

Methane Barrier

**Flexible Polypropylene (Permaliner®), Nonwoven Geotextile (Syntex®)
Warehouse development on old landfill site, Auckland, New Zealand**

Client: Fletcher Properties Ltd

Date: September 1999

The Circle International Warehouse site, located in Penrose, Auckland and adjacent to the Ericson Stadium, was constructed on an old landfill site. The monitoring indicated that some gas migration continues through the ground substrata in the adjacent areas. When the excavation was done for the site preparation, leakage of landfill gas was observed penetrating from the ground. It was decided by the Consultants to install a gas proof membrane to completely seal the building from the ground. A complete system was designed with a pipe system built below floor level.



Permaliner FPP (Flexible Polypropylene) .5 mm geomembrane was specified to be placed between the top of the subbase course and the concrete slab. Permaliner geomembrane offers excellent gas barrier characteristics and is resistant to most chemicals. In landfill applications, the principal gases generated are methane & carbon dioxide.

Permaliner is a coextruded flexible polypropylene with a low transmission rate for water and methane, which meets the barrier requirements for the municipal solid waste landfills in most countries. It is triple-layered, available from .3 mm to 2 mm thickness. It has excellent tensile strength and flexibility to withstand ground settlement and loading stresses.

As the liners are prone to damage from protrusions in the prepared subgrade onto which they are deployed, Syntex GNP B1 nonwoven geotextile was placed as a cushion to protect the liner from puncture. Syntex GNP B1 is a medium weight nonwoven (Strength Class B) geotextile with a high puncture and mullen burst strength, which increases its installation survivability. It is very resistant to aggressive chemicals and has been found acceptable in most solid and hazardous waste landfill sites. Prior to deployment of the steel framing and main panels all pads were covered with Permaliner, Syntex and neoprene gaskets over the bolts. These in turn were sealed with a flexible polyurethane sealant, designed to retain long-term flexibility during expansion and contraction.



Then total area of approximately 4300 m² was covered with 8 panels of Permaliner prefabricated in the factory under ideal quality control conditions. These panels were joined on-site with Vulcaneal (1 mm rayon reinforced isobutylene isoprene) moisture and vapour resistant double sided tape and installed by Permathene.

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**Flexible Polypropylene (Permaliner®), Nonwoven Geotextile (Syntex®)
Warehouse development on old landfill site, Auckland, New Zealand**

Client: Ampelite

Date: June 2001

It was determined that a high risk of methane was possible due to construction over an old landfill site. Permaliner FPP (Flexible Polypropylene) .5 mm geomembrane was specified to be placed between the top of the subbase course and the concrete slab. Permaliner FPP offers excellent gas barrier characteristics and is resistant to most chemicals. In landfill applications, the principal gases generated are methane & carbon dioxide.

Permaliner has a low transmission rate for methane, which meets the barrier requirements for the municipal solid waste landfills in most countries. It is a triple-layered, coextruded polypropylene product available in .5 mm to 2 mm thickness. It has excellent tensile strength and flexibility to withstand ground settlement, loading stresses, high tear, puncture resistance, and is free from additives such as plasticisers, adhesives and lubricants. It is manufactured to food grade standards and is suitable for potable water so will not contaminate ground water.

Syntex GNP D1 (Strength Class D) nonwoven geotextile was placed over the finished liner as a cushion to protect the membrane from puncture during concreting. Syntex GNP D1 is a heavy weight nonwoven with a high puncture and mullen burst strength, which increases its installation survivability. It is very resistant to certain concentrations of aggressive chemicals and has been found acceptable in most solid and hazardous waste landfill sites. Syntex has been widely used for similar applications worldwide.

A total area of approximately 3000 m² was covered with 3 panels of .5 mm Permaliner FPP, prefabricated in the factory under ideal quality control conditions. The panels were deployed over the entire site and sealed to all protrusions and footings using a combination of special adhesives and sealants. The adhesives are designed to remain flexible. The panels were fusion welded on-site with no taped joints. This provides an impervious membrane.

The combination of Permaliner FPP prefabricated panels and Syntex geotextile cushioning proved to be the most cost effective and environmentally acceptable construction method for this type of project.



Methane Barrier

**Spray-Applied Geomembrane (Liquid Boot®), Venting (Geovent®)
Mobil Service Station, Smales Rd, Auckland, New Zealand**

Client: SAI Developments

Dates: September 2007

Smales Road Mobil Service Station in Manukau City is part of a commercial development proposed to house a small commercial hub of office buildings on the now completed segment of the Greenmount Landfill. In this type of situation, old landfill sites have potential exposure to landfill gases.

Liquid Boot double-component bituminous cold-applied geomembrane was proposed for the Mobil Service Station site by Chow-Hill Architects and Specified by SKM Consultants.

Liquid Boot seals and protects against potential exposure from gases including methane and industrial chemical contamination (such as from chemical and petroleum production and storage). Liquid Boot is a chloroprene modified asphaltic (CMA) emulsion. Both components are water based and are cold applied, forming a seamless single course geomembrane – a complete water and gas proofing system suitable for large scale industrial applications as well as smaller buildings.

