GIGSA NewsLetter
FEB 2011 EDITION

The South African Chapter of the International Geosynthetics Society

Established in 1994 and Dedicated to the Scientific and Engineering Development of Geosynthetics and Associated Technologies

A newsletter of the Geosynthetics Interest Group of South Africa in Association with the South African Institution of Civil Engineering

PRODUCED BY GIGSA : www.gigsa.org

Liquid Geosynthetics – the way of the future?

The uncontrolled penetration or leaking of water into or through building structures, underground excavations, dam walls, foundations and mine tunnels is one of the most difficult, dangerous and costly problems faced by engineers, owners and operators. GAST, a company which has been working in this industry for over 50 years, is dedicated to finding solutions for these types of problems. Water has the uncanny ability to make an appearance in

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Liquid Geosynthetics - the way of the future?

the most unwanted places. The development of the Sovereign product was primarily focused on finding a solution for water ingress where accessibility is restricted or denied. Typical examples of these are water retaining concrete structures such as dams, reservoirs or retainer walls. Another application is water ingress in geological formations as often encountered in mining activity.

The Gast Sovereign system can be implemented wherever leakages occur where the source point is unknown or not easily identifiable. The system is unique and rather basic in application in that reverse water pressure is applied so as to determine the hydrostatic index of the leak. Water is then reverse pumped through the leak containing a particular isotope or marker. An investigation then takes place to determine if the leak is an accomplice to other related water problems or not.

The same water is then used as a carrier to enable liquidated rubber to be pumped in until there is correspondence with the isotope marker and the existing hydrostatic head. Once this is achieved the entire "plug" is activated by a unique catalyst bringing about homogenisation and solidification of all the rubber particles held in suspension. When this is completed, hydrostatic pressure is increased. The more hydrostatic pressure increases the more firmly the "plug" is forced against the apertures. This creates a mechanical seal with a success ratio of up to 80% on first injection. The "plug" itself remains flexible, is non-toxic and non-hazardous.

Sovereign has been successfully used on suspended concrete structures such as parking decks, roof decks and other construction areas post initial construction.

For more information on the GAST Sovereign product please contact the following person:

Mr. S. Langauge
Gast International S.A

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GAST SINCE 1961

"A child of five would understand this. Send someone to fetch a child of five." (Groucho Marx)

STOP PRESS

GRI GEI GII GSI GAI GCI
Geosynthetic Institute

The Geosynthetic Research Institute (GRI) on 26 January published an important new Design Guide for GCLs, called "GRI-GCL5 : Design Considerations for Geosynthetic Clay Liners (GCLs) in Various Applications". This is a must read for anyone connected to GCLs in any way.

It may be downloaded from the Geosynthetic Institute at http://www.geosynthetic-institute.org/grispecs/gcl5.pdf

Peter Davies
Editor

Prez Sez

It is with great pleasure and honor that I address you as President of our society for 2011/12.

The last two years have been a very successful and busy period for GIGSA: hosting our first regional (Internationally attended) conference, GeoAfrica, in 2009, and the Construction Quality Assurance Seminar with Sam Allen of TRI International in 2010. GeoAfrica has most certainly put South Africa on the map of the geosynthetics world while the CQA seminar has provided significant technical input into the South African geosynthetics industry.

GIGSA aims to continue this level of activity by hosting at least one major event per year. Prof. Kerry Rowe of Queens University, Canada will visit Southern Africa in September 2011 and will form the anchor presenter of a short course focused on geosynthetic design. More information on the course is presented further on in this newsletter.

Another focal point for GIGSA will be the 15th African Regional Conference on Soil Mechanics and Foundation Engineering in Mozambique in July 2011. The intention is to host a full day introductory training course on the use geosynthetics for the wider African audience. More on this will follow in the GIGSA May Newsletter.

Also of great interest to us as a society focusing on geosynthetics are the Waste Act Regulations to be gazetted in 2011. Although the regulations are still in draft form, it is clear that they will have a great impact on the geosynthetics industry. These regulations call *inter alia* for improved liner systems where certain types of hazardous waste will be required to have a double composite liner system, where a second geomembrane is introduced over and above the existing *Minimum Requirements* (1998) standard for a H:H liner system. Similarly, for certain other wastes, a single composite liner where a geomembrane is introduced over and above the clay layers is tabled. In addition, the Regulations will call for a number of related activities, including compulsory quality assurance, quantified service life assessments, and present acceptable leakage rates but to name a few. Thus, under the new regulations not only will the use of geosynthetics increase, but an in-depth knowledge of the functioning of the full suite of geosynthetics ,including geomembranes, GCLs, geotextiles, drains etc. will be required from the designer. I believe that the aim of GIGSA, which is to further the scientific and engineering development of geosynthetics, will contribute to this by the sharing of knowledge and being a forum for discussions and much needed debate.

