Designation: D6141 – 14

Standard Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids[1]

This standard is issued under the fixed designation D6141; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers procedures and test methods that can be used in the evaluation of the ability of the clay portion of a geosynthetic clay liner to resist change due to exposure to liquids. These liquids may come from a site, or be generated in a laboratory from a site-specific soil.

1.2 The scope of this guide is limited to short-term screening and is not intended to replace evaluation procedures that measure a performance property such as EPA 9100, Test Method D6766, or *other* suitable ASTM standards as they become available. This guide does not address potential adverse effects of wet-dry cycling.

1.3 This guide applies to the clay component of a GCL. The synthetic carrier components are covered independently as described in Practice D5322.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D4439 Terminology for Geosynthetics

D5322 Practice for Laboratory Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids

D5887 Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter

D5890 Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners

D5891 Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

D6072/D6072M Practice for Obtaining Samples of Geosynthetic Clay Liners

D6766 Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Aqueous Solutions

2.2 *EPA Document:*[3]

EPA Test Method 9100 Saturated Hydraulic Conductivity, Saturated Leachate Conductivity, and Intrinsic Permeability

3. Terminology

3.1 *Definitions:*

3.1.1 *geosynthetic clay liner (GCL), n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetics.

3.2 For definitions of other terms used in this guide refer to Terminologies D4439 and D653.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *test liquid, n—within this guide*, a liquid either supplied to, or obtained by the testing laboratory, or generated by the testing laboratory through prolonged contact of a reagent with a test soil or other solid material.

4. Significance and Use

4.1 This guide is intended as a starting place for those wishing to investigate the chemical compatibility of the clay portion of a geosynthetic clay liner to test liquids. Within the scope of this guide, the clay portion of a geosynthetic clay liner that is chemically compatible with a test liquid may be expected to maintain its swelling characteristics. Conversely, the clay portion of a geosynthetic clay liner that is incompatible

[1] This guide is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.04 on Geosynthetic Clay Liners.

Current edition approved July 1, 2014. Published July 2014. Originally approved in 1997. Last previous edition approved in 2009 as D6141 - 09. DOI: 10.1520/D6141-14.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20004, http://www.epa.gov.

with a test liquid may be expected not to maintain its swelling characteristics. In instances where the compatibility of the clay portion of a GCL is questionable, additional hydraulic testing under the expected site conditions may be warranted.

5. Apparatus

5.1 Refer to the appropriate evaluation test standards for a description of the apparatus necessary to perform those tests.

5.2 *Containers,* manufactured of a chemically resistant material, such as polyethylene or stainless steel, *may* be needed to prepare and contain test liquid generated from soils. The containers should be sealable to prevent the loss of volatile constituents. Separate containers will be needed for mixing batches and storing the test liquid for the tests.

5.3 *Mixer, motor driven,* capable of forming a slurry of the soil and the leaching fluid.

NOTE 1—It may be impossible to mix some soils to the extent previously described. In such cases, other means of exposing the soil to the leaching fluid should be agreed upon between the parties involved.

6. Sampling

6.1 Test liquid or soil samples from a site should be representative of the whole.

NOTE 2—Materials that contain or are suspected to contain hazardous constituents shall be handled in accordance with all applicable federal and state guidelines.

NOTE 3—The amount of test liquid needed will depend upon the number of tests to be performed. It is estimated that 2 L will be sufficient for a single series of tests. The amount of soil needed will depend upon number of tests to conduct and the suggested mixing ratio stated in 7.2.

6.2 Sample the geosynthetic clay liner in question in accordance with Practice D6072/D6072M.

6.3 Sample the clay portion of the geosynthetic clay liner in accordance with Test Methods D5890 and D5891.

6.4 Sample the geosynthetic clay liner in question in accordance with Test Method D6766.

7. Procedure for Generating a Test Liquid from a Soil

7.1 Prior to generating the test liquid, the testing laboratory shall note the general appearance of the soil.

NOTE 4—In noting the general appearance of the soil, important observations may include, but are not limited to, color, odor, and visual estimate of gradation (for example, sand, clay, or gravel).

7.2 Place a portion of the soil into the mixing container. The amount of soil will depend upon the amount of liquid required to complete the evaluation. Add to the mixing container an amount of distilled water equal to twice the apparent volume (bulk volume) of the soil.

