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TRANSMITTAL OF RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL SOIL-GEOSYNTHETIC INTERFACE DIRECT SHEAR TESTING REPORT

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DOE-FEMP EPAS
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RESPONSES

Department of Energy

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JAN 22 1997

DOE-0383-97

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Thomas Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-291112

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL SOIL-GEOSYNTHETIC INTERFACE DIRECT SHEAR TESTING REPORT

Enclosed are the responses to comments from the Ohio Environmental Protection Agency (OEPA) on the Draft *Final Soil-Geosynthetic Interface Direct Shear Testing Report*. The draft final report was approved by the U.S. Environmental Protection Agency (U.S. EPA) without comments on January 16, 1997.

Please contact Rod Warner at (513) 648-3156 if there are any questions regarding this transmittal.

Sincerely,

Johnny W. Reising
Fernald Remedial Action
Project Manager

FEMP:Warner

Enclosure: As Stated

cc w/enc:

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RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS
DRAFT FINAL SOIL-GEOSYNTHETIC
DIRECT SHEAR TESTING REPORT

1. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: General Pg #: Line #: Code: C
Original Comment #: 1

Comment: Information on GCL performance relative to the first exposure of actual hydrating liquids should be included. What types of leachate or site groundwater is expected to hydrate the GCL and how will this effect performance? What would be the effect on the shear strength results if the test specimens were soaked in representative leachate (rather than water) prior to testing?

Response: It is expected that significant hydration of the GCL could only occur from exposure to water used in the moisture conditioning of the clay layer or rainwater from precipitation events during the construction of the liner system. Tap water is appropriate for hydration of test specimens because it is representative of both rainwater and water to be used for moisture conditioning of the clay layer (OSDF specifications require that water used for moisture conditioning be obtained from a designated source which will be the site potable water system). The potential for hydration of the GCL by leachate is not considered significant because such hydration could only occur at defects in the overlying geomembrane and could therefore affect only very localized areas, Hydration in very localized areas is not expected to have any adverse effect on the shear strength parameters evaluated in this testing program.

Action: No action required.

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2. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: Appendix A Pg. #: 410 Line #: Note 7 Code: c
Original Comment #: 2

Comment: The frictional characteristics of some geosynthetics are dependent on the shear direction. What analyses were conducted to determine if a direction bias exists?

Response: The interface direct shear tests were conducted with the direction of shear in the geosynthetic machine direction. Based on the expected method of geosynthetic

installation during construction, this is the primary direction of possible interface slippage for the final cover system and the liner system. A possible exception is for the case of the liner system during impacted material placement (interim conditions). Slope stability calculations for these interim conditions have shown that the minimum factor of safety significantly exceeds the target value of 1.3 when the strength values measured in the interface direct shear tests are used. Therefore, any influence of direction of shear on the interface shear strengths would have to be large to significantly affect the results of the interim slope stability analyses. Such large influences are not expected for the geosynthetic materials in the liner system (i.e., geomembranes, nonwoven geotextiles, and GCLS).

Action: No action required.

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3. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: General Pg. #: Line #: Code: C
Original Comment #: 3

Comment: The conclusions section states that "an assessment of the laboratory testing conditions that form an appropriate basis for design" was conducted. However, it remains unclear what field values the test variables are being compared to. The text should more clearly state what steps were taken to insure that the conditions reproduced in the laboratory are consistent with expected field conditions, specifically the modes of failure expected in the field.

Response: The scope of the laboratory testing program, as described in Section 2.1 of the Soil-Geosynthetic Interface Direct Shear Testing Work Plan (SGIWP), includes those interfaces for which site-specific data are required and those for which existing data are considered insufficient for design. It is important to note that the interfaces tested are the ones that will lead to the lowest factors of safety for slope stability. With respect to the modes of failure expected in the field, the interface shear tests were set up so that the test specimens would fail at the intended interfaces. The mechanical set-up of the testing apparatus prevents any other failure mode.

