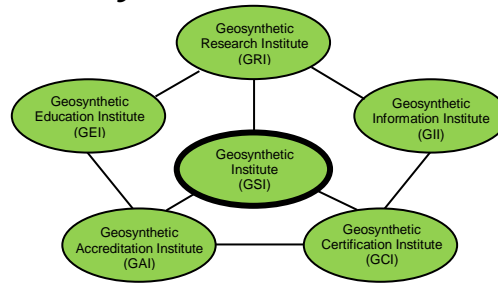


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 33, No. 2

June, 2019

This quarterly newsletter, now in its 33rd year, presents the activities of GSI and its related institutes to all who are interested. It is available on the institute's home page at www.geosynthetic-institute.org. It also serves as a quarterly report to its member organizations. Details are available by contacting George R. Koerner or Marilyn Ashley at phone (610) 522-8440; fax (610) 522-8441 or e-mail at gsigeokoerner@gmail.com or mvashley@verizon.net.

Activities of GSI's Officers and Board of Advisors (BOA)

1. GSI's call-for-proposals for GSI Fellowships is currently in progress. Many magazines and websites have been alerted in this regard. Each of those received and accepted by the BOA reviews will be granted \$5,000 toward their topic and its development.
2. If any readers of this Newsletter/Report want proposal information for transmittal to a university granting engineering graduate degrees contact Jamie Koerner at jrkoerner@verizon.net.
3. Jamie Koerner (Special Projects Manager) is also preparing a state environmental agency survey as to the status of closed municipal solid waste landfills insofar as post-closure care is concerned.
4. The March, 2019 ASCE GeoInstitute Conference in Philadelphia had a major presence of geosynthetics papers, exhibits and courses including Barry Christopher presenting the 2nd GMA Koerner lecture.
5. The annual GeoMEast Conference will be again in Cairo, Egypt on November 10-14, 2019. This ever-growing event will contain the 3rd Koerner Lecture presented by Chiado (Yuli) Doulala-Rigby, Chief Civil Engineer of Tensar International... for details see www.geomeast.org.
6. The GSI Board of Advisors for 2019-2021 is as follows:

Term Ends 2019

- Kent von Maubeuge - NAUE GmbH & Co. KG (International-1)
e-mail: kvmaubeuge@naue.com

- A. K. Mukhopadhyay – BTRA & GSI-India (Agencies)
e-mail: info@btraindia.com/
director@btraindia.com
- Ashish Sukhadia – Chevron Phillips (Resin and Additives)
e-mail: sukhaam@cpchem.com

Term Ends 2020

- Tony Eith - CEC Consultants, Inc. (Consultants and Testing Labs)
e-mail: teith@cecinc.com
- Jimmy Youngblood - GSE Environmental (Geomembranes and GCL's)
e-mail: jyoungblood@solmax.com
- Moreno Scotto - Maccaferri (International - 2)
e-mail: moreno.scotto@gmail.com

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- Why Does GSI Publish Geosynthetic Failures?
- GSI's Member Organizations

Term Ends 2021

- John Workman - Waste Management Inc. (Owners and Operators)
e-mail: jworkman@wm.com
- David Andrews – Propex (Geotextiles and Geogrids)
e-mail: David.Andrews@propexglobal.com
- Sam Allen – TRI Environmental Inc. (At-Large)
e-mail: Sallen@tri-env.com

Overview of GRI Projects (Research)

The following projects are all funded by GSI membership dues unless specifically noted. Most are long-term projects for which we are well positioned to accomplish. *Those projects marked with an asterisk have written papers available; please ask and we will send them accordingly.* Contact George Koerner (gsigeokoerner@gmail.com), Grace Hsuan (hsuanyg@drexel.edu) or Bob Koerner (rmk27@drexel.edu) for details and/or discussions.

1. **Field Exposed Lifetime of Geogrids Used at the Facing of Landfill Berms** - The facing of mechanically stabilized earth landfill berms (and other walls and slopes as well) often uses a wrap-around configuration leaving the geogrid exposed to the atmosphere. A project being conducted by George Koerner is presently investigating the behavior of two different geogrids and two erosion control materials at a local landfill over time. These four materials are also being exposed on the roof of the GSI carport. A 50-year time frame is envisioned! The long-term behavior will eventually be compared to our UV laboratory predicted database.
2. **Laboratory Exposed Lifetime of Geomembranes*** - GSI is using three UV-fluorescent devices to estimate the projected exposed lifetime of six different types of geomembranes. They are HDPE, LLDPE, fPP, EPDM and PVC (N.A.). They are being incubated at 60, 70, and 80°C until half-life of strength and elongation are measured. The goal is lifetime prediction. Incubation times are now over 60,000 light hours (8.2 years) and several are not yet complete. They will probably take as long as 90,000 light hours (\approx 12.3 years). The information up to this point in time was made available to the public on April 6, 2016 at the GeoAmericas Conference in Orlando, Florida. It has been republished in the International Geosynthetics Journal. A copy is available. It is now also being offered as a 90 min. webinar.
3. **HDPE Geomembrane Lifetime as a Function of Thickness** - This often-encountered question is

being evaluated at elevated temperature exposure at in a QUV weathering device per ASTM D7238. Formulations are exactly the same and only the sample thicknesses vary. These thicknesses are 2.76, 2.44, 1.58, 1.08, 0.77 and 0.48 mm. Parameters being evaluated in this decades long study are change in thickness and presence of crazing or cracking. Time will tell!

