



The Pioneer Of Geosynthetics  
S I N C E 1 9 7 2

## Fabric Encased Geosynthetic Clay Liners

### FABRIC ENCASED GEOSYNTHETIC CLAY LINERS (GCLS)

GSE BentoLiner GCL is produced by distributing a uniform layer of the sodium bentonite between two geotextiles. Fibers from the upper nonwoven geotextile are needlepunched through the layer of bentonite and incorporated into the lower geotextile (either a woven or a scrim nonwoven). This process results in a strong mechanical bond between the fabrics. A heat treating process is then used to modify and more permanently lock the needlepunched fibers into place.

The sodium bentonite clay utilized in GSE BentoLiner GCL is a naturally occurring clay mineral that swells as liquid enters between its clay platelets. When hydrated under confinement, the bentonite swells to form a low permeability clay layer with a hydraulic conductivity value of  $5 \times 10^{-9}$  cm/sec which is an equivalent hydraulic protection of several feet of compacted clay. Unique properties, including increased internal shear resistance and long term creep resistance, make GSE BentoLiner GCL ideal for a wide range of containment lining applications.



GSE BentoLiner GCL.

### NEEDLEPUNCHING MAKES A DIFFERENCE

By needlepunching fibers through the sodium bentonite clay layer, a completely uniform, reinforced GCL is produced with shear strength, creep resistance, and stability advantages important to any application.

### HIGH SHEAR RESISTANCE

Needlepunching reinforces the otherwise weak layer of sodium bentonite clay. Unreinforced bentonite is susceptible to shear failure, even on gentle slopes. The GSE BentoLiner GCL needlepunching process consistently reinforces the bentonite layer with thousands of high tenacity fibers that resist and transfer the shearing stresses into the encapsulating geotextiles.

### UNIFORM BENTONITE CONTENT

The uniform confinement provided by the fibers from the needlepunching process resist lateral migration of the bentonite clay within the GSE BentoLiner GCL in either the dry or hydrated state. As a result, a consistent bentonite content is preserved throughout the composite, in turn resulting in a consistent low permeability.

### GREATER INSTALLATION DURABILITY

During installation, the needlepunched fibers hold the bentonite in place and prevent the GCL from separating. GSE BentoLiner GCL is more durable over a wider range of installation conditions, and, because it is needlepunched, it can greatly reduce the adverse effects of premature hydration during installation.



Soil cover operations over installed GSE BentoLiner GCL.

### SUPERIOR GCL SLOPE PERFORMANCE

With GSE BentoLiner GCL, the clay component is no longer the limiting factor on side slopes. You can use GSE BentoLiner GCL to replace compacted clay layers on steep side slopes and be assured of low permeability without sacrificing slope stability. The inherent confining stress from the needlepunching also improves the hydraulic properties of GSE BentoLiner GCL under low confining stress applications.



Improved slope stability utilizing GSE BentoLiner GCL.

**ASSURANCE QUALITY CONTROL**

Because GSE Bentoliner GCL is factory manufactured liner products, the controlled environment of the production facility allows for greater control over critical performance characteristics. The intensive manufacturing quality control program ensures consistent hydraulic and physical properties through the latest ASTM testing procedures.

The thorough manufacturing quality control minimizes the expensive and time consuming on-site quality assurance testing required for compacted clay liners. GSE Bentoliner GCL provides consistent high quality performance.



GSE Bentoliner deployed in a composite bottom liner system.

**MORE VERSATILE THAN COMPACTED CLAY**

GSE Bentoliner GCL is part of an important trend towards the combined use of geosynthetics and clay materials in containment applications. In a typical composite liner system, GCL works synergistically with polyethylene and other geomembrane materials to maximize liner system efficiency.

**INCREASED AIRSPACE AND LINER EFFICIENCY**

In a composite landfill liner system, GSE Bentoliner GCL can in many cases completely replace or significantly reduce the required thickness of the compacted clay layer. This results in less excavation and re-compaction as well as increased containment volume. And, in a landfill, increased airspace means increased revenues.

**CAPS AND CLOSURES**

GSE Bentoliner GCL is ideally suited for use in landfill caps and closures. Used alone, or in conjunction with a geomembrane, GSE Bentoliner GCL is resistant to



GSE Bentoliner deployed on a landfill closure.

the deleterious effects of differential settlement and seasonal temperature fluctuations.

**EASY TO INSTALL**

GSE Bentoliner GCL is the widest fabric encased GCL in the industry. The widest width, coupled with available custom lengths, makes GSE Bentoliner the most versatile GCL available.

Simple, cost-effective installation techniques make GSE Bentoliner GCL a practical alternative to a compacted clay liner for a wide range of applications.



Deployment of GSE Bentoliner GCL.

**ENGINEERING SUPPORT**

The GSE Engineering Support Staff is comprised of multidisciplinary product professionals to support you across a range of project requirements. This includes knowledge in geomembrane, geosynthetic clay liners, geonet, geocomposite, nonwoven geotextile and concrete protection products and application solutions. Rely on our technical staff to help you solve your project issues.

**CUSTOM FABRICATION**

The GSE Custom Fabrication Group builds products to your exact specifications. We have extensive experience in prefabricated polyethylene products and components. A few examples of our custom fabricated products are Aqua Tanks, Quick Containment, concrete protection liners, boots, sumps, pads, pipes, daily covers, temporary containment, containment boom and other products to fulfill your fabrication needs.

**INSTALLER NETWORK**

The GSE Installer Network leads the industry with the most experienced, large, and flexible crews available around the world to meet your installation requirements. Each installer is equipped with state-of-the-art welding and testing equipment to ensure a successful installation. Selecting a qualified installer with the right product knowledge is critical to your success. Let GSE connect you to the right installer to handle your installation project of any size from start to finish.