



COAL ASH BARRIER SYSTEM

FACING THE CHALLENGE

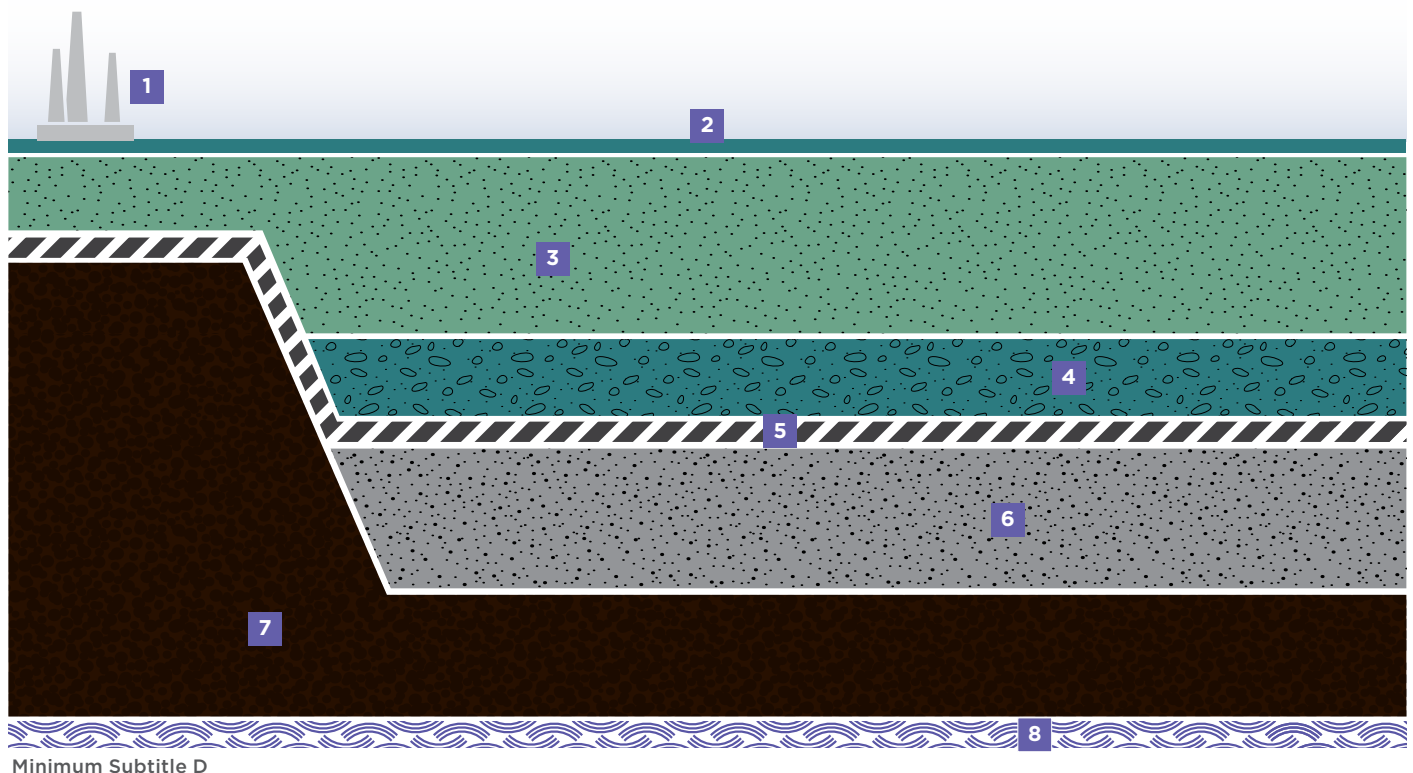
In recent years, the storage of coal ash has become an increasing concern. Power facilities and utility companies have realized and experienced the consequences of inadequate coal ash containment, and the possibility of contaminated groundwater has brought the issue to the forefront.

The EPA conducted a study that categorized coal ash as Subtitle D waste and determined that regulations were warranted. Incidents of groundwater contamination at or near coal combustion residual storage facilities have resulted in the EPA considering new regulation of coal ash storage and significant companion actions on the legal, federal congressional and multiple governmental fronts.

