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Standard Guide for Placement of ~~(Blind) Actual~~ Intentional Leaks During Electrical Leak Location Surveys of Geomembranes[1]

This standard is issued under the fixed designation D7909; 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 is for placing ~~(blind) actual~~ leaks in geomembranes before performing an electrical leak location survey. The geomembranes can be bare (not covered) or can be covered with water or moist soil.

1.2 This guide is intended to serve as an additional quality control/quality assurance (QC/QA) measure to ensure that leaks through the geomembrane are detectable, site conditions are proper for leak location surveys, and a valid and complete leak location survey is performed. Because various leak location practitioners use a wide variety of equipment to perform these surveys and have a wide range of expertise, placement of ~~actual~~ leaks by the owner or owner's representative helps ensure that the leak location survey is being performed correctly and completely.

1.3 Placing ~~actual~~ leaks should be done with the consent and knowledge of all involved parties and specifically the "owner" of the geomembrane. Geomembranes are typically purchased and installed by dedicated geosynthetic installers who "own" the geomembrane until the ownership gets transferred to the end user. A project meeting should be set up with the owner, the consultant, the geosynthetic installers, and the leak location contractor. The intention to ~~use actual~~ create leaks should be clearly stated by the owner or consultants or both, and the scope and number to be placed should be understood by all parties. The consultant should broadly identify to the lining contractor a location that can be easily repaired after the test. It is critical that all ~~actual~~ leaks be included on the liner documentation and repair record drawing.

1.4 Leak location surveys can be used on geomembranes installed in basins, ponds, tanks, ore and waste pads, landfill cells, landfill caps, and other containment facilities. The procedures are applicable for geomembranes made of electrically insulating materials. (**Warning—**The electrical methods used for geomembrane leak location could use high voltages, resulting in the potential for electrical shock or electrocution. This hazard might be increased because operations might be conducted in or near water. In particular, a high voltage could exist between the water or earth material and earth ground or any grounded conductor. These procedures are potentially very dangerous and can result in personal injury or death. The electrical methods used for geomembrane leak location should be attempted only by qualified and experienced personnel. Appropriate safety measures shall be taken to protect the leak location operators as well as other people at the site.)

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

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

[1] This guide is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

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1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4439 Terminology for Geosynthetics
D6747 Guide for Selection of Techniques for Electrical Leak Location of Leaks in Geomembranes
D7002 Practice for Electrical Leak Location on Exposed Geomembranes Using the Water Puddle Method
D7007 Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials
D7240 Practice for Electrical Leak Location Using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive-Backed Geomembrane Spark Test)
D7703 Practice for Electrical Leak Location on Exposed Geomembranes Using the Water Lance Method
D7953 Practice for Electrical Leak Location on Exposed Geomembranes Using the Arc Testing Method
D8265 Practices for Electrical Methods for Mapping Leaks in Installed Geomembranes

3. Terminology

3.1 *Definitions*—For general definitions used in this guide, refer to Terminology D4439.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 ~~*actual*~~*blind leak, n*—for the purposes of this guide, ~~an actual~~a blind leak is a circular hole in the geomembrane intentionally placed by the owner or owner's representative ~~to ensure that the site conditions are suitable for an electrical leak location survey. A blind actual leak is also referred to as an actual leak in this guide. One actual leak is used for equipment calibration and to gauge site-specific leak detection sensitivity before beginning~~ in a location unknown to the leak location ~~survey.~~practitioner.

~~3.2.2 *blind actual leak, n*—for the purposes of this guide, a blind actual leak is an actual leak created in a location unknown to the leak location practitioner.~~

3.2.2 *electrical leak location, n*—method that uses electrical current or electrical potential to detect and locate leaks in electrically isolating geomembranes.

3.2.3 *known leak, n*—for the purposes of this guide, a known leak is a circular hole in the geomembrane intentionally placed by the owner or owner's representative to ensure that the site conditions are suitable for an electrical leak location survey. One known leak is used for equipment calibration and to gauge site-specific leak detection sensitivity before beginning the leak location survey.

3.2.4 *leak, n*—for the purposes of this guide, a leak is any ~~unintended~~ opening, perforation, breach, slit, tear, puncture, crack, or seam breach in electrically isolating geomembranes.

3.2.4.1 *Discussion*—
Significant amounts of liquids or solids may or may not flow through a leak. Scratches, gouges, dents, or other aberrations that do not completely penetrate the geomembrane are not considered to be leaks.