4. **Laboratory Exposed Lifetime of PVC (European) Geomembranes** - We have been evaluating five different European formulations for nine years using three dedicated UV-fluorescent devices and the results are very impressive. The study is being conducted for CARPI Tech, a GSI member organization. The project also allows us to distinguish between PVC geomembranes manufactured in North America versus Europe. The differences are in the type of plasticizers used in the formulations as well as thicknesses.
5. **Retaining Wall Failure Evaluations*** - We have past GRI Reports 38, 39, and 40 addressing mechanical stabilized earth (MSE) walls using geosynthetic reinforcement which document 82-failures. Our data base has grown to 141, then 171, then 320 and now 340! *Readers, we have a very serious situation in this regard!* The failures are either excessive deformation or actual collapses. We have presented one-day courses on this topic along with inspector training and development insofar as a field inspectors certification program; see the certification section of this Newsletter/Report. An updated paper on 320 case histories has just been published in the Journal of Geotextiles and Geomembranes. Lastly, an ongoing GSI webinar is also available.
6. **pH Between Masonry Block Wall Units*** - George Koerner has been measuring the pH between three types of masonry blocks for over eight years to monitor the values. Concern here is over PET geogrids which are known to be sensitive to very high alkalinity environments. Indeed, the values started high, but over time they are now down to eight and lower. George has published a paper in this regard.
7. **Slow Pressurization of HDPE Geomembranes in Axi-Symmetric Testing*** - The ASTM D5716 method of testing geomembranes in a 3-D axis-symmetric mode uses a pressure rate of 6.9 kPa/min (1.0 psi/min). While such a rate is appropriate for most geomembrane types, it is very fast for HDPE which is semi-crystalline and cannot readily stress relax so as to accommodate the applied pressure. To investigate slower rates we have initiated a project with rates as low as 6.9 kPa/month (1.0 psi/month)! The last test, begun in 2017, is at a rate of 6.9 kPa/six months (1.0 psi/six months) and it will take an estimated five years to conclude. A preliminary paper was presented at Geosynthetics '15 in Portland.

- 8. PVD Strengthening of Soft Foundation Soils***
- A recent project, conducted over the past summer, addresses the use of PVDs for drainage (as customary) plus their tensile reinforcement (never recognized to date). An experimental device was developed and used to assess three different PVDs. This data was then used with the ReSSA soil stability code on a major foundation soil failure that did not have PVDs. The FS-values increased 4% and could go higher with closer spacing or stronger PVDs. A journal paper is available.
- 9. Geotextile Intrusion into Geonet and Geospacer Drainage Cores*** - A series of in-plane flow tests on geonet drainage composites has resulted in the flow rate results for the geonet by itself, the geocomposite with different weights of needle-punched nonwoven geotextiles, and composites with a heat-bonded nonwoven geotextile. The decrease in flow rates of the composites are large when testing boundaries use rubber surfaces. Since this simulates in-situ soil conditions it is significant. A paper has been accepted by the Geotechnical Testing Journal of ASTM. It also includes a generic specification and is available.
- 10. Seams of Reinforced Geomembranes** - There are now five scrim reinforced geomembranes available and the properties are listed in our GRI Specifications. To compliment these sheet products a set of shear and peel tests are have been evaluated. A new specification designated GRI-GM19(b) has been developed... Note that GRI-GM19(a) is presently solely for homogeneous geomembranes. Lastly, a review of the GRI-GM30 specification is underway and it will be modified to reflect new manufacturing of scrim reinforced coated polyethylene geomembranes (≥ 0.75 mm, or 30 mils)/barriers (< 75 mm, or 30 mils).
- 11. Generic Specifications** - A major continuing effort is ongoing with respect to the development and updating of GRI's generic geosynthetic specifications. The current status of these specifications is as follows. Incidentally, all 18 are currently presently copyrighted.

Completed and Available on our Website

GM13 – HDPE Geomembranes
 GM17 – LLDPE Geomembranes
 GM18 – fPP and fPP-R Geomembranes
 GM19a – Geomembrane Seams-Homogeneous
 GM19b – Geomembrane Seams-Fabric Reinforced
 GM21 – EPDM and EPDM-R Geomembranes
 GM22 – Scrim Reinforced PE Barriers
 GM25 – LLDPE-R Geomembranes
 GM28 – CSPE-R Geomembranes
 GM30 – Coated Tape PE Barriers (under revision)
 GCL3 – Geosynthetic Clay Liners

GS15 – Geocells using HDPE Strips
 GT10 – Geotextile Tubes
 GT12 (a and b) – Geotextile Cushions
 GT13 (a and b) – Geotextile Separators
 GN4 – Geonets and Geonet Composites
 GC14 – Turf Reinforcement Mats
 GC16 – Prefabricated Vertical Drains
 GS19 – Geospacers and Geospacer Composites

Under Consideration:

GGXX – Bidirectional Geogrids (tabled)
 GGXX – Unidirectional Geogrids (tabled)
 GMXX – VLDPE Geomembranes (working)

The complete set of formalized specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. There is also a brief tutorial accompanying each specification. Also note that this is where the latest modification will always be available. They are updated/modified on an as-required basis. Lastly, test methods of our most used specifications (HDPE, GCL, etc.) are also described on You Tube.

- 12. Guides and Practices** - GSI also develops standard guides and practices and these are also available free on our website. There are 12 guides and 6 practices. They are modified on a regular basis and the latest version is updated regularly.
- 13. Test Methods** - Since 1987 when we published our first test method on geogrid junction strength until the present, we have developed 72 test methods which are still current.

| | |
|------------------|--------------------|
| 10 - geotextile | 6 - GCL |
| 5 - geogrid | 15 - geocomposite |
| 2 - geonet | 12 - geosynthetics |
| 22 - geomembrane | |

Additionally, 31 have been co-opted by ASTM and we have depreciated our version. Incidentally, our test methods are for members only and are in the password protected portion of our website. We are delighted to report that ASTM has given the David Suits Award to GSI for our cooperation in sharing these GRI standards. We will continue to distribute our test methods in this manner, but specifications, guides and practices are available free as mentioned previously.