In light of pending regulations, utility companies are attempting to better contain coal ash using EPA Subtitle D minimum guidelines, but are facing multiple challenges, including:

- Investing time and resources into the management of coal ash containment

- More stringent assessments of groundwater and the risk of third party issues
- Difficulty finding sites for disposal or gaining permits to build new facilities
- Increased scrutiny by state officials
- Availability of suitable earthen materials and the economic and environmental impacts of borrowing materials
- Addressing opponents and concerned communities
- Managing impact to power costs and consumer rates



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|-------------|-------------------------|----------------------------------|-----------------|
| 1 Plant | 3 Coal Combustion Waste | 5 Geomembrane | 7 Existing Soil |
| 2 Top Cover | 4 Gravel | 6 Compacted Clay/Mineral Barrier | 8 Groundwater |

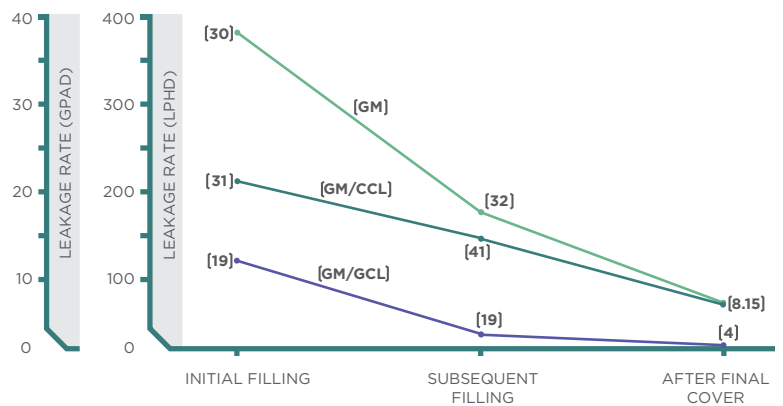
LAYING THE GROUNDWORK

The use of geomembranes in coal ash repositories has been proven to provide superior protection compared to non-lined repositories. There is, however, still significant risk of leakage when only a single barrier system is used. The inclusion of a secondary barrier, such as Geosynthetic Clay Liners (GCLs), can substantially reduce this risk, as illustrated on the graph below.

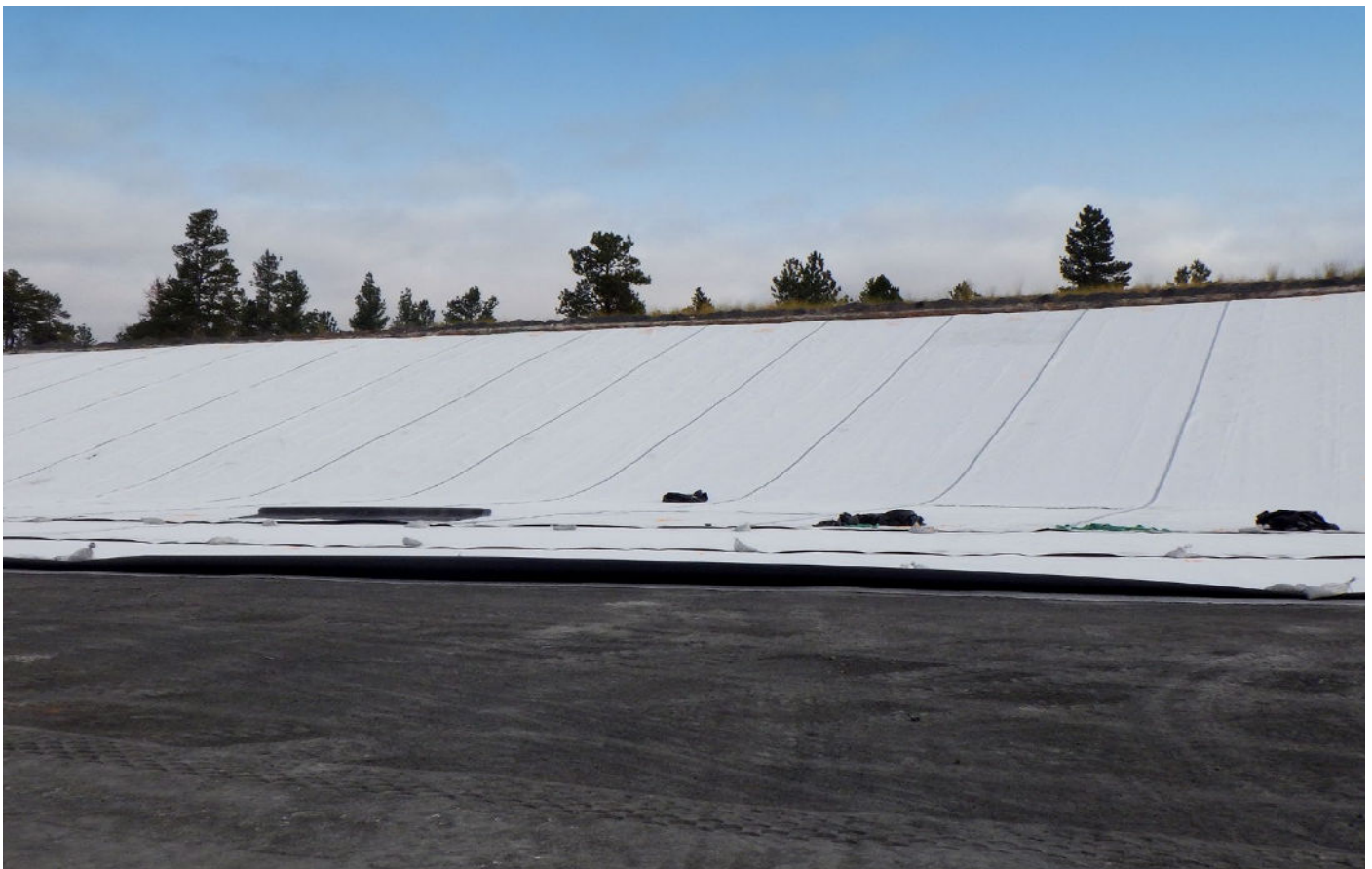
Our geomembranes and GCLs have been proven to provide utility companies with a solution that addresses the various concerns associated with coal power generation.