4. Significance and Use

4.1 Geomembranes are used as low-permeability barriers to control liquids from leaking from landfills, ponds, and other containments. The liquids may contain contaminants that, if released, can cause damage to the environment. Leaking liquids can also erode the subgrade. Leakage can result in product loss or otherwise prevent the installation from performing its intended containment purpose. For these reasons, it is desirable that the geomembrane have as little leakage as practical.

4.2 Geomembrane leaks can result even when the quality of the subgrade preparation, the quality of the material placed on the geomembrane, and the quality of the workmanship are not deficient.

[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.

4.3 Electrical leak location methods are an effective final quality assurance (QA) measure to locate previously undetected leaks in electrically insulating geomembranes. Practices for these implementations are contained in Guide D6747 and Practices D7002, D7007, D7240, D7703, D7953, and D8265.

4.4 It is important to realize that the detection of leaks depends not only on the capabilities of the leak location equipment, procedures, and experience of the leak location practitioner, but also on local site conditions that are not under the control of the leak location practitioner. In particular, to detect a leak, there shall be an electrical conduction path through the leak and through the materials above and below the leak to allow sufficient electrical current through the leak for detection. Some site conditions, such as a leak not making contact with the subgrade, dry geotextile, or geocomposite above or below the leak; dry materials above or below the leak; degree of isolation between the materials above and below the geomembrane; and other factors, may preclude the detection of leaks. Therefore, the use of a properly placed ~~actual~~ leak is also a test of site preparations and conditions.

4.5 It is not necessarily proper to conclude that, if ~~an actual~~ a leak is not detected, a leak location survey using the proper relevant ASTM International standard has no validity. Other leaks that have more favorable local conditions and larger leaks may still be detected.

4.6 The importance of blind ~~actual~~ leaks is to provide an additional measure to assess whether the site conditions throughout the entire survey area are proper for a leak location survey and that the electric leak location survey is performed correctly and completely. The use of blind ~~actual~~ leaks provides: (*1*) a check that the equipment is operating properly, (*2*) a test for proper survey coverage, and (*3*) a check that all survey data (results) have been assessed to confirm a proper survey has been done. These all result in a high likelihood that significant-sized leaks are detected.

4.7 The placement of blind ~~actual~~ leaks should not replace hiring a reputable and qualified leak location practitioner to perform the electrical leak location survey. Many site-specific issues and technical limitations can preclude the detection of ~~actual~~ leaks, but a non-expert will find it difficult to impossible to determine whether the non-detection of ~~actual~~ leaks is due to survey performance errors or issues with site conditions. It is therefore important to achieve a satisfactory resolution to any issues with the non-detection of ~~actual~~ leaks but, much more importantly, to check leak location practitioner references and qualifications before hiring. In addition to checking references from previous clients, qualifications should include reports from at least three projects completed, similar in cross section to the proposed project, where ~~actual~~ leaks were found. The report output should provide indisputable evidence that the survey was performed effectively.

4.8 It is important to note that the placement of ~~actual~~ leaks may affect the sensitivity of the electrical leak location survey for geomembranes covered with soil or water or both. The placement of ~~actual~~ leaks larger than the leaks present in the lining system may preclude detection of those smaller leaks, especially for highly conductive cover materials.

5. Procedural Guidance for the Placement of ~~(Blind) Actual~~ Leaks

5.1 The ~~fact that actual leak(s) will be installed in the geomembrane,~~ project specification should include: who will install the leak(s), who will survey the ~~locations~~location(s) of the leak(s), and ~~finally~~ who will repair the ~~leaks~~ leak(s). This should be clearly described in the project specifications and understood by all affected parties so responsibilities and costs involved are fully ~~understood by all affected parties.~~ understood. This guide details the placement of one ~~actual~~ leak in a location known to the leak location ~~practitioner to~~ practitioner, referred to as a "known leak," to verify site-specific leak location survey functionality and optionally placing blind ~~actual~~ leak(s). For the geomembrane leak location survey and use of blind ~~actual~~ leaks to be decisive, the project specifications should also specify the relevant ASTM International standard procedures to be used to perform the geomembrane leak location survey (see 2.1).

