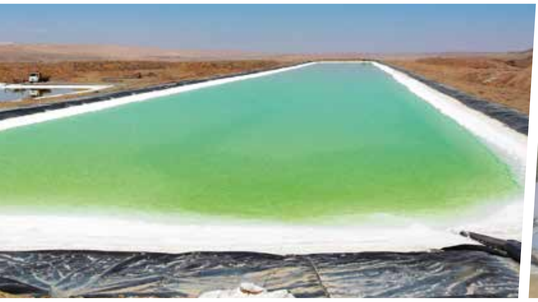
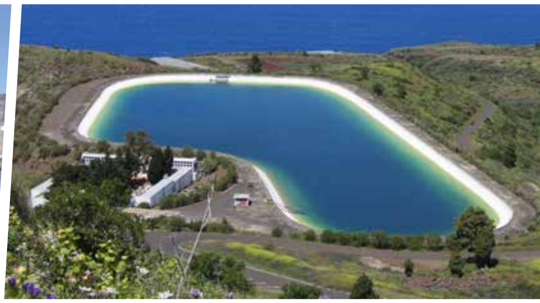
International Geosynthetics Society

GEOSYNTHETIC BARRIERS: Applications & Benefits





[1] 1 Truck with GCL

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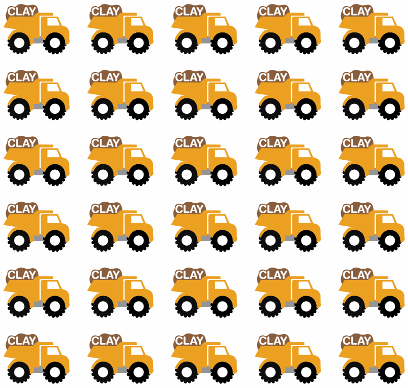
150 Trucks with Clay



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Geosynthetic Barriers

Containment of fluids is one of the major functions provided by geosynthetics. Geosynthetic Barriers (GBR) guard against seepage loss, prevent infiltration, improve the flow of fluids, protect groundwater, isolate contaminated soils, etc.

Overview

There are three generally recognized barrier options in the geosynthetic family of materials: Geosynthetic Polymeric Barriers (GBR-Ps), Geosynthetic Bituminous Barriers (GBR-Bs), both typically also known as Geomembranes, and Geosynthetic Clay Barriers (GBR-Cs), also known as Geosynthetic Clay Liners (GCLs). These material groups are engineered to be practically impervious to fluids and are key components in the design of geosynthetic barrier systems. Modifications to these products can improve the advection or diffusion properties of a geosynthetic barrier system. A geosynthetic barrier system is designed such that a geomembrane acts in conjunction with adjacent layers. The system should consider interactions with soil materials and/or other geosynthetics which complement the geomembrane and provide drainage, protection, reinforcement,erosion control, etc. The surrounding conditions allow the GBR to fulfill its barrier (sealing) function in its selected environment for the designed service life.

Impacting nearly every sector of civil engineering, GBRs are utilized for canals, dams, potable & wastewater storage and treatment, mining, waste burial, capping of polluted soils, industrial processing, energy production, remediation, levee defense, and much more.

Designing with Geosynthetic Barrier Materials

Geosynthetic Barriers may be either covered or exposed depending on the type of Geomembrane or GCL specified, the application and the site conditions. Exposed application examples include reservoirs, dam facings, interim covers on waste cells and floating covers on reservoirs. Typical covered geomembrane designs include base sealing systems for landfills, heap leach pads, and irrigation canals. Cover media may include soils, liquids, or hard armor (such as concrete).

GCLs, with their high-swelling clay cores—nearly always sodium bentonite—are engineered to be covered. Within the GCL, clay is sandwiched between and held in place by, cover and carrier geosynthetic layers (usually geotextiles). The bentonite core of a GCL hydrates and swells in contact with water, creating a barrier. Geosynthetic Clay Liners, under the correct conditions, have the ability to self-heal, providing additional protection against puncture damage. A few of the more typical applications include: canal and pond sealing, landfill base seals and cappings, structural waterproofing, barriers in infrastructure and mining applications, and secondary containment.

Impact of Geosynthetic Barrier Materials

Geosynthetic Barriers provide containment performance greater than or equal to significantly thicker soil-only barrier layers. Because of this, geosynthetic barriers can be used to construct projects which are safer, more robust, and more economical. From a sustainability perspective, geosynthetic barriers provide many benefits A single truckload of a rolled GCL is roughly equivalent to 150 truckloads of conventional clay [1]. Geosynthetic Barrier Systems can significantly reduce the thickness of required soil covers or the extent of engineering works, which greatly improves the carbon footprint of construction activities. These engineered materials go through rigorous testing, both in factory and in the field, providing a high-level of product consistency. The same level of consistency is difficult to achieve/monitor in field installed systems. With systems such as compacted clay there can be distinct variability in both the materials and the compaction providing less consistency than a factory-produced material.