GIGSA welcomes Fraser Alexander, Golder Associates, Nextube and Stefanutti Stocks as benefactor members. We are grateful for your support and trust that this is the beginning of a long standing relationship of mutual benefit.

Finally, I would like to use this opportunity to remind our individual and benefactor members that membership to GIGSA includes automatic membership to the International Geosynthetics Society. As an IGS member you have, amongst others, access to their membership directory, the two official peer reviewed online technical journals, educational videos and test method information.

On this note I wish you an exciting and prosperous 2011.

Until next time...

Geosynthetic Greetings,

Anton Bain
President

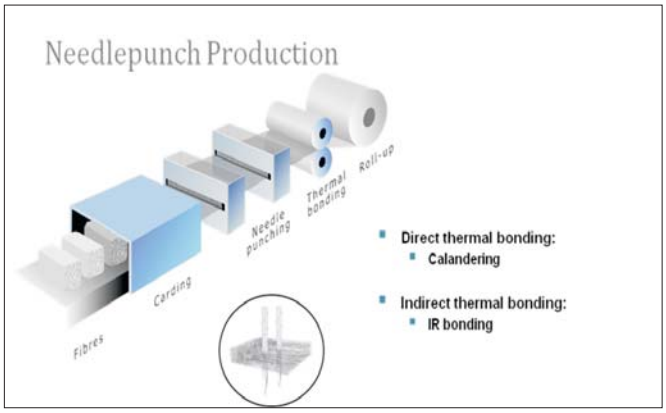
bain@jaws.co.za

"scientia potentia est" (Attrib Sir Francis Bacon)

Nonwoven Staple Fibre Needlepunched Geotextiles now Manufactured in South Africa

The Industrial Development Corporation and Safyr(Pty) have joined forces with Fibertex A/S of Denmark and the Danish Industrialisation Fund for Developing Countries, pooling their internationally recognised expertise to establish a state-of-the-art nonwoven geotextile manufacturing facility in South Africa. The plant, situated in Hammarsdale, between Durban and Pietermaritzburg, has been equipped with the latest technology from NSC Nonwovens in France and various machinery manufacturers in Germany, Denmark and the Czech Republic.

As one of the World's leading manufacturers of nonwoven geotextiles Fibertex A/S is supporting the local manufacturing operation, Fibertex South Africa, with technical and production assistance. With production having started in early 2010 the locally manufactured Fibertex geotextiles match their European equivalents.



The Nonwoven Needle Punch Process

Open & Blending

The manufacturing process starts with the opening and blending of bales of staple fibres which are mechanically re-orientated to form a web by passing them through a card. The process of web formation determines the characteristics and performance of the finished nonwoven.

Carding

Needle Looms

Both polypropylene and polyester nonwoven geotextiles are manufactured and significantly recycled fibres can be used. After carding the web is presented to a number of high performance needle looms, with more than 120 000 barbed needles, which mechanically bond it to form a high tenacity nonwoven fabric. There is a wide variety of needles that can be used depending on the fibre being used and the properties required of the end product.

After needle punching, the resultant product can be further treated by stretching and drawing and passing it through

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Nonwoven Staple Fibre Needlepunched Geotextiles now Manufactured in South Africa

specialised infra-red and conventional heat processes. This greatly enhances the mechanical characteristics and durability of the final product. Geotextiles varying in weight from 80g/sq m to 1200 g/m^2 in widths of up to 5,5m are produced. Automated process and quality controls ensure the manufacture of consistent products that meet internationally accepted standards.

The main focus is of the plant is nonwoven geotextiles for use mainly in civil engineering construction applications. Due to the versatility of the plant however, industrial nonwovens are also being produced for use in automotive, flooring, bedding, furniture and industrial filtration markets.

