Monitoring Geomembrane Aging with Sacrificial Test Coupons

Written By Brian Fraser & Pat Elliott – November 15, 2026

As **geomembrane systems age**, their performance should be assessed periodically, particularly when the liner is exposed (without a soil cover) or when the consequences of leakage are significant. Historically, conventional aging assessments have relied on destructive sampling of the installed geomembrane, followed by complex field repairs. Sacrificial monitoring coupons offer a less intrusive, non-destructive alternative for evaluating geomembrane aging. During construction, coupons made from the same geomembrane are strategically installed at locations that represent service conditions, then retrieved at planned intervals for laboratory testing. When properly designed and documented, a coupon monitoring program can track trends in antioxidant depletion, surface degradation, and mechanical performance without cutting or disturbing the primary liner. For this reason, a sacrificial coupon program is recommended as part of the design, installation, and in-service monitoring of geomembrane containment systems.



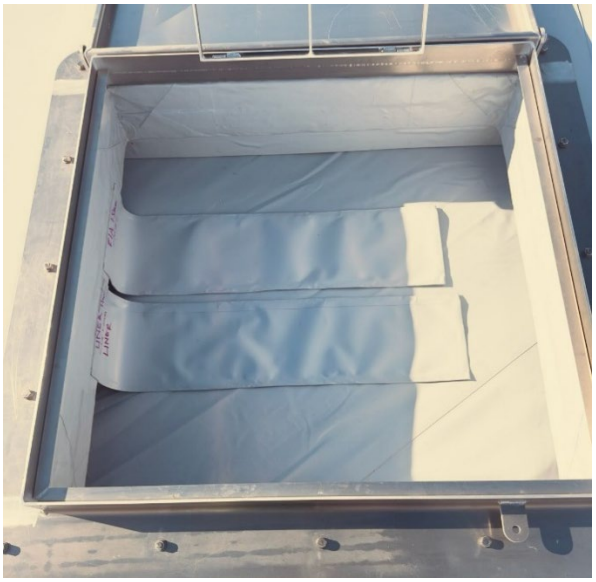
Photo showing sacrificial aging coupon frames installed on geomembrane lined slope

What Monitoring Aged Coupons Can Show

- **Site-specific exposure effects:** Accelerated laboratory aging is valuable for comparing materials and investigating degradation mechanisms, but it cannot reproduce every combination of temperature, ultraviolet radiation, chemical exposure, and mechanical stress encountered in service. Testing field-exposed coupons provides direct evidence of how the material is responding at a particular facility.
- **Antioxidant stabilization in polyolefins:** For polyethylene geomembranes, laboratories commonly use standard oxidative induction time (OIT) and high-pressure OIT tests to measure the stabilizer package. ASTM D3895 is used for standard OIT by polyolefins by differential scanning calorimetry and ASTM D5885/D5885M is used for high-pressure OIT testing of polyolefins using high pressure differential scanning calorimetry. The result is specific to the specimen and test conditions and should be interpreted as an indicator of stabilization not as a direct estimate of remaining service life.
- **Mechanical-property trends:** In geomembrane lifetime studies, **half-life** is commonly defined as the time required for a selected mechanical property, such as tensile strength or elongation at break, to decline to 50% of its initial value. This threshold marks the end of Stage 3 of the commonly cited three-stage degradation model. It is a benchmarking threshold rather than a universal definition of design service life or functional failure.
- **Physical material thickness:** Thickness measurements can identify material loss or localized thinning, but do not characterize polymer degradation by themselves. For exposed geomembranes, assess UV-related surface deterioration and changes in physical or mechanical properties. Reinforced geomembranes typically have thinner coatings and lamination and require evaluation of coating thickness and integrity, scrim encapsulation, ply adhesion strength, and any exposed or damaged reinforcement.

Developing a Testing Coupon Program

- **Material and baseline:** Coupons should be traceable to the installed geomembrane and, where practical, cut from the same production lot. Record the resin or product designation, roll and lot numbers, thickness, surface type, orientation, installation date, and relevant manufacturing test data. Retained unexposed material or initial test results provide an important baseline for later comparisons.
- **Size and quantity:** Each coupon must provide enough material for specimen preparation, conditioning, repeat testing, and chain-of-custody requirements. A coupon measuring approximately 300 mm × 600 mm (12 in. × 24 in.) may be adequate for a limited program, but the final dimensions and number of coupons should be confirmed



Geomembrane testing coupons installed in the hatch of a floating cover system in Australia

with the laboratory before installation. If seam condition and performance is important, install separate coupons containing representative field seams.

- **Exposure locations:** Place coupons where they represent the principal exposure zones and anticipated degradation mechanisms. Depending on the type of containment facility, locations may include above and below the operating liquid level, near inlets or process returns, on slopes with greater solar exposure, and near the upper berm or anchor trench. Use multiple coupons for each exposure condition so successive retrievals do not disturb material intended for later testing.
- **Installation and retrieval:** Coupons may be mounted on dedicated frames or secured at accessible monitoring points, provided the attachment and retrieval methods do not damage or compromise the containment system. The exposed face, orientation, depth, location, attachment method, and exposure history should be documented. Retrieval procedures must also address safe access and prevent contamination or unintended alteration of the specimen.



Geomembrane liner aging sample destructively removed for testing

- **Testing schedule:** Establish retrieval intervals during design stage based on geomembrane type, exposure severity, design life, consequence of failure, baseline properties, and expected degradation rate. A fixed rule, such as testing at one-half of the assumed service life, is not universally reliable. More severe service applications or high-consequence applications may warrant early baseline retrieval and shorter coupon testing intervals. For an exposed geomembrane with an anticipated 20 to 25 year surface life, five-year intervals may be a reasonable starting point, with more frequent testing as the liner approaches 15 to 20 years or if results indicate accelerating change.

Summary

A well-designed sacrificial coupon program provides a practical way to track site-specific geomembrane performance without repeatedly cutting and repairing the primary liner. Its value depends on representative placement, traceability to the installed material, reliable baseline data, planned retrieval intervals, and consistent laboratory testing. Results should be interpreted as trends in stabilization, physical condition, and mechanical performance rather than as a stand-alone prediction of remaining service life.

Coupon testing compliments but does not replace routine inspection, leak-detection information, operating records, and engineering evaluation. Considered together, these data can identify emerging deterioration, refine future monitoring intervals, and support timely decisions about maintenance, further investigation, or rehabilitation before containment performance is compromised.



Destructive removal of backfilled PVC material for age and performance testing – Colorado USA



PVC liner repair patch installed after aged sample removed for testing – Colorado USA.

Article Support References

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♦ Article Photos Courtesy of Colorado Lining and Layfield Geosynthetics