NOTE 5—It is recognized that other solutions may be applicable and more desirable than distilled water as the leaching fluid for the soil. In such cases, the nature of the leaching fluid should be agreed upon by the requestor.

7.3 Mix the soil and the distilled water (or other leaching fluid) to form a slurry.

7.4 Cover the mixing container such that the escape of volatile constituents is prevented, and allow the mixture to condition for a minimum of 24 h. Other conditioning periods are allowed upon agreement by the requestor. Agitate the mixture periodically during the conditioning period by rotating the container.

7.5 Following the conditioning period, carefully decant the test liquid from the mixing container into a sealable storage container. It is necessary to filter the test liquid prior to the evaluation.

8. Evaluating the Clay Portion of the Geosynthetic Clay Liner

8.1 Conduct baseline testing of the clay portion of the geosynthetic clay liner for fluid loss and swell index in accordance with Test Methods D5890 and D5891.

8.2 Conduct another series of tests for fluid loss and swell index in accordance with Test Methods D5890 and D5891, utilizing either a site-specific liquid, or a test liquid generated from a soil.

NOTE 6—If the site liquid or laboratory-generated test liquid is not transparent enough to allow the level of swell to be determined in accordance with Test Method D5890, then Test Method D5891 becomes the sole screening tool.

8.3 Record the results of both sets of tests in accordance with the referenced test methods.

NOTE 7—GCLs are manufactured with powder or granular bentonite, whereas the Test Methods D5890 and D5891 are carried out with powdered bentonite (typically after grinding). It might be necessary to carry out Test Methods D5890 and D5891 with the bentonite particles as used in the GCL to create realistic data as occurring in field.

9. Evaluating the Index Flux of the Geosynthetic Clay Liner

9.1 Conduct baseline testing of the geosynthetic clay liner for index flux in accordance with Test Method D5887.

9.2 Conduct another test in accordance with Test Method D6766, utilizing either a site-specific liquid, or a test liquid generated from a soil.

9.3 Record the results of both sets of tests in accordance with the referenced test methods.

10. Evaluating the Results of the Test Methods

10.1 As a screening tool, this guide does not offer specific values for the fluid loss and swell index tests that the clay portion of a geosynthetic clay liner must meet or the index flux value of the GCL in order to be considered chemically compatible with the test liquid in question. However, it is suggested that differences between the results of the baseline tests and those conducted with the test liquid may warrant further hydraulic testing.

NOTE 8—Signs that the site-specific liquid or test liquid generated from a soil is having a deleterious effect on the clay portion of a geosynthetic clay liner may include, but are not limited to, an increase from the baseline in the value of fluid loss, resp. the index flux value and a decrease from the baseline in the value for swell index. (See Appendix X1).

11. Report

11.1 Report the following information:

11.1.1 A description of the geosynthetic clay liner used in the evaluation including type, source, and manufacturer's codes of product identification,

11.1.2 A description of soil or other site-specific test liquid involved,

11.1.3 Amount of soil, type of leaching fluid used, and conditioning time for the generation of the test liquid. The mixing and settling times, agitation procedure and periods, and filter type,

11.1.4 The results of the baseline tests and the tests conducted with the site-specific liquid, or test liquid generated from a soil,

11.1.5 Any and all visual observations of effects on the clay component of the GCL that may be useful in the interpretation of the results, and

11.1.6 Other reporting information not listed here, but as may be required by the referenced ASTM test methods.

12. Keywords

12.1 chemical compatibility; fluid loss; geosynthetic clay liner; leachate; swell index

APPENDIX

(Nonmandatory Information)

X1. RELATED REFERENCE MATERIALS

X1.1 References on North American Bentonite

X1.1.1 Jo, H. Y., Katsumi, T., Benson, C. H. and Edil, T. B., "Hydraulic Conductivity and Swelling of Nonprehydrated GCLs Permeated with Single-Species Salt Solutions," Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 7, ASCE, pp. 557-567.

X1.1.2 Kolstad, D. C., Benson, C. H. and Edil, T. B., "Hydraulic Conductivity and Swell of Nonprehydrated GCLs Permeated with Multi-Species Inorganic Solutions," Journal of Geotechnical and Geoenvironmental Engineering, Vol. 130, No. 12, p. 1236-1249. and Vol. 132, No. 7, p. 962.