An example of where locally manufactured nonwoven Fibertex geotextile has been used is at a new warehouse in Johannesburg. When construction of the access road and hardtop loading area commenced the insitu soil was found to be saturated with ground water, which had to be dealt with before further construction could take place. The solution offered by Fibertex distributor Geotextiles Africa was to place Fibertex F-25 and Secugrid reinforcing geogrid over the prepared base followed by a layer of dump rock covered by a separation layer of Fibertex F-46.

Bottom layer of Fibertex F-25 & Secugrid

Layer of Fibertex F-50 above dump rock

Once the blanket drain had been installed the base layers and asphalt surface could be constructed. The total area treated in this manner was about 8 000m^2.

Paul Pratt

Fibertex South Africa (GIGSA Benefactor Member)

www.fibertex.co.za

GIGSA Awards: Call for Nominations

Members are invited to submit their nominations for the biennial GIGSA awards in the following categories:

- Development and Technology
- Construction
- Outstanding service to GIGSA

Nominations must identify the nominee, indicate clearly which category a candidate is being nominated for, and include a motivation of not more than 300 words. The awardees will be chosen from the nominations by a panel of three GIGSA committee members, and the decision will be ratified by the President.

All nominations are to reach the Awards Committee care of Riva Nortjé (nortje@jaws.co.za <mailto:nortje@jaws.co.za>) before the end of June 2011. We await your response!'

"Two things are infinite: the universe and human stupidity; and I'm not sure about the universe." (Albert Einstein)

From Gauteng to Eritrea (via Cairo)

From time to time we, as Geosynthetics materials installers, are awarded contracts far away from our home base in Gauteng, especially for geomembrane installations. Gundle Geosynthetics experience with such contracts could be of interest t other GIGSA members. Over the years we have completed many extensive contracts and operate throughout Africa.

The Eritrea contract, however, was considerably larger than the others (see picture) and more challenging than normal. The task was to line an area of 1.2 million squares meters for the BISGA gold mine leach pad using a 1.5 mm thick HDPE geomembrane. The mine is situated far away from any other human settlement and a six hour drive on bad roads through very mountainous terrain was necessary to reach the mine from ASMARA, the capital city of Eritrea. The roadsides are littered with burnt out military equipment from recent war activities in this part of the world. Road are well guarded by many soldiers equipped with AK47s. Such protection is also visible around the government owned mining facility. Permits to enter the country were difficult to obtain. Our installation crew flew via Cairo, Egypt, to ASMARA arriving around midnight. Our staff was accommodated in suitable air-conditioned prefabricated housing 3 km away from the construction site. However they had to deal with the nasty scorpions, black acid flies and plenty of spiders. On one occasion a pair of Springbok was sighted which made everybody homesick!

The lining material was manufactured and trucked in from Egypt via Sudan on a ongoing basis. The installation was done to the South African National Standard (SANS 10409) by our installers. It took six months to complete the work: installing 2500 individual HDPE liner panels. Installation had to be interrupted for about two hours daily during the hottest time of the day. Our installation crew was in contact with their home base via one satellite phone on the mine that was available only at certain times of the day. To stand in line for more than a hour for a 2-4 min call (allowed only twice a week per person) was the rule. The Laawan wind was always blowing, and one 25kg sand bag was placed as ballast to counter wind uplift for every 3 sq.m of installed material. Liner surface temperatures of up to 80 degrees Celsius were experienced and occasional sandstorms did not make matters easier. Locally available assistant laborers were mostly elderly people and the language barrier was challenging.

Dehydration had to be counteracted with an increase water consumption of up to 15 liters a day per person. Some of our staff lost quite a bit of weight, but all returned safely before the end of the year to be with their families.

Our permission to release other technical details on this contract is restricted, however for assistance and matters relating to the geosynthetic materials and geomembrane installation please feel free to contact:

Gundle Geosynthetics (Pty) Ltd

Technical Sales Director- Colin de Bruyn

Tel: (011) 813 2180 or

colin@gundleapi.co.za

BISGA gold mine leach Pad

"Get your facts first, then you can distort them as you please." (Mark Twain)

Erosion Control Works for Kusile Power Station

As part of Eskom's multibillion-rand expansion, two new coal-fired power station projects are currently underway. Kusile, a coal-fired power station, located close to the existing Kendal Power Station in the Delmas Municipal area of the Mpumalanga Province, is the second of two base-load stations scheduled for completion in 2013. The project has a unique location, with sensitive wetland areas situated adjacent the site. Construction has necessitated the need to remove alien vegetation, leaving the cleared land vulnerable to erosion. Kaytech has devised innovative and cost-effective erosion control measures to ensure the long-term protection of the area, including preventing loss of the valuable top soil and inhibiting nearby streams from being contaminated with eroded soil.

