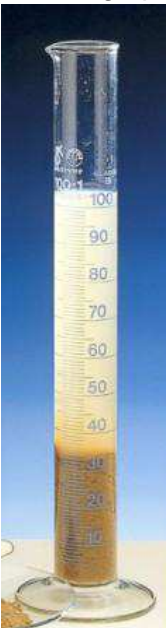


MODULO GEOBENT HC

Clay Geosynthetic Barriers for Applications in contact with Hydrocarbons (Oil Tank Farming)

Bentonite

The special Bentonite used for the MODULO GEOBENT HC production is mainly composed of montmorillonite (clay mineral of the smectite group) modified with special organoclays to increase the performance of the barrier in contact with low dielectric constant fluid. The smectites are a group of minerals that swell as they absorb water or organic molecules within the structural layers; they also have considerable cationic exchange properties.



The clay minerals have crystalline state derived from the devitrification, and consequent chemical change, of glass of magmatic origin, usually tufa or volcanic ash (definition by Ross and Shannon, 1926).

The nature and volcanic origins of bentonite deposits give rise to varieties of the mineral that are often extremely heterogeneous. The bentonites that are thus formed can be described as sodium, calcium and acid bentonites.

The crystallographic basis of the montmorillonite (bentonite) is typical of phyllosilicates: sheets of AlX octahedrons (X=oxygen or oxydriil) between two sheets of SiO₄ tetrahedrons.

In the octahedron layer the Aluminum may be replaced by magnesium, thus giving rise to an excess negative charge: the negative charge in excess is compensated by various

mono and bivalent cations (Ca⁺⁺, Mg⁺⁺, Na⁺...).

The elementary particle is the "lamella": the various lamellas are held together in "packets" by Van der Waals force, but they can be "delamellised" and dispersed in water in submicronic particles until a specific superficial area of 800 m²/g is developed.

Product Description

Modulo Geobent HC belong to the family of needle-punched Clay Geosynthetic Barrier (GBR-C) made of one non-woven polypropylene geotextile as cover layer, one woven polypropylene geotextile as carrier layer, which encapsulate a uniform layer of special bentonite and organoclay mix.

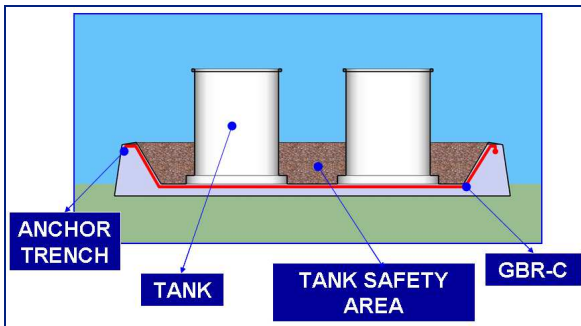
The connection between the cover and carrier geotextile is achieved by a specific reinforcement system which enable the two geotextiles to be joined by thousands of fibers through the bentonite layer. This kind of reinforcement is especially made in order to cut down internal shear forces acting on the barrier, making Modulo Geobent HC a perfect solution for application on steep slopes and vertical surfaces, and giving the barrier a pre-confinement which increase the barrier capability to remain exposed before the final confinement is reached.

The dimension of the particles of the bentonite together with the open size of the non-woven geotextile are carefully calibrated in order to achieve a full saturation of the geotextiles, once the barrier is fully hydrated, increasing the self-seaming of the rolls on the overlapping area.

The Application

It is well recognized that the standard bentonite performance drops in contact with liquids with high ionic strength and/or low dielectric constant. In presence of hydrocarbons a reduction of the hydraulic efficiency of standard bentonite can be expected due to significantly lower dielectric constant of the fluid, which causes a compression of diffusive double layer (DDL) of clay. Fluids with the above mentioned characteristics may occur in several applications, tank farms for crude oil and derivatives among others.

Modulo Geobent HC are a multi-layer geocomposite systems that employ two polypropylene geosynthetic encapsulating a special kind of double function bentonite that, beside to be a water barrier as standard bentonite, is able to contain simultaneously hydrocarbons and water as responsible of the major transport of contaminants in groundwater.



Tanks farms (sometime called oil depot or oil terminal) are industrial facilities for the storage of different products, generally hydrocarbons (gasoline, gas-oil, etc.) before delivery to the end users, or as temporary depots. Tank farms must guarantee the management of products avoiding leakage during handling and maintenance. In order to prevent migration of hydrocarbons in case of accidentals spills or leakage from tanks, a composite barrier acting as a primary HDPE layer coupled with a secondary mineral layer is often used. The latter acts in case of failure of the HDPE and should be able to minimize the fluid migration to the groundwater.