The "assessment of the laboratory testing conditions that form an appropriate basis for design" that is presented in Chapter 5 of the laboratory testing report provides the specific testing condition variables (shear rate, clay compaction conditions, etc.) used to evaluate appropriate interface shear strengths for design.

These conditions were shown to be either realistic or conservative approximations of the conditions expected in the field.

Action: No action required.

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4. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: General Pg. #: Line #: Code: C
Original Comment #: 4

Comment: Please explain the QA/QC procedures for retesting or eliminating test outliers. For example, if one or more of the tests conducted at different normal compressive stresses were inconsistent with previous results.

Response: The majority of the direct shear test series (i.e., 19 out of 22 series) consisted of three independent direct shear tests of individually constructed samples, each conducted at a different normal stress. A straight line representing the shear strength parameters was fitted through the three data points from each test series. The individual tests results were then considered, with respect to the fitted line, to see if any of the three tests did not correlate with the other two and was potentially erroneous. Any potentially erroneous tests would have been rerun. This procedure, which relies on the experience of the laboratory professionals, was used in the absence of specific guidance in the testing standard.

It is noted that no potentially erroneous test results were identified using this procedure. Therefore, no test data was discarded and no tests were rerun.

Action: No action needed.

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5. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 3.2 Geosynthetic and Soils Materials Pg. #: 3.1 Line #: Code: C
Original Comment #: 5

Comment: It is our understanding that shear tests are very material specific. In performing the tests only on the materials listed in this section, DOE has significantly narrowed the potential list of liner materials to be used in the landfill. Are these all of the materials in consideration, or will tests be performed an the final design after all vendors and materials have been selected?

Response: The geosynthetic and soil materials included in the testing program are representative of typical commercially available products. Therefore, the measured shear strengths should be achievable by the majority of products that would be considered for use in construction. In any case, the OSDF technical specifications contain requirements that the GCL and geomembrane to be used for construction will be tested to verify that they have adequate interface shear strength.

Action: No action needed.

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6. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 3.2 Geosynthetic and Soils Materials Pg. #: 3-1 Line #: Code: C
Original Comment #: 6

Comment: Only two HDPE geosynthetics, both GSE materials, were retained for testing in this study. Are these the same two GSE materials that were tested in the compatibility study? The names given for the materials are not the same as in the compatibility test document.

Response: The two textured HDPE geomembranes used in the interface direct shear testing program were manufactured by GSE. The two smooth HDPE geomembranes that were tested in the compatibility testing program are also GSE products. The product referred to as HD textured geomembrane in the interface testing program is manufactured in the same manner as the product referred to as blown film (GSE-Gundle) in the compatibility testing program. The product referred to as Hyperflex Frictionflex geomembrane in the interface testing program is manufactured in the same manner as the product referred to as cast extrusion (GSE-SLT) in the compatibility testing program.

Action: No action needed.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 3.3 Soil Characterization Tests Pg. #: 3-4 Line #: Code: C
Original Comment #: 7

Comment: In describing soil sample selection, clay soil samples to be used for this study were screened so the Plasticity Index exceeded 17 for clay soil and exceeded 30 for supplemental clay soil. Where did these guidelines for Plasticity Index come from?

Response: The plasticity index guidelines for the clay soils used in the interface testing program are described in Section 2.3 of the SGIWP.

Action: No action needed.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 3.4.2 Testing Procedures Pg. #: 3-19 Line #: Code: C
Original Comment #: 8

Comment: In Test Series Number 7, 8, and 12 through 22B, the procedure for placing the clay soil or supplemental clay soil is given as compaction by hand tamping to the reported dry unit weight for each normal stress condition. How will the level of compaction be verified? The level of compaction will affect the results of the test, and there must be some way of monitoring this before the testing is performed.