- 14. Other GRI Standards** - There are several GRI Standards in various forms of preparation. These include the following:
- A test method to determine the tensile strength of geosynthetic strips
 - Three standards on GCL joining so as to prevent/monitor panel separation.
 - A White Paper explaining the use of MARV for geotextiles

- A transverse rib bending test for homogeneous geogrids
- Several field installation guides are being developed in cooperation with geosynthetic installer personnel vial IAGI... more later

Progress within GII (Information)

Our GSI Home Page is accessed as follows:

<<<http://www.geosynthetic-institute.org>>>

It has been revised and is being maintained through the fine efforts of Marilyn Ashley. Everyone (members and nonmembers) can access the open part, which has the following menu:

| | |
|----------------------|--------------------|
| Newsletter | Research |
| Prospectus | Certification |
| Specifications | Information |
| White Papers | Education |
| Bookstore | Accreditation |
| Keyword Search (new) | Personnel Contacts |
| Members Only | Upcoming Webinars |

To go further one needs a members-only password. Your contact person (see the last section of this Newsletter/Report if you do not know who it is) must obtain a password from Marilyn Ashley. Marilyn can be reached by e-mail at mvashley@verizon.net. When you get into this section, the following information is then available.

- | | |
|--|-------------------------------------|
| • GRI Test Methods | • Links to the GSs World |
| • GRI Reports | • Keyword Search for Generic Papers |
| • GRI Technical Papers (419 Citations) | • Example Problems |
| • Notes of GSI Meetings | • Frequently Asked Questions (FAQs) |

The Keywords Section contains about 35,000 citations which is the vast (~ 90%) majority of the geosynthetics literature published in English. It is updated as each published paper is received. Citation retrieval is quite easy provided that you have a specific topic, or area, in mind. This is the section of the website that we (and others we are told) use the most in our daily activities.

Important Note: This keyword search is now available to everyone. It is on the open section of our website, however, there is a charge for non-GSI members, (www.geosynthetic-institute.org/keywordpay.html). The duplicate information is in the password protected section and is free for GSI members.

In addition to the information provided in our home page as just mentioned, Jamie Koerner (Special Projects Manager) performs various surveys on pertinent topics in geosynthetics. The latest surveys by Jamie Koerner were on the status of geosynthetic use by U.S. State

Departments of Transportation, (White Paper #39) and on their pavement design methods (White Paper #40). Also, if you have topics in need of the current status via a survey please advise accordingly.

Progress within GEI (Education)

GRI Reports

To date, we have 46 GRI Reports available to members and associate members. These reports vary in length from 30 to 200 pages. They are on the password protected section of our home page at www.geosynthetic-institute.org/member/reports.html. Most of them are also available in hard copy. Our most recent report is:

- #46 - Utilizing PVDs to Provide Shear Strength to Saturated Fine-Grained Foundation Soils

GSI Webinars (90 minutes long)

11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at

www.geosynthetic-institute.org/webinar.htm

1.5 Professional Development Hours
Nonmembers Cost - \$250;
GSI and GMA Member Cost - \$200

Commentary on Webinars: Never in Bob K's long career has he "reached out" to so many people than when giving these webinars. For the single cost of \$250 or \$200 a feed is delivered over Adobe Connect to the requested site. This can be transmitted anywhere, e.g., office, conference room, hotel room, auditorium or even sent to additional offices and sites. For example, NY-DEC had the feed going into their Albany auditorium and then into the 13-regions of New York State. Clearly, hundreds of participants were involved! *Dear readers we feel that on-line distance learning, aka, webinars, is the way to communicate information to masses of people in an inexpensive and time efficient manner. Indeed, the future of distance learning is here!* The 2019 schedule of GSI Webinars (19 of them) is as follows:

| Date | GSI No. | Title |
|-------------|---------|---|
| January 10 | W-18 | Pond Liner Design and Performance |
| January 24 | W-20 | Geosynthetic Drainage Materials: Applications, Design, Installation and Performance |
| February 6 | W-1 | A Data Base and Analysis of 320 Failed MSE Walls With Geosynthetic Reinforcement |
| February 20 | W-2 | MSE Wall Back Drainage Design |
| March 6 | W-3 | MSE Wall Remediation and Monitoring |
| March 20 | W-4 | MSE Wall Inspection |

| | | |
|--------------|------|---|
| April 10 | W-23 | Geosynthetic Filters: Concerns and Issues |
| April 24 | W-5 | Geosynthetics in Hydraulic Applications |
| May 8 | W-9 | Behavior and Analysis of Twenty Solid Waste (Landfill) Failures |
| May 22 | W-14 | Lifetime Predictions of Covered and Exposed Geosynthetics |
| June 12 | W-26 | Applications and Design of Geotextile Tubes |
| July 17 | W-17 | Geosynthetics in Erosion Control |
| August 14 | W-16 | Sand Drains-to-Wick Drains-to-Sand-Columns (Including a Major Failure Case History) |
| September 11 | W-21 | A Brief Overview of Geosynthetics and Their Major Applications |
| October 9 | W-15 | In-Situ Stabilization of Soil Slopes Using Nailed (or Anchored) Geosynthetics |
| October 23 | W-27 | Stability Design of Landfill Cover Soils |
| November 13 | W-24 | Disposal of Coal Combustion Residuals |
| November 27 | W-25 | Soil Consolidation by Wick Drains, aka PVDs |
| December 11 | W-22 | Geosynthetic Reinforced MSE Walls; Overview, Failures and Items for Improvement |

Courses

We have now abandoned our in-house, one-day, courses (which have been given for the past 30-years) and are presently delivering two of them in six segments over three consecutive days, one each morning and then afternoon. They are the following:

1. Quality Assurance/Quality Control of Geosynthetic in Waste Containment Facilities (scheduled for June 4-5-6, 2019 and December 3-4-5, 2019)
2. Construction Inspection of Mechanically Stabilized Earth (MSE) Walls, Berms and Slopes (currently not scheduled)

The third and newest of GSI courses is an On-Line “Designing With Geosynthetics (DwG)” course. Please go to <http://www.geosynthetic-institute.org/courses.htm> and scroll down to Course #3. Here you will see the requisite details. The course itself is completely synchronized with the 6th Edition of the DwG textbook. It consists of 1540 slides with \approx 18 hours of voice over; about one minute for each slide.

Contact Jamie Koerner at jrkoerner@verizon.net if you want information and details.

