FINAL VERSION

Guideline for Air Lance Testing of Fabricated Geomembrane Seams

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Introduction

Geomembranes have been used in a variety of containment applications, e.g., landfills, ponds, mining leach pads, and tanks, as a barrier material to prevent leakage to the environment. The seam between sheets constitutes a leakage source, thus once the geomembranes have been installed and seamed in the field it is required to verify the integrity of the seams. A variety of nondestructive and destructive tests have been developed to verify the integrity of the field seams. One nondestructive test is the Air Lance Test, which is a nondestructive-qualitative method for evaluating seam integrity and possible liquid migration. The Air Lance Test is based on the visual and/or sound effects produced by the injection of pressurized air through the sheets joints or voids when there is an opening. This test is recommended for the more flexible thermoplastic geomembranes, such as Polyvinyl Chloride (PVC), Reinforced Polypropylene (RPP), and Reinforced Polyethylene (RPE), and unreinforced thermoset elastomeric geomembranes such as Butyl rubber or EPDM rubber. This test can be used on all seam types, except extrusion-type welds. With respect to other commonly used nondestructive methods, e.g., Air Channel Evaluation of Dual Seamed Geomembranes (ASTM D5820), the Air Lance test can detect holes that are located outside of the air channel and the seam region. Figure 1 presents a geomembrane with a defect in the bottom sheet due to excessive pressure being applied to the nip rollers. This defect cannot be detected by the air channel test because it is outside of the air channel. Due to the economic cost of the equipment with respect to other nondestructive tests, the speed of the air lance procedure and the low labor intensity that it requires, the Air Lance Test is a widely used nondestructive test for evaluating the seam between geomembrane sheets.

This guideline provides some recommendations for the equipment, procedure, and reporting of the Air Lance test as a nondestructive method for the evaluation of field seams between the sheets of geomembranes because of the limited information included in ASTM D4437. ASTM D4437 presents a

brief description of a variety of nondestructive test methods but does not include “best practices” for these tests to facilitate their use in practice. This guideline is intended to present field personnel with some “best practices” for the air lance test to facilitate the nondestructive evaluation of the field seams. This guideline 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 guideline to establish appropriate safety.

Figure 1: Geomembrane defect below intact dual-track geomembrane seam under the salvage edge of the geomembrane. The Air Lance test is able to detect such defects located outside of the dual-track geomembrane seam even though the air channel passes the required pressure test according to ASTM D5820 or D7177.

Terminology

Some terms used in this guideline are defined herein and the other terms are defined in ASTM D4437 and ASTM D4439.

Air Lance: A hollow tube with an ell and orifice at the end as shown in Figure 2.

Figure 2: Air Lance equipment that attaches to air supply for testing

Geomembrane: Essentially impermeable geosynthetic material composed of one or more synthetic sheets.

Leak: for the purposes of this practice, a leak is any unintended opening, perforation, breach, slit, tear, puncture, crack, defect, or seam breach. 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 but they can be located, sometimes, paying close attention during the test to changes in sound and sheet movement. Type of leaks detected during an air lance survey include, but are not limited to, burns, circular holes, linear cuts due to nip rollers, seam defects, tears, punctures, and material defects.

Seam: the connection of two or more pieces of geomembrane material by mechanical, chemical, or fusion methods to provide the integrity of a single piece of the material.

Recommended Equipment

1. Electrical generators are used as a power supply for air pressure generation.

2. A suitable air compressor capable of generating a pressure of approximately 50 psi (345 kPa) at the air lance. Higher pressures can be used and are helpful in detecting leaks, but can damage the seam or the geomembrane sheet. Check the maximum pressure that can be applied according to the recommendations provided by geomembrane manufacturers.

3. An air lance wand of approximately 3 feet in length made of aluminum or plastic, and a discharge nozzle of 3/16 inch diameter with a pressure gauge capable of measuring the air flow at the tip. The nozzle is set at the end of the air lance wand.

4. An air hose to connect the air lance wand and discharge nozzle to the air compressor.

Recommended Test Procedure

1. Once the geomembrane sheets have been seamed, the air compressor is connected to the air lance wand and discharge nozzle with an air hose connection.

2. Hold the air lance at an inclination of 10 to 45 degrees with respect to the geomembrane surface. The air nozzle is manually operated and is directed towards the edge of the upper flap of the seam at a distance of ¼ to ½ inch, but not more than 2 inches, from the edge of the completed seam.

3. Stream air is injected through the nozzle perpendicularly to the edge of the seam following while closely monitoring of the backside of the sheet for any air penetration through the seam, loose edges, riffles, and/or noise. Any air penetration through the seams indicates an unbounded area within the seam or a defect in the underlying geomembrane. Both of the seam conditions are undesirable and further investigation of the seam in this area should be undertaken with the area eventually patched as discussed below.

4. In a seam area of some air penetration and/or noise detection, a flapping sound indicates an area of inadequate bonding and a whistling sound generally indicates a leak passageway through the weld.

5. For visual detection, air penetrating into the seam can be detected via the formation of veins or inflation of overlapping geomembranes along the seam zone.

6. The air lance technician should be closely followed by one or two technicians to mark and repair leaks. The portion of the seam is tested again after repairs to confirm elimination of any opportunity for leakage.

