		RTEP11AC120V	RELAY TIMER, 120VAC, SPDT, 10A
17				
18				
TECHNICAL SYSTEMS INC.				HANFORD RMW LAND DISPOS
LYNNWOOD, WASH. 206-775-				Pump Control Panel

11-Jan-94

V-12

	Mfr.	Vendor	PO #
E DOOR, SIZE 36x30x8, ANSI 61 GREY	HOFFMAN	STUSSER	25795
ERIOR OF ITEM 1, PAINTED GLOSS WHITE	HOFFMAN	STUSSER	25795
INTAINED; GLOVE HAND KNOB; 2-NC, 2-NO	SQUARE D	STUSSER	25795
RONG (ON/OFF)	SQUARE D	STUSSER	25795
RONG (HAND/OFF/AUTO)	SQUARE D	STUSSER	25795
INTAINED; GLOVE HAND KNOB; 2-NC, 2-NO	SQUARE D	STUSSER	25795
R TYPE; PUSH TO TEST; (2) RED	SQUARE D	STUSSER	25795
R TYPE; PUSH TO TEST; (2) AMBER	SQUARE D	STUSSER	25795
	BUSSMAN	ICC	STOCK
3A	BUSSMAN	ICC	STOCK
	TSI	TSI	STOCK
15A	LEVITON	GRAINGER	STOCK
3	RACO	GRAINGER	STOCK
C, SPDT, 10 AMPS	DIEHL	ICC	25797
	IDEC	ICC	STOCK
FACILITY	JOB 3225		

Item	Qty	Tag	Mfr. Part	Description
19	3		8501X020V02	CLASS 8501 MACHINE TOOL RE
20	1		9T58L2911	ISOLATION TRANSFORMER, ENC
21	2		PD690	DIGITAL PROCESS CONTROL PA
22	6		RH2B-U	RELAY, 2PDT, 120VAC COIL
23	6		SH2B-05	RELAY SOCKET FOR ITEM #22
24	3		RH4B-UL	RELAY, 3PDT, 120VAC COIL
25	3		SH4B-U	RELAY SOCKET FOR ITEM #24
26	5		RR3B-UL	RELAY, 4PDT, 120VAC COIL
27	5		SR3B-05	RELAY SOCKET FOR ITEM #26
28	2		1492-H4	FUSED TERMINAL BLOCK, 100-30
29	1		1492GH150	CIRCUIT BREAKER, 120VAC, 15A
30	5		8WA10110DF21	TERMINAL BLOCK, 750VAC, 22-10
31	2		575	SUBMERSIBLE LEVEL TRANSMITT
32	2		2900	FLOAT SWITCH, N.O. CONTACTS, 3
33	1		2903	FLOAT SWITCH, N.C. CONTACTS, 3
34				
TECHNICAL SYSTEMS INC.				HANFORD RMW LAND DISPOS
LYNNWOOD, WASH. 206-775-				Pump Control Panel

11-Jan-94

	Mfr.	Vendor	PO #
, 120VAC, 2 CONVERTIBLE CONTACTS	SQD	STUSSER	25795
PSULATED, 120VAC. 300VA	GE	ICC	25797
L METER, NEMA 4, 2 RELAY, 4-20 MA IN	PREC.DIG.	SEAPORT	25802
	IDEC	ICC	STOCK
	IDEC	ICC	STOCK
	IDEC	ICC	STOCK
	IDEC	ICC	STOCK
	IDEC	ICC	STOCK
AC, 30A, #18-8 AWG	AB	N COAST	STOCK
	AB	N COAST	STOCK
G, 10 EA./BLOCK	SIEMENS	ICC	STOCK
12-40VDC, 4-20 MA, 0-6 PSI	AMETEK	TECH CONT	25804
/, 2 A	CONERY	CROWN	25798
/, 2 A	CONERY	CROWN	25798
FACILITY	JOB 3225		

P13
709.94
600
708.62

CP14

+ W 78900
+ N 44300

Cor

[illegible]

W 78300
N 44300

+

PERMIT SURVEYING INC.
6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691

DATE: 10/15

SCALE: 1" =

DRAWN BY:

APPROVED BY:

3392

WHC-SD-WO

W 78300
N 44000

SHEET
1
OF **6** SHEETS

WHC-SD-W025-RPT-001, Rev. 0

W 78900
+ N 44300

+

CP14

CP13

C

+ 712.06
1604

+ 710.43
1601

+ 707.72
1119

+ 713.11
1621

+ 706.15
1126

+ 713.13
1624

+ 705.96
1144

+ 700.12
1142

+ 701.80
1159

+ 713.17
1625

+ 705.95
1166

+ 697.65
1168

+ 713.12
1627

+ 705.92
1190

+ 697.58
1191

+ 713.09
1641

+ 705.90
1199

+ 697.56
1200

+ 713.17
1649

+ 705.98
1220

+ 697.66
1219

CP12

C-11

+ 702.55 1614									
+ 702.29 1118	+ 702.24 1613	+ 702.03 1611	+ 701.70 1609	+ 701.37 1607	+ 701.18 1606	+ 700.61 1608	+ 6 1		
+ 693.96 1140	+ 693.93 1138	+ 693.93 1136	+ 693.91 1135	+ 693.93 1134	+ 693.96 1131				
+ 685.61 1162	+ 685.58 1160	+ 685.60 1157	+ 685.61 1155	+ 685.58 1153	+ 685.58 1151				
+ 677.25 1185	+ 677.22 1183	+ 677.26 1182	+ 677.22 1181	+ 677.25 1179	+ 677.23 1178	+ 677.2 1184			
+ 673.76 1630	+ 673.17 1631	+ 672.54 1637	+ 671.88 1636	+ 671.29 1635	+ 670.81 1629				
+ 673.40 1209	+ 672.87 1208	+ 672.17 1207	+ 671.60 1206	+ 670.97 1205	+ 670.31 1204				
+ 672.87 1224	+ 672.21 1225	+ 671.52 1226	+ 671.03 1227	+ 670.40 1750	+ 668.25 1229	+ 666.31 1749			
+ 673.52	+ 672.94	+ 672.27	+ 671.69	+ 670.89	+ 670.45				

OPD

CP10

W 78300
N 44300

PERMIT SURVEYING INC.
6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691

DATE: 11/17/

SCALE: 1" =

DRAWN BY: (

APPROVED BY:

3392

**DMIX AS-BUILT
L FACILITY
OFF
025
WASHINGTON**

NOTE:
SURVEY PERFORMED 11/15 THRU 11/17 AND

5 THRU 11/17 AND 11/19 1993

W 78300
N 44000

SHEET
2
OF 6 SHEETS

3392SADM.DWG PLOTTED: 4/28/94

.3392

CP13

CP14

W 78900
N 44300

+

+

+

+

TOE OF

CP10

W 78300
+ N 44300

+

Control Line

+

CP15

CP16

GRAPHIC SCALE

1 inch = 20 ft.

W 78900

N 44000

PERMIT SURVEYING INC.

**6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691**

DATE: 1/11/94

SCALE: 1"=20'

DRAWN BY: C.O.

APPROVED BY:

3392

+

CP16

+

CP17

NC.
222
3

DATE:	1/11/94
SCALE:	1"=20'
DRAWN BY:	C.O.
APPROVED BY:	
	3392

**TOP OF SECONDARY GRAV
RMW LAND DISPOSAL F
NON-DRAG-OFF
PROJECT W-025**

HANFORD

676.32 2747	675.83 2667	675.22 2668	675.04 2673	674.57 2669	674.33 2674	673.9 2670	673.7 2675	673.3 2671	673.1 2676	672.7 2672	672.5 2677
----------------	----------------	----------------	----------------	----------------	----------------	---------------	---------------	---------------	---------------	---------------	---------------

**RY GRAVEL AS-BUILT
SPOSAL FACILITY
RAG-OFF
CT W-025
WASHINGTON**

NOTE:
SURVEY PERFORMED 1/14 1994

67 26 67 26 67 26 67 26

PERFORMED 1/14 1994

W 78300

N 44000

SHEET

3

OF **6** SHEETS

3392

WHC-SD-W025-RPT-001, Rev. 0

CP13

C

CP14

W 78900

N 44300

CP12

+

+

+

+

TOE OF SLOPE

72	+ 676.15	+ 675.46	+ 674.82	+ 674.27	+ 673.60	+ 673.04
0	5209	5208	5207	5206	5205	5204

10	+ 675.46	+ 674.85	+ 674.24	+ 673.68	+ 672.98	+ 671.44
3	5224	5225	5226	5227	5750	5229