SOLMAX has pioneered a complete Coal Ash Barrier System using products that comply with regulatory standards to maximize groundwater protection and minimize both risks and cost.

LANDFILL LINER SYSTEM PERFORMANCE



(Ref: 2002 Bonaparte, Daniel and Koerner, U.S. EPA)



WITH SOLMAX, YOU'RE COVERED

Regulations require every coal ash landfill to be sufficiently capped to prevent ground-water contamination. SOLMAX's durable geosynthetics ensure the highest level of protection and compliance possible.

COMPOSITE LINER SYSTEM

A composite liner system combines the low permeability of a polyethylene geomembrane with the self-sealing characteristics of bentonite clay to provide the best leak protection in the industry. In many cases, the geosynthetic clay liner can replace the compacted clay layer.

Geomembranes

A geomembrane covers the composite liner system. SOLMAX's High Performance White Smooth geomembrane is an ideal choice for coal ash capping because its UV-stabilized upper white surface reflects light, enables damage detection, and reduces wrinkles and subgrade desiccation.

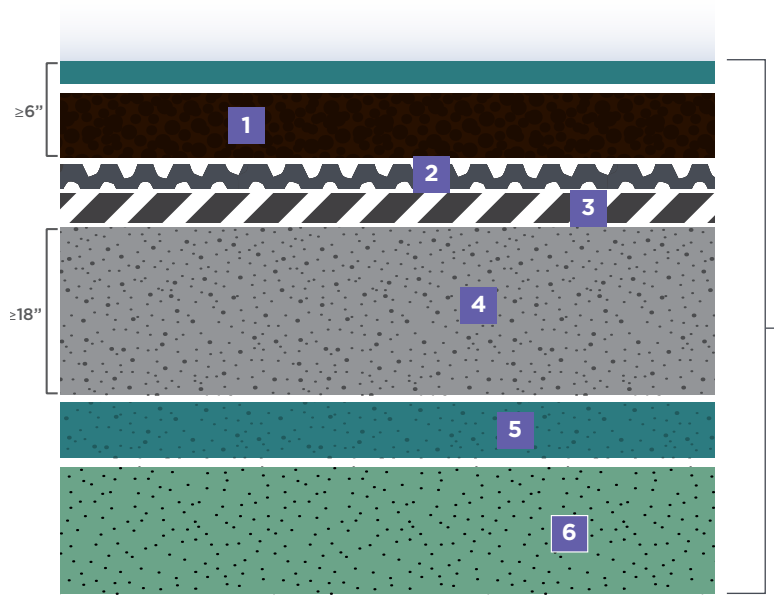
GCLs

GCLs combine geosynthetics with sodium bentonite clay to form a highly impermeable barrier.

The synergy between Bentoliner and Solmax geomembranes creates the most effective barrier system, in which Bentoliner adds its self-healing properties creating a virtually impenetrable hydraulic barrier.

Drainage Geocomposites

The composite drainage product overlays the geomembrane and can be used to replace earthen drainage materials. SOLMAX offers an extensive line of geocomposite products that save time and money and provide greater consistency than natural soil materials.