GSI Fellowships

GSI, with the guidance of the its Board of Advisors, has made their fellowship award selections for the 2018-'19 academic year. The program recognizes and supports outstanding students from around the world studying geosynthetics. The GSI fellowship program for this academic year continues to include candidates

pursuing a master's degree, as well as a doctoral degree. The amount awarded to each fellowship recipient is \$5000. The fourteen recipients for the 2018-'19 GSI Fellowship awards are as follows. Proposals are now being accepted until August 15th for the 2019-'20 academic year.

| | Recipient | University | Advisor | Topic |
|-------|----------------------|----------------------|-------------------|---|
| 1-18 | Alsharabaili, Alaa | U. of South Carolina | Charles Pierce | Strain hardening method to evaluate the crack resistance of virgin and aged geomembranes |
| 2-18 | Faterna, Nuzhath | Syracuse U. | Shobha Bhatia | Role of geotextiles in dewatering tests |
| 3-18 | Goudarzi, Anahita | Texas A&M | Jean-Louis Briaud | Experimental and numerical simulation of geosynthetic reinforcement soil interaction |
| 4-18 | Hanumasagar, Sangy | Georgia Tech | David Frost | Experimental and numerical evaluation of lateral confinement of aggregates in geogrid stabilized flexible pavements |
| 5-18 | McCafferty, Conor | Drexel U. | Grace Hsuan | Numerical modeling to simulate dewatering process of GT tubes filled with fine-grained slurries |
| 6-18 | Norris, Anna | Colorado State U. | Joseph Scalia | Indicator parameter test development for screening the hydraulic compatibility of enhanced bentonites |
| 7-18 | Rahmaninezhad, Seyed | U. of Kansas | Jie Han | Bearing capacity and deformation of GS walls with flexible facing subjected to footing loads |
| 8-18 | Ryoo, Sung | U. of Maryland | Ahmet Aydilek | Hydraulic compatibility of GT compost systems in landfill covers |
| 9-18 | Sheikh, Bahman | Penn State | Tong Qiu | Breakwater design guidelines for GT tube applications |
| 10-18 | Thabo, Mosta | National Pingtung U. | Wayne Hsieh | Effects of grass and rolled erosion control products at different growth stages on the Manning's coefficient in channel flow |
| 11-18 | Ullah, Saad | George Mason U. | Burak Tanyu | Experimental methodology to evaluate long-term performance of GT to minimize the migration of soft clay into highway base courses |
| 12-18 | Wang, Dongfang | U. of Mass Amherst | Guoping Zhang | Improvement of GCLs with super hydrophobic hybrid organic-inorganic polymeric powder |
| 13-18 | Wright, Jason | U. of Georgia | Sonny Kim | Utilization of accelerated pavement layers due to use of GS materials |
| 14-18 | Xia, Xiaolong | Missouri U. | Xiong Zhang | Photogrammetric method to measure 3D full field displacement of GS during the tensile test |

Activities within GAI (Accreditation)

The Geosynthetic Accreditation Institute's (GAI) current mission is focused on a Laboratory Accreditation Program (LAP) for geosynthetic test methods. George Koerner is in charge of the program. The GAI-LAP was developed for accrediting geosynthetic testing laboratories on a test-by-test basis. GAI-LAP suggests that laboratories use ISO 17025 as their quality system model. In addition, the program uses the GSI lab as the reference test lab and operates as an ISO 17011 enterprise. *It should be emphasized that our GSI lab does not conduct outside commercial testing.*

It should also be made clear that GAI-LAP does not profess to offer ISO certification, nor does it “certify” laboratory results. GAI-LAP provides accreditation to laboratories showing compliance with equipment training and documentation for specific standard ASTM or ISO test methods. In addition, GAI-LAP verifies that an effective quality system exists at accredited laboratories by way of proficiency testing.

There have been significant additions to the number of GAI-LAP tests. Presently, there are 252 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of June, 2019, the following laboratories are accredited by the GAI-LAP for the number of test methods listed in parenthesis. Contact personnel, telephone numbers and e-mails are also listed.