Response: The compaction conditions (i.e., dry unit weight and moisture content) for the clay soil component of the test specimens are controlled by using premeasured weights of moisture-conditioned soil and compacting a specimen of predetermined thickness in the direct shear box. After specimen preparation, a small amount of the clay is taken for a moisture content to verify that the compaction conditions were as intended. The actual compaction conditions are reported in Table 3-5 of the testing report.

Action: No action needed.

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9. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5 Pg. #: 5-1 Line #: NA Code: C
Original Comment #: 9

Comment: The sensitivity analyses performed relative to shear rates includes an evaluation of rates that are ten times faster, but does not include rates that are slower (i.e., less than 0.1 mm/min). The sensitivity analysis should include an evaluation of rates on either side of the selected value.

Are the shear tests performed at the slower 0.1 mm/min rate considered drained or undrained tests? How does this effect the test results ?

Response: The shear displacement rate recommended in the ASTM testing standard is 1.0 mm/min. The testing program was performed using a reference shear displacement rate ten times slower (0.1 mm/min). Comparison of test results for different shear displacement rates, as reported in Table 5-1 of the testing report, indicated that the result of changing the rate by a factor of ten was an average increase of four percent in the measured shear strengths. Based on this observed small effect of shear displacement rate, it was judged that tests at even slower rates would not result in significantly different measured shear strengths. Furthermore, the average trends indicated that slower rates would produce higher strengths.

The measured shear strengths from the tests performed at 0.1 mm/min. are considered representative of drained tests based on the observation mentioned above that shear strengths from tests run at slower rates would not be expected to produce significantly different strengths.

Action: No action needed.

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10. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5-2 Effect of Shear Displacement Rate Pg. #: 5-1 Line #: Code: C
Original Comment #: 10

Comment: The conclusion reached about the summary of the shear displacement rate tests is that the slower rate tends to have a higher shear strength. However, the results on Table 5-1 indicate this is true for two of the three interfaces tests. Is it possible that this trend is material specific? Can we safely draw the conclusions about this trend based on testing of three material interfaces?

Response: The reported trend that slower shear rates produce higher shear strengths in interface testing with GCLs and compacted clays is consistent with typically observed trends. It is noted that the reported comparison case where the opposite trend was observed involved a GCL type (Claymax) without a needlepunched structure. The testing report (Section 5.5.5) recommends that GCLs of this type not be used for construction.

Action: No action needed.

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11. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5.2 Effect of Shear Displacement Rate Pg. #: 5-1 & 5-2 Line #: Code: C
Original Comment #: 11

Comment: In the conclusion to this section, the slower shear rate is chosen as the design basis; however, this gives the highest shear strength of the two rates tested. It would be more conservative to use the lower of the two shear strengths, or the higher of the two shear rates.

Response: The slower shear rate is chosen as the design basis because longer shear times are more representative of conditions in the constructed facility where interface shear stresses will develop over time periods measured in years. It is also noted that the measured strengths for the two shear displacement rates differ, on average, by only four percent.

Action: No action needed.

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12. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 5.4 Pg. #: 5-6 Line #: NA Code: c
Original Comment #: 12

Comment: Sensitivity analyses were conducted for shear displacement rate, clay compaction conditions, and clay plasticity. The cumulative effect of varying these parameters was not considered. What would be the cumulative effect under the worst case scenario for each variable?

Note that summing the individual results with no retesting will likely not give the same result as an actual test.

Response: The measured average variations in shear strength due to shear rate, clay compaction conditions, and clay plasticity were 4 percent, 10 percent, and 15 percent, respectively. The approach followed is that the possibility that these relatively small variations will act cumulatively in the least favorable manner is small and would potentially exist only in localized areas. Therefore, rather than analyzing for the worst possible combination, the slope stability analyses consider generally average conditions and apply factors of safety that have been shown to produce safe slopes. This approach is consistent with standard geotechnical engineering practice for slope stability analyses.

Action: No action needed.