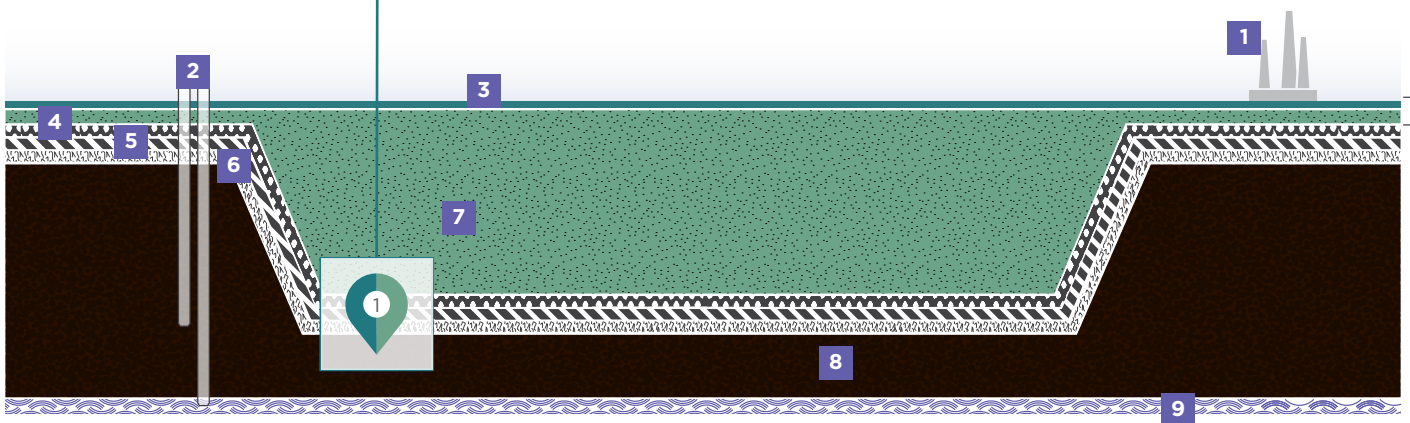
Subtitle D Cover System

- 1 Top Soil
- 2 Drainage Geocomposite
- 3 Geomembrane (≥40mils)
- 4 Compacted Clay Liner (CCL)
- 5 Intermediate Cover (if necessary)
- 6 Coal Combustion Waste



FLEXIBLE TESTING

This durable liner maintains its physical properties during long-term exposure in mining applications that demand protection against solution loss and environmental damage.



SOLMAX Coal Ash Barrier System

- 1 Plant
- 2 Groundwater Monitoring
- 3 Top Cover
- 4 CoalDrain Geocomposite
- 5 Geomembranes
- 6 Bentoliner Coal Ash Resistant GCL
- 7 Coal Combustion Waste
- 8 Existing Soil
- 9 Groundwater

MULTIPLE LAYERS OF RELIABILITY

SOLMAX collaborated with leading utility companies to develop its Coal Ash Barrier System, which outperforms other Subtitle D-like constructions. It's the only system of its kind and combines three of our innovative geosynthetic products working in tandem to provide superior results.

Benefits Over Minimum Subtitle D

- Provides greater durability, consistency and reliability than standard Subtitle D liner systems at a potentially lower cost
- Reduces risks of groundwater contamination
- Ensures compliance with current and future government regulations
- Increases landfill capacity and optimizes land use
- Easier and quicker to install, so you stay on schedule



PROTECTING LAND AND COMMUNITIES

Effective management, containment, drainage and closure of coal combustion residuals are imperative to protect the environment and surrounding communities from potential hazardous materials.

At Solmax, our geosynthetics create effective, long-term barriers to protect soil and water for future generations.



COAL ASH BARRIER SYSTEM

COALDRAIN GEOCOMPOSITE



CoalDrain replaces the filter layer and the leachate collection layer in a typical Subtitle D liner system. It uses a highly engineered geotextile that has been developed specifically for CCRs. The filter and drainage performance of CoalDrain has been verified through laboratory and field-testing.

Ohio State University's Olentangy River Wetland Research Park, in collaboration with the department of Civil and Environmental Engineering and Geodetic Science, conducted a laboratory and field-testing program to evaluate the performance of Solmax's CoalDrain geocomposite. In this test program, CoalDrain was tested under the exact same conditions as would exist in an actual CCW disposal site. The research performed by Ohio State University showed that Solmax's Coal Ash Drainage geocomposite effectively allowed for unimpeded flow of liquids and did not let coal ash particles pass through.