- 1^A - TRI/Environmental Inc. (155 tests)
Jarrett Nelson -- (512) 263-2101
jnelson@tri-env.com
- 3^A - Golder Associates (43 tests)
Henry Mock -- (770) 492-8280
Henry_Mock@golder.com
- 4^C - Geosynthetic Institute (108 tests)
George Koerner -- (610) 522-8440
gsigeokoerner@gmail.com
- 8^B - Propex Operating Co., Ringgold (17 tests)
Todd Nichols -- 438-553-3757
todd.nichols@propexglobal.com
- 9^B - Lumitec (17 tests)
Rebecca Kurek -- (770) 869-1187
rkurek@lumiteco.com
- 13^A - Precision Geosynthetic Labs (TRI Env.) (87 tests)
Cora Queja -- (714) 520-9631
cqueja@tri-env.com
- 14^A - Geotechnics (50 tests)
J. P. Kline -- (412) 823-7600
JPkline@geotechnics.net
- 20^A - GeoTesting Express, MA (60 tests)
Gary Torosian -- (978) 635-0424
gtt@geotesting.com
- 22^B - CETCO Hoffman Estates (11 tests)
Minerals Technologies Inc.
Barbara Gebka -- (847) 851-1904
Barbara.gebka@mineralstech.com
- 24^B - CETCO Lovell (10 tests)
Minerals Technologies Inc.
Stuart Yates -- (307) 548-6521
stuart.yates@mineralstech.com
- 25^B - Ten Cate, Pendergrass (13 tests)
Darrell Scoggins -- (706) 693-2226
d.scoggins@tencategeo.com
- 26^B - Agru America Inc. (27 tests)
Maria Coffey -- (843) 546-0600
mcoffey@AgruAmerica.com
- 29^E - FITI Testing and Research Institute (80 tests)
Dong Whan Kim -- 82-2-3299-8071
dwhkim@fitiglobal.com
- 31^D - NYS Dept. of Transportation (9 tests)
Tom Burnett -- (518) 485-5707
tburnett@dot.ny.gov
- 34^B - GSE Lining Technology - Houston (29 tests)
Lana Hickman
Lhickman@solmax.com
- 38^C - CTT Group (123 tests)
Jacek Mlynarek -- (450) 771-4608
jmlynarek@gcttg.com
- 40^B - GSE Environmental (14 tests)
Thomas Harrelson -- (843) 382-4603
tharrelson@solmax.com
- 41^A - SGI Testing Service, LLC (18 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@sgilab.com
- 42^C - NPUST (GSI-Taiwan) (71 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
CWH@mail.npust.edu.tw
- 43^A - Ardaman & Associates (22 tests)
George DeStefano -- (407) 855-3860
gdestafano@ardaman.com
- 44^B - Fiberweb, a Berry Global Inc. Co. (9 tests)
Devin Clem -- (615) 847-7299
devinclem@berryglobal.com
- 45^B - Ten Cate Geosynthetics Malaysia SDN Bhd. (24 tests)
Boon Kean Tan -- (603) 519 28576
BK.tan@tencase.com
- 46^B - TAG Environmental Inc. (13 tests)
Ryan Ackerman -- (705) 725-1938
ryan_ackerman@tagenv.com
- 49^B - Engepol Geossintéticos (15 tests)
Patricia Ferreira -- (55) 51 3303-3901
patricia@engepol.com
- 50^B - ADS, Inc. Hamilton (7 tests)
Justin Elder -- (513) 896-2065
justin.elder@ads-pipe.com
- 51^B - Solmax (22 tests)
Claude Cormier -- (450) 929-1234
ccormier@solmax.com
- 53^B - Polytex Autofagasta (19 tests)
Mario Contreras Cardenas -- 011 55-288-3308
mcontreras@polytex.cl
- 55^B - Atarfil Geomembranas (21 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com
- 56^B - Polytex Santiago (13 tests)
Luedy Utria Caicedo -- 011 56-2-677-1000
Lutria@polytex.cl
- 57^B - Ten Cate Cornelia (22 tests)
Melissa Medlin -- (706) 778-9794
m.medlin@tencategeo.com
- 58^B - Propex Operating Co. Hazelhurst (10 tests)
Victoria Shoupe -- (912) 375-6180
Victoria.Shoupe@propexglobal.com
- 59^B - Firestone (9 Tests)
Janie Simpson -- (864) 439-5641
SimpsonJanie@firestonebp.com
- 60^B - TDM Geosintéticos S.A. (17 tests)
Roberto Diaz -- 051-1-6300330
rdiaz@tdmgeosinteticos.com.pe
- 61^B - Raven Industries (18 tests)
Clint Boerhave -- (605) 335-0288
Clint.Boerhave@ravenind.com
- 62^B - Solmax (14 tests)
Pei Ching Teoh -- (450) 929-1234
pcteoh@solmax.com
- 63^A - TRI-SC Labs (11 tests)
Jay Sprague -- (864) 346-3107
Jesprague@tri-env.com
- 64^B - Agru America (NV) (14 tests)
Ryan Steele -- (775) 835-8282
RSteele@AgruAmerica.com
- 65^C - Bombay Textile Research Assoc. (BTRA) (21 tests)
Riyaz Shaikh
(0) 022-25003551
btra@vsnl.com
- 66^B - Rowad International Geosynthetics Co. Ltd (13 tests)
Asad Ullah Khan -- +966-3-812-1360
asad@rowadplastic.com
- 68^B - Shawmut Corporation (4 tests)
Tania Currie -- (336) 229-5576
tcurrie@shawmutcorporation.com
- 69^B - GSE Lining Technology Co. (13 tests)
Siriporn Chayaporenert -- 6638-636638
siripornc@solmax.com
- 70^A - RSA Geo Lab LLC (48 tests)
Rasheed Ahmed -- (908) 964-0786
geolab13@yahoo.com
- 71^B - Plasticos Agrícolas y Geomembranas S.A.C. (24 tests)
Manuel Constantino Olivares Espinoza -- 073-511814-511829
calidad@pgaperu.com
- 72^B - Tensar Corp. GA (5 tests)
Lynn Cassidy-Potts (770) 968-3255
lcassidy@tensarcorp.com
- 73^B - Gai Loi JSE (10 tests)
Paul Wong 84-650-362-5825
paul905677@gmail.com
- 74^B - Agru America Inc. (9 tests)
Mark Locklear - (843) 221-4121
mlocklear@agruamerica.com