669.7
565

669.7
565

75	+ 676.11	+ 675.48	+ 674.86	+ 674.27	+ 673.64	+ 672.99
	5240			5240

CP10

CP9

W 78300
N 44300

C

CP8

PERMIT SURVEYING INC.
6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691

DATE:	1/06/9
SCALE:	1"=20'
DRAWN BY:	C.C.
APPROVED BY:	
3392

+

CP 16

△

CP 17

+

INC.
222
3

DATE:	1/06/94
SCALE:	1"=20'
DRAWN BY:	C.O.
APPROVED BY:	
	3392

**TOP OF PRIMARY ADMIX
RMW LAND DISPOSAL F
NON-DRAG-OFF
PROJECT W-025**

HANFORD

**MIX AS-BUILT
AL FACILITY
OFF
-025**

WASHINGTON

NOTE:
SURVEY PERFORMED 1/19 THRU 1/20/19

PERFORMED 1/19 THRU 1/20/1994

W 78300
N 44000

SHEET
4
OF 6 SHEETS

3392PDM.DWG PLOTTED: 4/28/94

WHC-SD-W025-RPT-001, Rev. 0

3392

+ W 78900
+ N 44300

CP14

CP13

+ 715.50
HDPE PIPE

+ 715.46
HDPE PIPE

LEG:

LEGEND

----- 4" HDPE PERFORATED PIPE

————— 4" HDPE NON-PERFORATED PIPE

+ 715.56
HDPE PIPE

+

Control Line

+

CP15

GRAPHIC SCALE

1 inch = 20 ft.

+ W 78900

+ N 44000

+

CP15

PERMIT SURVEYING INC.
6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691

DATE:	1/24/9
SCALE:	1"=20'
DRAWN BY:	C.C.
APPROVED BY:	
3392

ICB'S

C. 22

DATE:	1/24/94
SCALE:	1"=20'
DRAWN BY:	C.O.
APPROVED BY:	
	3392

HANFORD

**TOP OF PRIMARY GRAVEL
RMW LAND DISPOSAL F.
NON-Drag-Off
PROJECT W-025**

**GRAVEL AS-BUILT
POSAL FACILITY
RAG-OFF
T W-025**

WASHINGTON

NOTE:
SURVEY PERFORMED 2/01/1

NOTE:
SURVEY PERFORMED 2/01/1994

ER - NON PERFORATED

699.31
HDPE PIPE

C

CP8

C27

N

SCALE 1" = 20'

699.77
HDPE PIPE

+ W 78300

+ N 44000

700.16
HDPE PIPE

SHEET

5

OF

6

SHEETS

WHC-SD-W025-RPT-001, Rev. 0

3392

3392PCRV.DWG PLOTTED: 4/28/94

W 79000
+ N 44400

+

+

711.12

712.00

713.16

714.00

714.00

+

+

PERIMETER ROAD

ABBREVIATIONS

AP	=	ANGLE POINT
EP	=	EDGE PAVEMENT
EB	=	EDGE ASPHALT BERM
LOW PT.	=	LOW POINT
MID	=	MIDDLE POINT
PC	=	POINT OF CURVE
POC	=	POINT ON CURVE
PT	=	POINT OF TANGENT
TB	=	TOP OF ASPHALT BERM

W 78200

N 44400

W 79000
+ N 44000

714.00

713.76

PERMIT SURVEYING INC.
6515 West Clearwater Suite 222
Kennewick, Washington 99336
509 783-4691

DATE: 1/25

SCALE: 1"

DRAWN BY:

APPROVED BY:

3392

ING INC.
 Suite 222
 99336

DATE: 1/25/94

SCALE: 1"=30'

DRAWN BY: C.O.

APPROVED BY:

3392

HANFORD

**TOP OF OPERATIONS
 RMW LAND DISPO
 NON-DRA
 PROJECT**

NOTE:

SURVEY PERFORMED 2/14 THRU 2/15 AND 3/10, 3-23 1994
 SURVEY REVISED 2/25/1994
 REVISED: POINTS 4157, 4631, 4642, 4644, 4672, 4682
 SURVEY REVISED 3/28/1994 : TRUCK STAGING AREA ADDED
 SURVEY REVISED 6/22/1994 : TRUCK STAGING AREA
 REVISED: POINTS 4810, 4817, 4825-4829,
 AND ADDED ASPHALT BERM.