Spray-applied geomembrane completely and seamlessly covers all protrusions such as venting, pipe works, steel works, columns, pads, etc. This is almost impossible when using traditional sheet materials, where the integrity of the product can be compromised when fastened to the foundation walls, footing and especially service penetrations.

Liquid Boot is quick to install. Installation of the traditional materials can often take weeks even for small buildings, especially if there are a number of service penetrations as seen in the Smales Rd service station. In this case, over 50 pipe penetrations required sealing. The entire Liquid Boot geomembrane including testing, penetrations and detailing was completed in just three days; a very impressive timeframe relative to the size of the site. Liquid Boot can be applied to almost any surface type, including service channels, below footing, above footing, walls, columns, etc. The membrane adheres to the structural surfaces (e.g. foundation walls), making it impossible for harmful gases to migrate under the membrane and accumulate under areas where most leakage is possible.

An integral part of this system is the GEOVENT gas-collection system, complete with outlets with reducers for connection of the 300 mm × 30 mm geocomposite to conventional PVC or High Density Polyethylene (HDPE) pipes. Geovent has a number of advantages over traditional gas-collection systems. There is less trenching required due to its flat nature making it quick and easy to install. Geovent does not use slots for gas collection and thus is less vulnerable to siltation and other clogging. The Smales Road Service Station Gas Collection System was successfully installed in less than an hour, complete with outlet connectors with reducers.

The Quality Assurance protocol for Liquid Boot includes thickness and Smoke Testing, ensuring the maintenance of the membrane integrity. Usage of the Smoke Testing protocol allows for Permathene to find and fix even smallest pinholes in the geomembrane.

Permathene Ltd. engineers supplied consultants with a complete set of standard details and specifications, making design of the geomembrane an efficient, comprehensive and cost-effective project for all parties.

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Spray-Applied Geomembrane (Liquid Boot®), Venting (Geovent®), HDPE, Flexible Polypropylene (Permaliner®), LLDPE, Nonwoven Geotextile (Syntex®)

Client: Ryman Healthcare, Auckland, New Zealand

Date: October 2005 – August 2008

The Edmund Hillary Retirement Village Development, recently under construction in Remuera, Auckland, is one of Australasia's leading projects of its type, involving the use of gas proofing through installation of Permathene spray geomembrane. "The Edmund Hillary Village is our new flagship," said Ryman chairman Dr David Kerr, and "has set a new benchmark for retirement living in New Zealand."

During monitoring of the preparation stage, gas discharge was found throughout the site. To negate this problem, a multifaceted double-layer gas proofing geomembrane system, with gas collection media under and monitoring lines between layers of the geomembrane was designed and implemented by environmental engineers.

Permathene was awarded with the contract for installation of Gas and Water Proofing Geomembrane in 2005 and has since installed more than 20,000 m² of Liquid Boot, over 10,000 m² of High Density Polyethylene Geomembrane (HDPE), over 10,000 m² of Flexible Polypropylene Geomembrane (FPP), and around 2000 m² of Linear Low Density Polyethylene Geomembrane (LLDPE). These materials required battening to the foundation walls, done by using flat aluminium bars fixed to the wall with Ramset® anchor fasteners. Altogether around 8 km of flat aluminium bars have been installed throughout the site, fixed with more than 30,000 anchor fasteners, installed by Permathene technicians.

Although HDPE has an excellent reputation in design and construction of gas proofing systems, its rigidity made it somewhat difficult to fit to the foundation wall's shape and even more difficult is the sealing of rigid materials to the many protrusions, including venting systems, ducting, pipes, etc. This method of using only rigid materials was extremely time consuming and inefficient. Even when fastened these types of membranes suffer from expansion and contraction at the fastening points which only add to the problem of gas proofing.

Permathene has managed to increase speed of installation significantly by using a spray (cold applied, double component) geomembrane. Permathene spray geomembrane has very intensive history of applications around the world, with more than 2,000,000 m² installed in the USA alone. Comparatively, it is quick in installation (three-four times faster than HDPE). Additionally, it fully adheres to foundation

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Continued from Page 1

walls without the need for battening. The implementation of a strict Quality Assurance system, including a comprehensive Smoke Test, allows for even the smallest pinholes in the membrane to be detected, and ensures consistency in the membrane during any part of the installation.

Permathene spray geomembrane is extremely stretchable, with a coefficient of elasticity around 1300 % with around 90 % built-in polymer memory. The membrane can thus accommodate severe movements in building foundations without compromising integrity. It has been approved by various USA environmental authorities, CSIRO Building Product and Systems Approval Agency (Australia), and by the Auckland City Council (for both gas and water proofing).

Over 40,000 m² of gas proofing membrane has so far been installed at the Ryman Health site, and with several more buildings approaching construction stage, Permathene expect the system to serve as an integral part of this comprehensive project.

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