- 75^B - GeoMatrix S.A.S. (37 tests)
Javier Diaz Cipagauta (571) 424-9999
jdiaz@geomatrix.com.co
- 76^B - Tehmco (Chile) (15 tests)
Rodrigo Campoy 56-22-580-2852
rcampoy@tehmco.cl
- 78^B - PQA Mexico (15 tests)
Cesar Augusto Arcila (669) 954-8202
directorcalidad@payq.mx
- 79^A - TRI Geosynthetic Testing and Services (32 tests)
Ping Wang 86-512-6283-1396
Pwang@tri-env.com
- 80^B - Texel Technical Materials (11 tests)
André Parent (418) 387-4801
andre.parent@lydall.com
- 81^B - GSE Lining Technology GmbH (18 tests)
Evelyn Kroeger 49-40-767420
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- 83^B - Solmax GSE (13 tests)
Ahmed Abdel Tawab - 202-2-828-8888
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- 84^B - Owens Corning (14 tests)
Ashutosh Dixit - 1-778-945-2888
Ashutosh.dixit@owenscorning.com
- 85^B - PAG Tacna (17 tests)
Manuel Constantino Olivares Espinoza –
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calidad@pqaperu.com
- 86^B - BOSTD China (29 tests)
Zheng Hong - 86-532-8780-6919
zhenghong@bostd.com
- 87^B - Willacoochee Industrial (19 tests)
Jason Booth - 912-534-5757
jason@winfabusa.com
- 88^B - Geosynthetic Testing Services Pvt. Ltd. (16 tests)
Ravi Kant - 02717-250019
rkant@gts-pl.com
- 89^B - Megaplast India Pvt. Ltd. (13 tests)
Hermendra Behera - 91-937404-4620
geo.sqc@megaplast.in
- 90^B - Techfab (India) Industries Ltd. - Daman (10 tests)
Jagdish Chandra Joshi - 91-22-2287-6224
nonwoven.qualitylab@techfabindia.com
Anant Kandi - anant@techfabindia.com
- 91^B - Techfab (India) Industries Ltd. - Rakholi (3 tests)
Rajendra Chavan - 91-982-593-9922
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- 92^B - Techfab (India) Industries Ltd. - Khadoli (2 tests)
Navir Kumar - 91-22-229-76224
woven.qualitylab@techfabindia.com
- 93^B - Garware Technical Fibres (18 tests)
Rajendra K.Ghadge - 0-932-601-8083
rghadge@garwareropes.com
- 95^B - Mexichem Colombia (Pavco) (8 tests)
Juan David Lopez Torres - 57-1-782-5100 (ext. 1534)
juan.david.lopez@mexichem.com
- 96^B - Tensar China (6 tests)
Zhu Shaolian - 603-6148-3276
zsl@tensar.com.cn
- 97^A - TUV SUD PSB Singapore (16 tests)
CHA Ming Yang - 65-6885-1514
ming-yang.CHA@tuv-sud.psb.sg
- 98^B - NeoPlastic Filmes e Embalagens Plasticas Ltda. (7 tests)
Daniel Meucci - 55 (11) 4443-1000
daniel.meucci@sapphireoffice.com.br
Nathalia Santos
nathalia.santos@neoplastic.com.br
- 99^B - Atarfil Middle East (16 tests)
Mohammad Hneine - 971-564-33-1271
mhneine@atarfil.com
- 100^B - Atarfil Geomembranes USA (12 tests)
Alejandro Carreras - 757-263-4057
acarreras@atarfil.com

- 101^B - Solmax (Spearfish) (7 tests)
Chuck Taylor - 605-642-8531
ctaylor@solmax.com
- 102^B - SKAPS Industries (11 tests)
Nilay Patel - 706-336-7000
patel@skaps.com
- 103^B - STRATA Geosystems Pvt. Ltd. (6 tests)
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^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

If anyone desires more information on the GAI-LAP, its test methods, the associated laboratories, etc., a directory is published in December of each year. It is available on GSI's home page at <http://www.geosynthetic-institute.org/gai/intro.pdf>.

Other GS Laboratory Activities

The ASTM Technical Committee on Geosynthetic Clay Liners (GCLs) D35.04 had a workshop on **Advances in Characterization of Hydraulic Barrier Performance of GCLs** Sponsored by ASTM Committee D35 on Geosynthetics. The workshop was held on Wednesday June 5, 2019 in Denver, Colorado. There were thirty-six people in attendance for this all day workshop which had four sessions within it.

George Koerner was the chair for the fourth session of the workshop. There were only two presenters in the session as follows;

“The Uncertainty with ASTM D5887 and DIN 16416 Flux through GCLs” by George R. Koerner of the Geosynthetic Institute (GSI) and Point & Counterpoint of ASTM D5887 “Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liners Specimens Using a Flexible Wall Permeameter” versus ISO EN 16416 “Geosynthetic clay barriers: Determination of Water Flux Index, Flexible Wall Permeameter Method at Constant Head” by Kent von Maubeuge, Naue GmbH & Co.

Koerner discussed data obtained from the past five years of the Geosynthetic Institute's (GSI) Proficiency Testing Program (PTP) under the auspices of the GAI-LAP. GSI PTP is modeled after the requirements of ISO/IEC 17043:2010 “Conformity Assessment - General Requirements for Proficiency Testing” and is a statistical quality assurance mechanism that enables laboratories to evaluate and improve performance, and maintain and fulfill mandatory accreditation requirements.

Knowledge of testing result uncertainty is fundamentally important for laboratories, their clients and stakeholders using these results for comparative purposes. Uncertainty of measurement is a requirement of ISO 17025 and a key to mitigating risks, improving quality and reducing costs. Despite the established requirements of a test standard or norm, no measurement is exact. No matter how careful or accurate the result is obtained. Every measurement

result contains an independent amount of uncertainty. Therefore, if measurement is important, then measurement uncertainty is equally important. According to both ASTM and ISO, no measurement is complete without an accompanied statement of the associated amount of uncertainty. Creating awareness for the importance of measurement uncertainty is the key to ensuring that the geosynthetic industry has a focus on measurement quality.

von Maubeuge discussed the two standard methods for GCL Flux (ASTM and ISO) and determined that the norms were essentially the same. He meticulously went through the requirements for apparatus, reagents, test specimen preparation, consolidation and backpressure saturation, permeation and termination criteria. The only major difference between the two methods is the determination of thickness of the specimen. ASTM D5887 measures the average thickness of the clay cross section at three locations of clay component cross section after dissection. This is different from the Annex of the DIN 16416 standard which specifies a dead weight micrometer per EN ISO 9863-1 at 35 kPa using a loading plate of area 25 cm² measuring the entire GCL composite.

Throughout the session there was lively discussion and nice feedback to improve ASTM's D5887 Flux. It was universally thought that the section was a success.

In other ASTM Meeting activities...

- Sam Allen of TRI Env. received the L. David Suits Award from ASTM committee on Geosynthetics (D35). This award is given to individuals who distinguish themselves in the geosynthetics field with contributions that result in an advancement of geosynthetic knowledge in the areas of test methods, guides, practices and specifications. Sam received this prestigious award which was presented in person by Dave Suits in Denver CO along with his family and many colleagues from TRI offices around the country.
- Kent von Maubeuge of Naue GmbH & Co. KG, Germany received "The Award of Merit" from ASTM in Denver, CO. This award was established in 1949 by the ASTM International Board of Directors and is the highest society award granted to an individual member for distinguished service and outstanding participation in ASTM International committee activities. Recipients also receive ASTM's honorary title of "Fellow."
- Sam and Kent are pictured below beaming after receiving their respective awards. Congratulations to both Sam and Kent who also both serve on GSI's Board of Advisors.



