



The Pioneer Of Geosynthetics

S I N C E 1 9 7 2

## Needle Detection & Removal Manufacturing Process for Fabric Encased GCL Products

### OVERVIEW

GSE BentoLiner fabric encased geosynthetic clay liners (GCLs) transmit internal shear stresses from the upper geotextile to the lower geotextile by needlepunching the fibers from the nonwoven cap geotextile, through the bentonite layer, and lodge the polypropylene fibers into the lower carrier woven or nonwoven geotextile. This forms a composite GCL consisting of geotextiles which encapsulate, support, and provide internal shear strength to the low permeability bentonite layer (Figure 1). The geotextiles utilized in the production of all GSE BentoLiner materials are specially formulated polypropylene woven and nonwoven geotextiles manufactured to specification specifically for GSE BentoLiner GCL materials.

GSE BentoLiner fabric encased GCLs have been utilized extensively as a standard replacement for compacted clay liners in numerous bottom liners, pond liner, and cap applications in many countries given the excellent hydraulic performance and, as importantly, their documented superior performance on slopes primarily due to the reinforcement process during manufacturing.

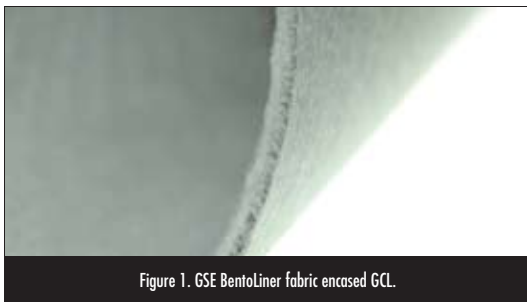


Figure 1. GSE BentoLiner fabric encased GCL.

### THE NEEDLEPUNCH MANUFACTURING QUALITY ASSURANCE PROCESS

The 4 in (100 mm) long needles used in the needle punching process for GSE BentoLiner reinforced GCLs, consist of steel needles with spaced barbs, which grab fibers from the upper nonwoven geotextile, and pull the fibers through the bentonite and the lower woven or nonwoven geotextile (Figure 2). This transforms the random fiber arrangement of fibers in the upper polypropylene nonwoven geotextile into a 3-dimensional structure by the up and down moving needle boards during conveyance of the GCL material through a needlepunching loom. These looms punch the barbed needles, containing up to 13,800 needles/meter width, at up and down speeds rang-

ing up to 1200 strokes/min (Koerner & Koerner, 2002). This is similar to the needlepunched process by which nonwoven geotextiles are manufactured and has been commonly used in the textile industry in the U.S. since the 1950's.



Figure 2. Needle punched manufacturing process of the GSE BentoLiner GCL.

### BROKEN NEEDLES IN GCLS

Due to abrasion, wear, and plugging of the needle boards during manufacturing, needles may be broken. Broken needles, if undetected, will remain in the GCL and, when the material is deployed in the field, present a serious problem associated with potential puncture and damage to adjacent geosynthetics. This would include geomembranes when GCLs are commonly deployed below geomembranes in composite (geomembrane-clay) liner systems (Figure 3). If a geomembrane is punctured by a needle, the resulting potential leakage could range from minimal up to a leakage rate more than 0.25 gal/hr (1 liter/hr) through the geomembrane with poor contact with the underlying GCL under 1 ft (300 mm) hydraulic head (Koerner and Koerner, 2002).

Thus, undetected broken needles in GCLs may pose a serious threat to the integrity of an installed geomembrane GCL composite liner system. This has also resulted in many specifications requiring quality control procedures to be conducted at the manufacturing facilities that reduce the potential for undetected needles, for both geotextiles and GCLs (Purdy & Yazdani, 1999).



**ADDITIONAL INFORMATION**

If you have an upcoming project please give us a call. We will provide you with recommendations for material and installation.

**THE NEEDLE DETECTION MANUFACTURING QUALITY ASSURANCE PROCESS**

Due to the potential for broken needles, GSE BentoLiner has incorporated a highly effective and proprietary needle detection and removal system into the manufacturing process, which greatly minimizes the possibility of broken needles remaining undetected and lodged in the finished GSE BentoLiner GCL product.

The quality assurance process includes two quality controls to detect needles.

1. Primary Metal Removal. The first control includes conveying the GCL material past one powerful in-line magnets which remove any loose needles or metal debris from the GCL after being needle punched. One magnet is located directly above the upper cap geotextile side of the product and the second magnet is located directly below the bottom carrier geotextile side. It is a continual removal process that covers the entire width and length of the GCL roll, both the upper and lower sides of the GCL.
2. Secondary Metal Detection and Removal. The second quality control includes an in-line electronic metal detector that scans the entire width and length of the GCL. If a needle is detected in the GSE BentoLiner material which was not removed by the magnet, the manufacturing line is automatically stopped at the metal detector station, signifying the location of the metal debris, and a red warning light is activated to signal detection of a broken needle.

Any metal or broken needles are subsequently removed manually by the operator and the material is then re-scanned by the metal detector to ensure all metal has been removed.

Thus, the primary and secondary manufacturing quality control systems result in continual 100% inspection and removal of any needles or metal debris within every manufactured square meter of GSE BentoLiner GCLs.

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