Kaytech delivered the blankets in easy to handle rolls, already measured to the projects required lengths. Installation was simple, with experienced teams simply unrolling the blankets into their required positions and staked in place, ensuring they remain fixed even in windy and wet conditions. Garth James, Kaytech's Marketing Director, stated that "The blankets will give plant life time to take hold, without soil loss compromising the process."

Some of the ECC-2 product being installed

The erosion control strategy uses biodegradable soil blankets to stabilize the soil, making them a no-maintenance environmentally friendly solution. Included in the range Kaytech supplies are a number of eco-friendly materials, including coir, wood chips, and grass, held together with a photodegradable synthetic reinforcement, making these blankets appropriate for use in this sensitive environment. On this project Kaytech employed the use of East Coast Erosion Blankets™ ECC-2 product, made from 100 percent coconut husk material which biodegrades over a number of years. The steep slopes of the wetlands, once devoid of alien vegetation, will lie exposed to the elements for a long time before natural plants can establish in sufficient number to bind the soil properly, and a rapidly-degrading solution such as geojute would have been inappropriate in this case.

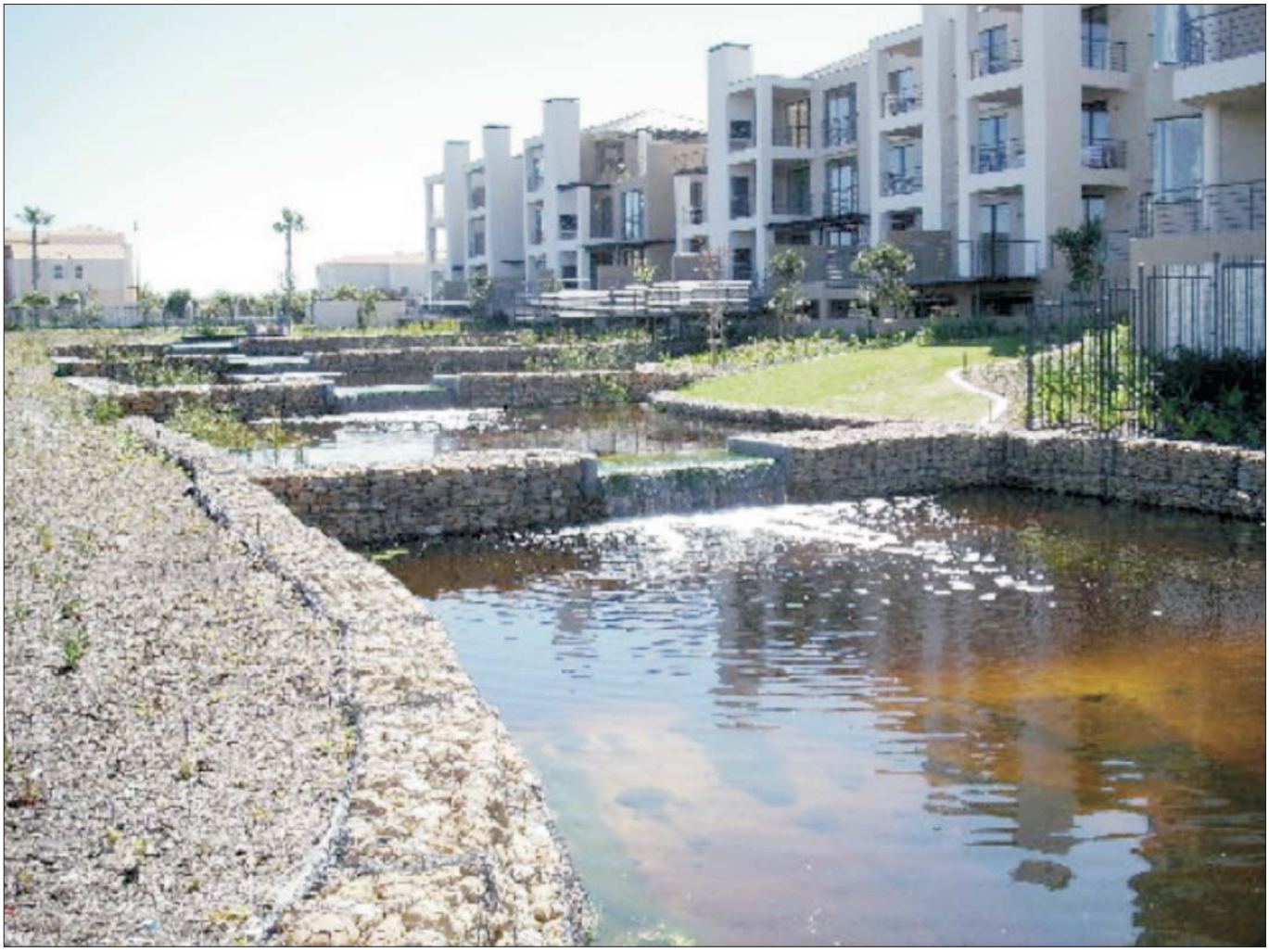
Kaytech's range of erosion control blankets are playing an increasingly important role in assisting farmers, landscapers and homeowners with affordable, viable and simple erosion control solutions.