CoalDrain Benefits

- Replaces up to two feet of earthen material for filtering and drainage
- Easier and less costly to install than earthen material
- Because large equipment and natural materials are not used for installation, damage to the liner system is greatly reduced
- More accurate estimation of installation cost
- Always meets requirements, while earthen material can be inconsistent
- Lower quality assurance costs
- An engineered system that is more effective and consistent than natural systems and other geocomposites with no clogging or piping
- Installation is less time consuming than natural materials and is not impeded by weather conditions, so you stay on schedule
- Installation interferes less with the surrounding community

BENTOLINER COAL ASH RESISTANT GCL



Our Bentoliner coal ash resistant geosynthetic clay liner (GCL) combines geosynthetics with sodium bentonite clay to form a highly impermeable barrier that often replaces thick layers of expensive compacted clay liners. SOLMAX has added polymer-enhanced sodium bentonite clay to our standard GCL to provide superior coal ash resistance.

HIGH-PERFORMANCE HD SERIES



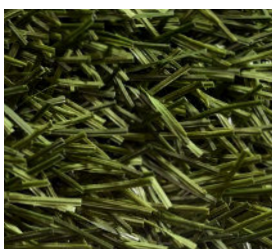
A high-performance co-extruded [high-density polyethylene \(HDPE\)](#) geomembrane specifically designed for use in the most stringent applications. This product has a UV-stabilized upper white surface that reflects light, enables damage detection and reduces wrinkles and subgrade desiccation in addition to an electrically conductive bottom layer, which can be tested for leaks in a safe, effective and cost-efficient manner. It decreases risks of leaks and mitigates groundwater impact.

LLDPE SERIES



[LLDPE Series](#) is a linear low-density polyethylene geomembrane that exceeds the requirements of the GRI GM-17 specification standard for LLDPE geomembrane liners. LLDPE geomembranes are flexible and able to conform to the soil subsidences that may occur below the capping. The unparalleled performance of Solmax LLDPE geomembranes is well represented by their high multiaxial strain performance.

LiteEarth™



[LiteEarth™](#) is made of LLDPE, the most common capping material around the world. It requires no additional equipment or expertise to install than standard 40-mil LLDPE Series geomembranes, which have standardized and proven installation and QA/QC methods.

LiteEarth's™ monolithic design also allows for fast and easy installation, reducing cost and time of installation, while ensuring a long-term performance.

WHY SOLMAX

Our no-compromise approach to quality and reliability makes Solmax the brand of choice. As we have grown, so have our capabilities. Now represented in more regions, we have a clear competitive advantage. It means faster deliveries and better service for our customers, today and tomorrow. And, with some of the smartest minds in the business, Solmax brings products to market which no other company can offer.

Our key objective—to enable progress by protecting the earth—propels us forward. With better support and solutions to protect the ground, our customers can aim higher, achieve more, faster.

Our strategy to build the capacity, capability, reach, expertise, and culture to deliver innovation rapidly and at scale, is well advanced. Our people are motivated, united by a single vision: to set the pace and reshape the industry.

SETTING STANDARDS

Solmax works with governments to draw up industry regulations, collaborates with stakeholders worldwide to raise environmental requirements, and enhances technical designs for projects.

Groundbreaking products brought to market by Solmax and its wholly owned companies include the first HDPE geomembranes, textured liners, geosynthetic clay liners (GCLs), white reflective geomembranes, conductive geomembranes, and high-flow and pressure-resistant drainage solutions.





ISO AND INDUSTRY-RATED

Solmax has achieved ISO 14001 certification for environmental management, and ISO 9001 for quality assurance. Our laboratories are accredited by the GAI-LAP (Geosynthetic Accreditation Institute - Lab Accreditation Program), assuring our customers that we apply the highest standards in product testing. Solmax has also achieved BAM, Asqual, KIWA, CE, and other certifications.

QUALITY ASSURANCE

Extensive manufacturing quality assurance (MQA) testing is performed on our products at our labs. Our MQA program starts with testing and verification of specially formulated quality resins and other raw materials and extends through delivery to the project site.

Our standards are high. All Solmax geomembranes, GCLs, and drainage solutions are tested for strength and durability, and against key criteria. Geomembranes, for example, are 100% spark tested for pinholes during the manufacturing process to ensure every delivered roll is leak free.

OUR LOCATIONS



 **HEADQUARTER**
VARENNES, QC | CANADA

SOLMAX.COM

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.