7. Once seam defects are repaired and re-tested, mark the repair locations with the date, the initials of Certified Quality Auditor (CQA) and a suitable mark that affirms repair location.

8. The area should be patched with a piece of new geomembrane material that extends at least six inches all around the leak or defect.

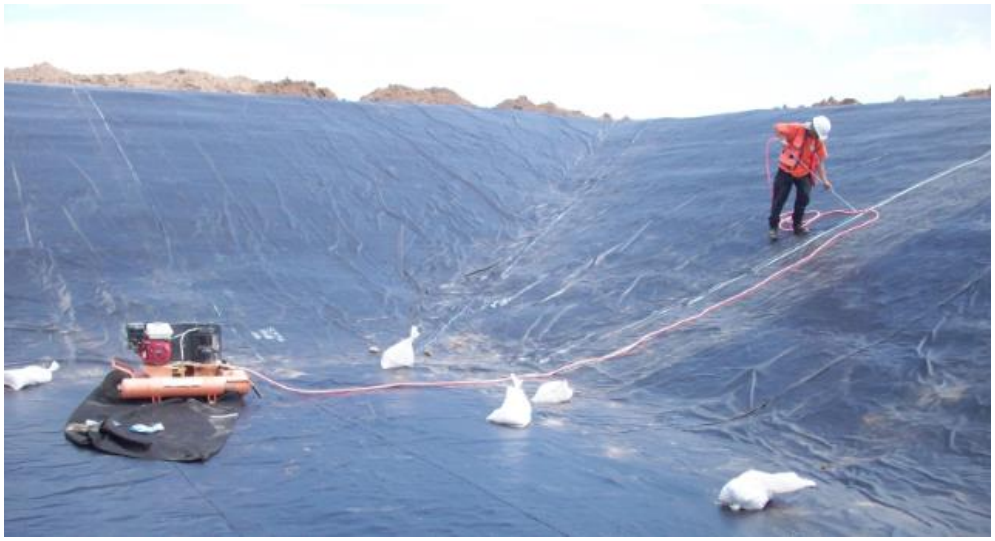

Figure 3: Performance of an air lance test on a sideslope in a geosynthetic lined pond.

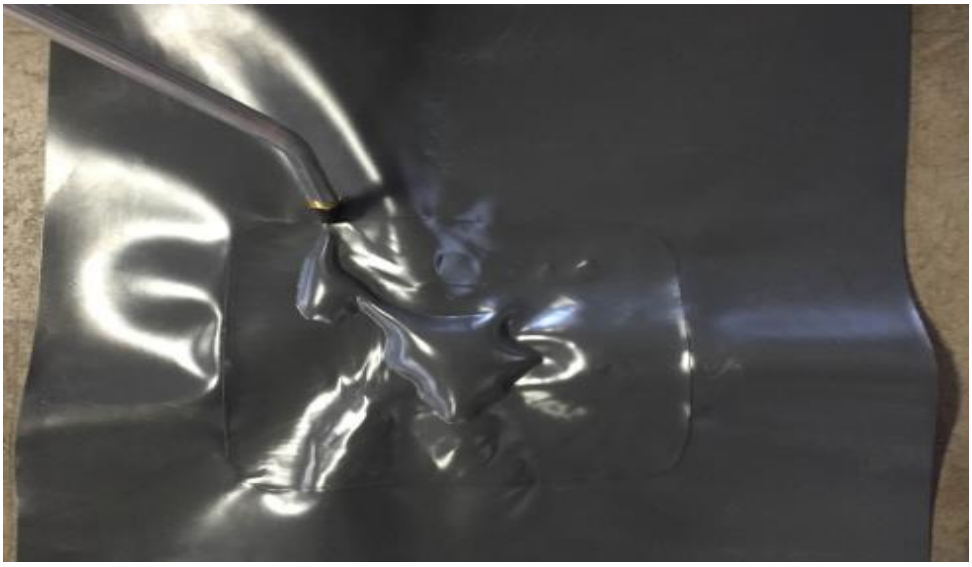

Figure 4: Performance of air lance test of a PVC patch that shows an aneurysm in the patch which means there is a leak.

Additional Recommendations:

The air pressure of approximately 50 psi has to be monitored during the test by periodically checking the air compressor pressure gauge, a gauge at or on the air lance and the diameter of the discharge nozzle, which has to be free of obstruction. In other words, the reliability of the test can be impacted by using an air pressure less than 50 psi from the air compressor or using a larger aperture for the discharge nozzle, both of which reduce the discharge pressure. The reliability can also be impacted by the improper use or aim of the nozzle which can reduce the pressure applied to the seam being tested. It is recommended to keep a record of the tested seams and those that need reparation.

CQA marks should be clear and limited to just the length of seam in question so an unaffected area is not patched. Also, usage of spray paint and wide swath markers to identify defective areas should be avoided because patches do not generally adhere well to paint, markers, or white-out materials.

Acknowledgments:

This guideline was prepared by Timothy D. Stark, Juan S. Lopez and Jagrat Jariwala, Professor and Graduate Students of the University of Illinois at Urbana-Champaign, respectively.

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