For more information contact: Garth James

Garth james. Marketing Director
Kaytech Engineered Fabrics
www.kaytech.co.za
garth@kaytech.co.za or Tel : (031) 717 2300

"Wine is constant proof that God loves us and loves to see us happy." (Benjamin Franklin)

Waterstone Village Water Feature



The development of the Water Stone Village complex near the Canal Walk shopping centre in the Western Cape included a cascading waterfeature and planters as the main aspect of the landscaping for the complex. The engineers on the project originally designed a concrete lined water feature with various interleading ponds. Soon after excavation and construction had started on the building footings, it was found that the underlying soil condition would be problematic for a rigid, concrete lined structure.

Engineered Linings were approached to assist in designing an alternative, more flexible solution to replace the concrete design.

Design Methodology:
The final design consisted of a 1,5 mm thick HDPE lining as the primary barrier, a thick A10 Bidim as protection layer above and below the liner and the construction of gabion baskets to create the vertical pond walls.

Construction Process:
The construction process followed specific steps to ensure the integrity of the liner system.
Step 1 – the ponds were set out, slightly over excavated, and the base compacted in order to receive the initial perimeter HDPE lining

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Waterstone Village Waterfeature

Step 2 – a narrow width of HDPE was installed around the perimeter of the ponds, and folded up the over excavated sides. The HDPE was then protected by the A10 Bidim which was installed to cover all exposed HDPE.

Liner, Bidim and gabion baskets in place around perimeter

Step 3 – the gabion baskets were placed on top of the protection geotextile and filled with selected river stones. These gabions created the shape and free flow layout of the various ponds.

Hand filling of gabions

Step 4 – the liner behind the gabions (between the gabion and the excavation) was then folded up tightly against the back of the gabion and backfilled with clean soil to hold it in place.

Clean fill and topsoil in place behind gabions

Step 5 – the protection layer of Bidim inside the ponds was folded back to expose the perimeter HDPE liner inside each pond. The floor lining was then completed.

Floor lining being installed after all construction activities completed on site

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Waterstone Village Waterfeature

Special attention needed to be taken at the various overflow weirs, as the water could not be allowed to simply flow through the gabions. A very well protected HDPE liner was installed (sandwiched) between the two rows of gabions at each overflow. The weir concrete was then cast in such a way that it trapped the HDPE and created a low point where the water would be forced to flow.

Installation of weirs between each pond

The project did pose some challenges, and at times the soil conditions created some tense moments.

Summary

Overall the project ran extremely smoothly and this project proved again that a geosynthetic lining solution can be used to good effect where other more conventional construction methods would have failed. The overall cost of the liner and gabion solution also came in well under the original budget.

For any further details on the project, please feel free to contact:

Engineered Linings

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paulr@englining.co.za

Peter Hardie
021 551 2430
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"A government that robs Peter to pay Paul can always depend on the support of Paul." (George Bernard Shaw)

The Importance of Independent CQA Services during the Installation of geosynthetic Liner Systems

CASE HISTORY: THE SHELL PEARL GAS-TO-LIQUIDS PROJECT: OFF-PLOT WASTE CELL, RAS LAFFAN INDUSTRIAL CITY, STATE OF QATAR

During construction of the Shell Pearl Gas-to-Liquids plant within Ras Laffan Industrial City (RLC), cognisance had to be given to the disposal of toxic chemical waste products. Since the plant is in many respects a 'world first', the chemical composition of the waste product could only be predicted theoretically. A multi-layered geosynthetic liner system was chosen, with the aim of ensuring negligible ground water contamination. The waste cell was divided into 2 'compartments' separated by an internal 1m high berm, the smaller of the compartments for salt storage, and the larger for biosludge containment.