In related laboratory activities...

The semi-annual GAI-LAP meeting was held in Denver, Colorado in conjunction with ASTM D35 on Thursday June 6, 2019 in the Downtown Sheraton. Fourteen people attended this meeting which was held at 7:00 AM in the morning before Task Group meetings began. We should point out that a virtual repeat meeting will be held as a webinar on Wednesday July 10, 2019. We are grateful that ASTM allowed us the venue. I also want to thank all that were in attendance for their time and effort.



Front row: Rich Lacey (TRI), Cora Quaja (TRI), Rebeca Kruek (Lumite), Melissa Medlin (TenCate), Marshall Susman (Propex), Sam Allen (TRI) Back Row: Nigel Wrigley (NewGrid Ltd.), Mauricio Ossa (GSE), Jeff Kuhn (TRI), Gary Torosian (GTX), Nathan Ivy (AGRU America), J.P. Kline (Geotechnics), Not Pictured: George Koerner (GSI) Katerina Koperna (ASTM)

The discussion at the one hour meeting was as follows. A brief introduction and background of the GAI-LAP program was presented. Please note that we are in our 24th year of operation. The program started in 1995. We accredit only geosynthetic labs and model the program after ISO 17025. On-site audits are conducted every five years and proficiency tests every year with a goal of the coefficient of variation less than five for each test conducted. The demographics of the current GAI-LAP labs are summarized as follows: 20 independent labs, 50 manufacturer QC labs, 5 centers (research or government) and 8 labs participating in the PTP only. Thirty-eight of these labs are GSI members. Also, the entire group is from 21 different countries. There are

257 possible ASTM or ISO tests for accreditation. The number of accredited tests per lab varies greatly, e.g., 4 min., 27 ave. 160 max. There has been a rapid rise of new test methods. Many of the new tests being added are in erosion control materials and geocomposites.

Proficiency testing is still the hallmark of GAI-LAP. There were over 4,500 proficiency test results submitted this year, with only 17 first submittals as outliers. All outliers were resolved. Results of the proficiency tests were shared at the meeting and also distributed electronic via e-mail and CD. Congratulations to the GAI-LAP members on a job well done!

The expanded GAI-LAP Customer Survey was sent out to all program participants and the findings were reviewed at the meeting. The program is receiving high marks thanks to the hard work of Jamie and Marilyn in the front office of GSI. People are embracing the audits and enjoying robust discussion during the process that were conducted by GSI this year. We feel that the program has had a very good year and look forward to expanding our outreach going forward.

As usual at these annual meetings we had a lively discussion regarding the various *conflict resolution* cases addressed by the GAI-LAP this year. They are summarized below;

1. ASTM D5199 & D5994; should only report to the 1 mil precision
2. ASTM D3895 & D5885; plaquing is a requirement for both standards in the name of specimen halogenation
3. ASTM D4491; sealing the specimen with glue is sometimes needed to assure no specimen bending or perimeter leakage
4. ASTM D5887; puttying the perimeter of the (porous stone, filter paper, GCL, filter paper and porous stone) specimen sandwich with auxiliary clay paste is commonplace in the industry.
5. ASTM D5321; gripping and clamping for midplane and interface shear testing with saturated GCL at high normal pressures are challenging.
6. ASTM D6364; movable platen for the "B" procedure typically involves a steel ball and machined top plate

The next GAI-LAP annual meeting will be held in February 5th, 2020 in conjunction with ASTM D-35 in Atlanta, GA. It is a pleasure working with you. We appreciate your participation and congratulate you on your success! If you have questions, please contact me accordingly. George Koerner (gsigeoerner@gmail.com).

Activities within GCI (Certification)

GSI presently has three separate inspector certification programs. One (begun in 2006) is focused on QA/QC of field inspection of waste containment geosynthetics and compacted clay liners. The second (begun in 2011) is focused on MSE Wall, Berm and Slope field inspection. The third on Geosynthetic Designer Certification began on September 1, 2016. See our website at www.geosynthetic-institute.org under "certification" for a description and information on all three of them. They are similar in that a perspective candidate must...

- Be recommended by a superior or professional engineer who knows, and can attest to, at least six months of acceptable experience performing professional services within the specific application area.
- Submit a completed application and be approved by the Geosynthetic Certification Institute to take the exam.
- Must successfully pass a written examination (70% of the questions is the passing grade) proctored by GCI or a GCI designated organization and graded by the Geosynthetic Certification Institute to become a certified inspector or engineer.
- Must pay a one-time fee which covers a five-year period upon completion of the above items. The fee is \$500 for five-years of certification. It is renewable if so desired.

Program #1 - Inspection of Liner Systems for Waste Containment Facilities

This program now in its thirteenth year has been recommended, and in some cases required, by solid waste owners, state regulators, and design consultants for proper QA/QC in field installation of both geosynthetic materials and compacted clay liners. The statistics to date are as follows. The examination has been gradually revised attesting to the changes occurring over the past years. For example, geospacers are now included with geonets and drainage composites. This program, by far, is the most successful of the three GSI certification programs.

**Inspector Certification Test Results for
Waste Containment Inspectors
2006 – 2018**

| Year | Geosynthetic Materials | | Compacted Clay Liners | | Commentary No. of people failing both exams |
|------------------------|---------------------------|----------------------------|---------------------------|----------------------------|--|
| | No. of people taking exam | No. of people failing exam | No. of people taking exam | No. of people failing exam | |
| 2006 | 141 | 5 (3%) | 128 | 12 (9%) | 2 |
| 2007 | 82 | 11 (13%) | 73 | 12 (16%) | 7 |
| 2008 | 95 | 25 (26%) | 89 | 20 (22%) | 13 |
| 2009 | 36 | 7 (19%) | 36 | 2 (5%) | 2 |
| 2010 | 59 | 12 (20%) | 54 | 7 (13%) | 5 |
| 2011 | 54 | 6 (11%) | 53 | 3 (6%) | 1 |
| 2012 | 34 | 5 (15%) | 28 | 3 (11%) | 3 |
| 2013 | 32 | 4 (12%) | 30 | 1 (3%) | 1 |
| 2014 | 45 | 1 (3%) | 42 | 3 (7%) | 0 |
| 2015 | 56 | 6 (11%) | 51 | 6 (12%) | 1 |
| 2016 | 36 | 3 (10%) | 35 | 5 (18%) | 0 |
| 2017 | 78 | 5 (6%) | 66 | 3 (4%) | 1 |
| 2018 | 53 | 5 (10%) | 51 | 1 (3%) | 0 |
| 2019 | 43 | 8 (18%) | 43 | 5 (12%) | 4 |
| TOTAL (to date) | 844 | 103 (12%) | 779 | 83 (11%) | 40 (5%) |