The innovative advantage of Modulo Geobent HC is to be able to guarantee good performance, in comparison with a standard

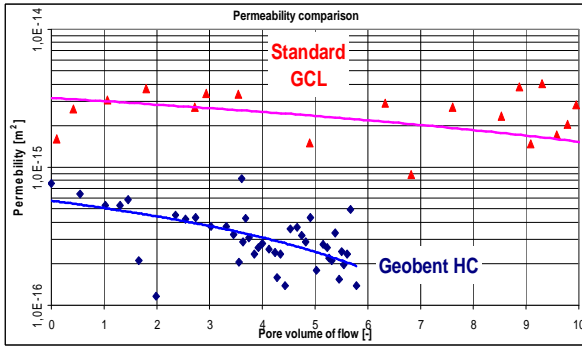
GBR-C, both in the presence of water and in direct contact with hydrocarbons in case of failure of the primary layer.

While priority should be given to preventing leak of primary containment, adequate secondary containment such as Modulo Geobent HC remains necessary for environmental protection and safety of people in the event of a damage of primary containment of hazardous substances.

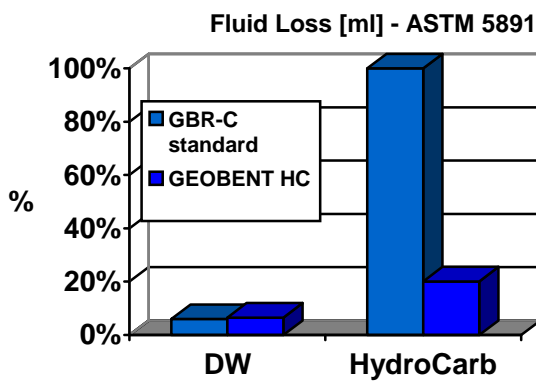


Fires, vandalism, spillages and failure of primary containment sorts of incidents on an industrial site can cause the release of hazardous substances into the environment. Once released, these hazardous substances can enter the water environment through surface or foul drainage systems, by direct runoff into a watercourse or by infiltration into the ground. Secondary containment systems can provide protection in the event of loss of containment of materials which could cause water pollution.

Modulo Geobent HC provide a good tool in the huge field of the hydraulic barriers design due to its high waterproofing properties by modified bentonite with good hydraulic performance both in standard conditions (groundwater) and in particular situations such as in contact with hydrocarbons in tank farm application. In the family of GBR-C, Modulo Geobent HC improve the performance by adding special additives (organoclay) able to increase the bentonite resistance in contact with aggressive permeants, focalizing the result in presence of hydrocarbons such as diesel oil, petrol and many crude oil derivate.



Modulo Geobent HC in presence of hydrocarbons show considerably higher performance compared to the untreated bentonite normally use in the standard GBR-C; in fact Modulo Geobent HC maintain an index flux closer to the pure Bentonite in distilled water and has a flux of one order of magnitude lower than alone bentonite in hydrocarbons hydraulic test.



This considerable result is an excellent opportunity to use the barrier under particular conditions, especially in presence of diesel oil, petrol and many crude oil derivatives. It is important to underline that the advantage of Modulo Geobent HC can be reach without prehydration because the Modulo Geobent HC hydraulic performance is unaffected to the initial water content, so the performance of the GBR-C are unaffected by uncontrolled site conditions where full pre-hydration of GBR-C is not always reached.

Product Advantages

Low hydraulic conductivity to polar and non-polar fluids, which ensures protection of the environment and a high level of safety.

Easy installation - does not involve high costs in terms of machinery and labor, neither welding operations.

Easy to repair - slight accidental damage of the Modulo Geobent HC is self-repairing and does not require any intervention; if wide areas are damaged it is possible to intervene simply by "patching" the damaged surface with pieces taken from rolls of GCL still available on the site.

Cost effective – compared to high costs for the construction of compacted clay layers.

High internal shear resistance – the particular reinforcement system enable the Modulo Geobent XP to reach a strong resistance to internal friction and to be used on steep providing the system with excellent stability.

High puncturing resistance – Modulo Geobent HC also have strong resistance to penetration (static puncturing).

Less CQ on site - because thickness, hydraulic properties and mechanical are quality controlled during production, there are also considerable financial saving costs by reducing the need of on-site tests.

Modulo Geobent HC can be installed as secondary containment either in case of soil embanked or can be designed with poured concrete safety containment.

The geotextiles used for Modulo Geobent HC beside ensure high mechanical performance optimize both the chemical and oxidant resistant in term of long service life.

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