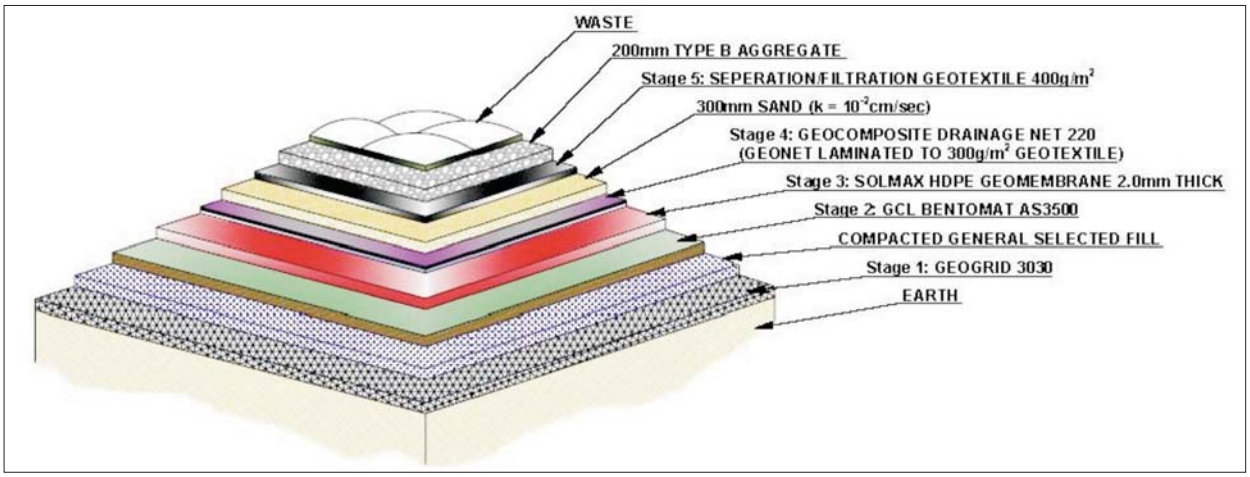
The DAMAC Group was appointed as Construction Project Managers for the excavation and shaping earthworks, installation of the geosynthetic liner system, leachate and rainwater management system construction, as well as construction of the access road into the waste cell. DAMAC appointed KEO International Consultants in Doha, Qatar as consulting engineers for the design of the cell and the lining and drainage system. The specialist geosynthetic liner installation was performed by Arabian Specialised Materials Co. (ASMA). Envitech Solutions (Pty) Ltd was approached to assist with technical design and slope stability calculations for the liner system, in addition to the provision of independent on-site Construction Quality Assurance (CQA) Services.

DAMAC used their own construction labourers during the installation of the liner system and only six trained ASMA geosynthetic liner installation staff were on site for the duration of the project. This in itself created a problem, not only as the labourers had to be trained from scratch, but there was also a significant language barrier.

Koerner[1] (1993) describes Construction Quality Assurance or CQA (as opposed to CQC, MQC and MQA) as: "A planned system of activities that provides the owner and permitting agency assurance that the facility was constructed as specified in the design. CQA includes inspections, verifications, audits, and the evaluation of materials and workmanship necessary to determine and document the quality of the constructed facility. CQA refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications for a project." CQA (and MQA) is performed independently from Construction Quality Control (CQC) and Manufacturer Quality Control (MQC).

Some of the most important CQA tasks for this project included:

- Inspection of delivered lining materials.
- Ensuring that the relevant MQC documentation was supplied for the delivered material on site.
- Inspecting anchor trench and sub-grade preparation.



Schematic Cross Section Detail for the Geosynthetic Lining System

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- Providing advice to the main contractor with respect to the anchor trench construction.
- Observing deployment of lining materials.
- Inspecting deployed GCL, geocomposite, geotextile and geosynthetic membrane panels for defects, physical damage and correct overlapping.
- Observing seaming pre-weld performance and destructive test results.
- Observing and inspecting field seaming of geosynthetic membrane panels.
- Observing and verifying non-destructive air pressure testing, vacuum box testing and high-voltage spark testing of field seams, extrusion welds, patches and repairs.
- Removing destructive test samples from completed field seams, on-site testing of destructive samples, recording results, and keeping archive samples for the Engineer.
- Identification and noting of non-conformances, as well as monitoring rectification work.
- Inspection of sand drainage material and Type B Aggregate.
- Checking and confirming the contractors field installation reports.
- Updating sketches of as-built HDPE panel layouts.
- Keeping a photographic record of GCL, geocomposite, geotextile and geosynthetic membrane liner installation.

