

FGI Webinar: Geomembranes for Produced Water and Brine Containment



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Presenters:

Brian Fraser

Senior Engineer at Layfield Group, specializing in geomembrane design and installation for produced water and brine containment. Extensive experience with double-liner systems and QA/QC protocols for industrial applications.

Greg Parent

Project Manager, Layfield Group, focused on large-scale containment projects including aboveground storage tanks (ASTs) and complex leak detection systems. Expertise in prefabricated geomembrane panels and site-specific adaptations.

Host: Dr. Timothy D. Stark

Professor of Civil Engineering, University of Illinois

Technical Director, Flexible Geomembrane Institute

1. Introduction & Key Concepts

Geomembranes serve as ultra-low permeability barriers (10^{-12} to 10^{-15} cm/s) critical for containment of produced water and brine, which are characterized by high salinity, hydrocarbons, and trace contaminants. Flexible geomembranes such as LLDPE, RPE, and PVC-Alloy are preferred for their multi-axial stress resistance and factory prefabrication capability, enabling high-quality field installations.

2. Design & Material Selection

Containment System Types

Application	Design Life	Liner Type	Key Features
Earth-Lined Ponds	5–25 years	Double-liner (LLDPE/RPE)	UV-stabilized, exposed surface
Aboveground Storage Tanks (ASTs)	<5 years	Prefab LLDPE (30–40 mil)	Modular, reusable
Large Concrete Tanks	25 years	Dual-liner + conductive geotextile	Spark-testable, high-capacity containment

Materials are selected based on chemical resistance (LLDPE/RPE excel in brine environments; HDPE preferred for UV exposure) and long-term durability tracked by Oxidative Induction Time (OIT) testing and sacrificial coupons.

Critical components include conductive geotextiles for leak detection, venting systems to prevent gas entrapment, and robust anchoring methods tailored via FGI’s anchor trench calculator.

3. Construction & QA/QC

Subgrade Preparation:

- Achieve ≥98% Proctor density with slopes ≤3:1; remove sharp protrusions.
- Anchor trenches designed per FGI guidelines to secure geomembranes.

Welding & Inspection Standards:

Method	ASTM Standard	Acceptance Criteria
Dual-track wedge weld	D4437	≤10% pressure drop in 5 minutes

Extrusion weld	D6392 / D7747	Peel/shear strength $\geq 90\%$ of parent
Vacuum testing	D7877	Ultrasonic detection of defects

Case studies highlighted a Colorado produced water pond (75,000 sf double-liner system), Australian LNG ASTs with conductive geotextile interlayers, and Arctic tanks operating at -40°F with heated leak detection.

4. Lessons Learned & Recommendations

- **Water Management:** Failures largely due to inadequate drainage; geocomposite liners and venting mandatory.
- **Design Rigor:** Connection capacities must be validated by ASTM D6638 testing, especially for prefab panels.
- **Regulatory Compliance:** Systems align with EPA requirements for double-liners and leak detection, with site-specific UV warranties.
- **Emerging Trends:** Factory prefabrication reduces field seams by 75%; coupon monitoring extends service life beyond 25 years.

Conclusion:

Produced water containment success depends on defensive design integrating chemically resistant geomembranes, stringent QA/QC, and climate-adapted venting systems. Fraser and Parent demonstrated that approximately 90% of failures can be prevented through comprehensive material selection and construction oversight.

FGI Tools: Anchor Trench Calculator, Technical Topic #47

Next Webinar: *Retaining Wall Global Instability* (June 5, 2025)