Since the mid-1980s, Geosynthetic Barrier Systems have been increasingly used and even required for environmental protection in waste

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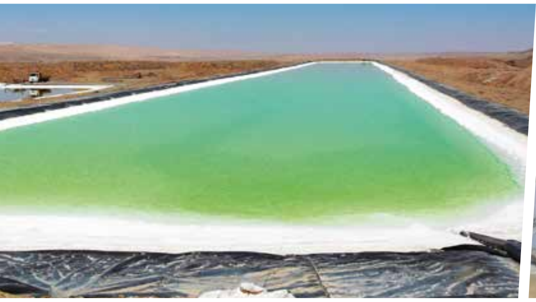

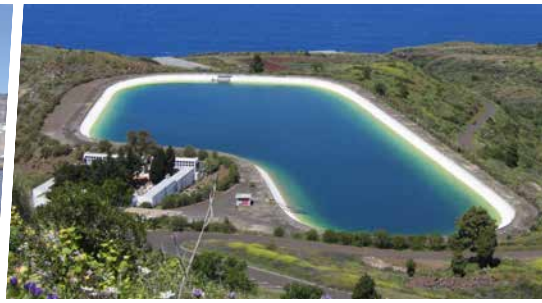

[2] US Infrastructure Grades (2013)

Stats courtesy ASCE: www.infrastructurereportcard.org

Energy	D+
Schools	D
Public Parks & Recreation	C-
Transit	D
Roads	D
Rail	C+
Ports	C
Inland Waterways	D-
Bridges	C+
Aviation	D
Wastewater	D
SOLID WASTE	**B-**
Levees	D-
Hazardous Waste	D
Drinking Water	D
Dams	D

A: EXCEPTIONAL, B: GOOD, C: MEDIOCRE, D: POOR, F: FAILING

Each category was evaluated on the basis of capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation

management applications. An indicator of the effectiveness of Geosynthetic Barrier Systems is the strong infrastructure grades awarded to waste management sectors in world regions in which geosynthetics are required to be used in waste containment [2].

For critical environmental applications like waste management, geomembranes and GCLs are often used together to create a composite barrier design. Composite systems provide redundancy which in turn provides additional protection. Composite systems increase containment performance and ultimately environmental protection.

Protecting the System So It Can Protect You

Protecting the Geosynthetic Barrier Material in the system is essential to having the system succeed and function as designed. This protection begins with design. To protect against unnecessary stress on the barrier, designers must carefully consider site-specific needs and conditions like the placement of appurtenances and penetrations and the shape and contours of the location. In addition the systems should be designed with necessary physical protection such as geotextile cushions and geocomposite drainage/venting materials. Finally, to ensure the best construction of the design, the designer should specify proper site preparation, proven installation methods and a CQA plan.

Quality Control of Engineered Materials & Their Installation

Each material type has a series of index and conformance tests which have been established via nationally and internationally recognized bodies including ASTM, CEN and ISO. Based on these standardized test methods the manufacture of geosynthetic materials is subject to strict analysis and quality control. Based on current practices in a given region products are typically tested at specified intervals to provide the highest level of quality control and assurance. These quality control programs ensure products meet their specified performance characteristics and provide complete documentation from the raw material to the final product.

Geosynthetic installation methods vary based on the type of barrier being installed. There are a number of well-established published installation guidelines/specifications for installation of these materials, many of which are identified by national jurisdiction.

Members of the International Geosynthetics Society (IGS) who work with geosynthetic barriers are encouraged to contact the IGS Secretariat (**IGSsec@GeosyntheticsSociety.org**) and inquire about the Technical Committee on Barrier Systems (TC-Barriers). Non-members who want to get involved can learn more about the IGS and join at **www.GeosyntheticsSociety.org**.

About the IGS

The International Geosynthetics Society (IGS) is a non-profit organization dedicated to the scientific and engineering development of geotextiles, geomembranes, related products and associated technologies. The IGS promotes the dissemination of technical information on geosynthetics and their appropriate uses through a newsletter (IGS News), two official journals (Geosynthetics International and Geotextiles and Geomembranes), conferences and technical seminars, dedicated task forces, 43 international chapters, special publications, and multiple other communications and outreach methods.

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