Although most CQA work is concentrated around project documentation, the essence of on-site independent CQA services is to identify possible non-conformances before and during the installation phase and to initiate and monitor remedial work. Even though a CQA officer has little authority over work progress on site, it is his/her duty to provide sufficient motivation to the contractor to rectify any non-conformances, failure of which could result in non-approval of the project as a whole.

During the project a number of problems were found, many of which would have gone unnoticed - buried beneath 300mm of drainage sand - had they not been identified during the course of the construction phase through continuous CQA scrutiny. Sand backfilling is known to be responsible for up to 73% of overall liner defects (survey data: Nosko[2] et al 1996). In this case, the use of a non-cohesive beach sand ($k=10^{-2}$cm/sec) – perfect as a drainage layer – but very difficult to place, caused significant damage to the Geocomposite drainage net below, and some minor damage to the underlying Geomembrane, particularly in areas heavily trafficked during the sand placement. After the sand placement had been completed, spot checks were initiated by the CQA officer, revealing the damaged areas. Areas marked were cleared of sand backfill, repaired and tested for leaks (high voltage spark & vacuum box testing), and the Geocomposite net restored, before final approval was given and backfill replaced. Without effective independent CQA, this entire exercise would not have taken place, and the damage would have gone undetected.

Some additional problems addressed through effective

Area cleared of sand backfill, damaged Geocomposite net replaced, geocomposite liner inspected and tested for leaks

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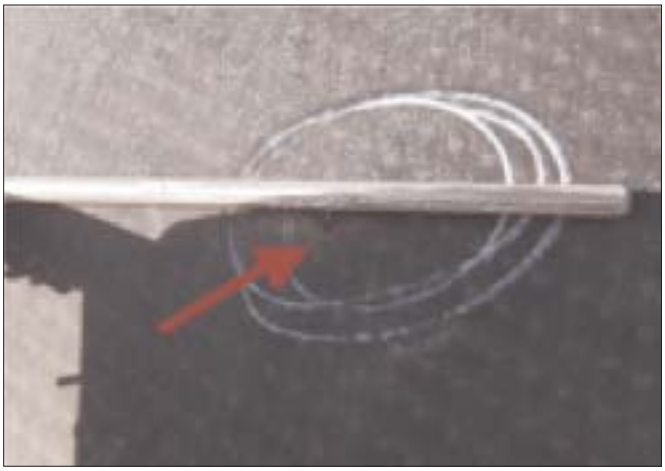
The Importance of Independent CQA Services during the Installation of geosynthetic Liner Systems

CQA included: prevention of damage to geosynthetic liners through puncturing by removal of large/sharp edged stones in the sand backfill by ordering on-site sieving; stopping geomembrane welding during unfavourable – too hot/windy – weather conditions; re-compaction of certain sub-grade areas to ensure uniform and compacted subgrade, free from sharp objects, prior to liner deployment; minimization of wrinkle formation below the sand backfill by ordering night work and training earthmoving vehicle operators; and assisting the contractor with planning the installation activities to ensure minimal damage to lining system as a whole.



Pinhead size leak detected on geomembrane through high voltage spark testing

This particular project illustrates that the extensive time, money and other resources spent on the design and development of a complex geosynthetic lining system can be wasted if the system's integrity is compromised during the installation phase. The use of independent CQA services should provide reassurance that every measure is taken to ensure the installation of a geosynthetic lining system of the highest quality and workmanship.

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www.envitech.co.za

Children we would prefer not to know…

"Advertisements contain the only truths to be relied on in a newspaper". (Thomas Jefferson)

The Editor

Peter Davies
GIGSA Newsletter Editor

Send your contributions, comments and suggestions for the GIGSA newsletter to the Editor at: peter@kaytech.co.za

The GIGSA Newsletter is published on a sort-of-quarterly basis.
Contributions and compliments eagerly received. Criticism may take some time to respond to…

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