5.2 Leak detection is dependent upon the site conditions at each leak. Site conditions that affect leak detection sensitivity (particularly for surveys with earth materials on the geomembrane, to some degree with surveys on bare geomembranes) include:

5.2.1 Having adequate moisture throughout the overburden material and near subgrade,

5.2.2 Moisture in the leak,

5.2.3 The presence of dry insulating materials such as geotextile or geonet in contact with the leak,

5.2.4 Contact of the geomembrane with the overburden and subgrade,

5.2.5 Degree of isolation of the overburden from earth ground or the conducting material under the geomembrane, and

5.2.6 The composition of the material in contact with the liner (large stones may bridge a leak).

5.3 Because of these varying site conditions, detecting a leak of the same size as the ~~actual leak~~ known or blind leak (or both) used to determine the leak detection sensitivity as specified in the ASTM International standards (see 2.1) could be problematic. Better leak detection sensitivity will be obtained at some locations, and worse leak detection sensitivity will be obtained at other locations. The specific guidelines for installing ~~actual~~ known and blind leaks are:

5.3.1 The ~~actual~~ leaks are to be constructed by drilling a hole with a minimum diameter of 1.0 mm for exposed geomembranes, 1.4 mm for a water-covered geomembrane, and 6.4 mm for an earthen-covered geomembrane. In no case shall the ~~actual~~ leaks measure larger than 40 mm in diameter. The ~~actual~~ leaks shall be installed the same day as the geomembrane installation, and as early as practical before the geomembrane leak location survey is performed so that the ~~actual~~ leaks will be exposed to the same conditions of rainfall, condensation, consolidation, and equilibrium as the rest of the geomembrane in the installation. If the ~~actual~~ leaks cannot be installed the same day as during geomembrane placement and installation, the diameters of the ~~actual~~ leaks shall be increased to twice the above-mentioned diameters. Specifically, the ~~blind actual~~ leak diameter would result in using a diameter of 12.8 mm for geomembranes that are to be covered with earth materials, 2.8 mm for geomembranes that are to be covered with water, and 2.0 mm for bare geomembranes.

5.3.2 For a double geomembrane system or underlying geosynthetic clay liner (GCL), procedures shall ensure that the drill bit does not damage the secondary geomembrane or GCL. The hole shall be drilled, and the drill bit moved forward and backward in the hole so the geomembrane material is removed rather than just displaced. (**Warning—**Because of the shock or electrocution hazard that may be involved with high voltage, do not attempt to drill the ~~(blind) actual~~ leak with the excitation power supply on or connected.)

5.3.3 Blind ~~actual~~ leaks are to be installed by the owner or a representative of the owner without revealing the locations to the leak location practitioner or others.

5.3.4 The locations of the ~~actual~~ known and blind leaks shall be documented using appropriate land-surveying methods so the leaks can be located for future repair.

5.3.5 The ~~actual~~ leaks shall be put in representative locations and not on wrinkles, areas of bridging, in fusion seams, or in other areas where the geomembrane is not in contact with the ~~subgrade.~~ subgrade or in areas to purposefully detract from detectability. They should not be placed within 5 m of the edge of the survey ~~area.~~area and should not be covered with something such as a piece of paper or sandbag.

5.3.6 The ~~actual~~ leaks shall be backfilled with a compaction representative of the rest of the installation. Ensure that any cavity made by the drill in the subgrade under the ~~blind actual~~ leak is filled with soil.

5.3.7 The number of placed ~~blind actual~~ leaks should be consistent with the size and complexity of the overall installation, as well as with the purposes for which the ~~blind actual~~ leaks are installed. The owner or owner's representative should consider the cost of installing, surveying, documenting, and repairing the ~~blind actual~~ leaks and the fact that a repair weld or patch of inferior integrity will replace an otherwise intact geomembrane.

5.4 In summary, for the leak location survey to detect the intentionally placed ~~actual~~ leaks successfully, the ~~actual~~ leaks should have conductivity through the openings; otherwise, they may not be detected. If the owner or owner's representative has their own independent leak location equipment, the ~~actual~~ leaks could be verified after they are placed.

5.5 The owner or owner's representative shall indicate the location of ~~one actual~~the known leak to the leak location practitioner, and this ~~actual~~ leak shall be used as an equipment functionality check and site condition assessment before beginning the leak location survey. For soil-covered geomembranes, this location may require excavation in order to electrically isolate the leak after the verification of functionality and before beginning the leak location survey. As a courtesy to the leak location survey practitioner, the owner or owner's representative should mention at the start of the survey that a blind ~~actual~~ leak has also been placed in accordance with this guide, if applicable.