There are currently 324 practicing certified inspectors - 268 inspectors (2014-2018) and 56 inspectors (2006-2013) who have renewed to keep their certifications current. Renewals represent 17%. This is felt to be encouraging from our perspective. Incidentally, the next on-line course is December 3-4-5, 2019.

**Program #2 - Inspection of MSE Walls,
Berms and Slopes**

While a field inspector cannot require proper design or direct a contractor how to build a wall, flaws can be identified for possible design modification or mitigation action. Furthermore, and at minimum, construction practices can be observed and corrected if inadequate or improper.

The official launch of this inspection program was on December 1, 2011 with a course and the examination afterward. A somewhat revised course on November 29, 2012 was presented. Presently, the corresponding course for this certification program has been transferred into a series of six presentations over a consecutive three-day period. The live on-line course has not been scheduled, however, recordings are available. Contact Jamie Koerner at jrkoerner@verizon.net for details and arrangements.

The status of the program is shown in the following table. Here it can be seen that this particular GSI certification has not been particularly successful even though we have 340 similar MSE wall failures (recall Item #5 in the research section on page 3).

**Inspector Certification Test Results for
MSE Walls and Berms Inspectors
(2011-2018)**

| Year | Course Location | MSE Wall And Berms | |
|--------------|--------------------|-------------------------------|--------------------------------|
| | | No. of People Taking the Exam | No. of People Failing the Exam |
| 2011 | GSI Course | 7 | 0 |
| 2012 | GSI Course | 6 | 0 |
| 2013 | GSI Course | 2 | 0 |
| 2014 | GSI Course | 3 | 0 |
| 2015 | GSI Course | 4 | 0 |
| 2016 | GSI On-Line Course | 2 | 2 |
| 2017-19 | GSI On-Line Course | 0 | 0 |
| TOTAL | | 24 | 0 |

Program #3 - Geosynthetic Designer Certification

The “Geosynthetic Designer Certification Program (GDGP)” is also now available. Please go to <http://www.geosynthetic-institute.org/gdcpintro.pdf> for the requisite details. Included are introduction (rationale behind the program was given in a recent GSI Column called “We’re Losing the Battle”), disclaimer, requirements, application, reference material, sample questions, proctor manual and proctor application. In the *requirements* section you will see that the applicant must;

- be a graduate of an accredited engineering program,
- have six-months geosynthetic designer experience,
- complete the application form,
- pay the \$500 fee for 5-years certification, and
- take a 45-question examination with \geq 70% passing.

The *examination* itself is subdivided into 15-sections, each consisting of five questions. A candidate must answer any 3 questions in each section, making a total of 45 questions to be answered. Most of the questions are numeric, as is geosynthetic design practice in general. Unlike our other certification examination questions, however, this examination is of an open-book, open-notes format and does require a calculator so as to “crunch the numbers”.

Lastly, please spread-the-word within your organization and to others as well. We sincerely hope that one, or all three, of the above programs will be beneficial in upgrading the technical base of geosynthetic design and installation so as to properly utilize all of our geosynthetic materials in all of their many applications. All three programs are on-going and if you have questions and/or comments please contact us accordingly.

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The GSI Affiliated Institutes

It has long been realized that the information generated within the GSI group should have a timely outlet to all countries, and in all languages. To this end, GSI has created affiliated institutes in three countries (Korea, Taiwan and India), and potentially others in the future. These affiliated institutes are full members of GSI and are empowered to translate and use all available information so as to create similar institutes and activities in their respective countries.

GSI-Korea was formed on February 9, 1998 as a collaborative effort between FITI Testing and Research Institute (a quasi-government organization) and INHA University (through its Geosynthetics Research Laboratory). It is presently held entirely within INHA University.

INHA University is located in Incheon and the geosynthetics laboratory is led by Professor Han-Yong Jeon. Dr. Jeon has 10-students working on geosynthetic-related projects and is extremely active both nationally and internationally. His active participation at conferences worldwide is very admirable. He has provided research and development in many geosynthetic subjects including geotextiles, geomembranes, geocells, additives for GCLs, recycled plastics for improved formulations, etc.

GSI-Taiwan was formed on August 18, 2000 and is wholly contained within the National Pingtung University of Science and Technology in Nei Pu, Pingtung (southern Taiwan). It completely parallels GSI in that it has specific units for research, education, information, accreditation and certification. The Director is Dr. Chiwan Wayne Hsieh who is a Professor in the Department of Civil Engineering and Dean of the R & D Office. GSI-Taiwan has a Taiwanese consortium of geogrid/geotextile manufacturers who work toward producing quality products according to the draft GRI geogrid specifications and the associated test methods. As such, GSI-Taiwan is a GAI-LAP accredited laboratory for 59 geosynthetic test methods. Dr. Hsieh has 10 students working on geosynthetic-related projects and is extremely active nationally and internationally. GSI Taiwan has hosted three very successful internal conferences to date and has also held a much broader one, namely, GSI-Asia in Taichung, Taiwan.

GSI-India under the new direction of Dr. A. K. Mukhopadhyay (who succeeds Dr. A. N. Desai) was formed in 2015. The hosting organization is the Bombay Textile Research Association (BTRA) which is

world known for its excellence in textile R & D and is currently branching out into all forms of geosynthetics. We are delighted in this regard and, as a side-note, Dr. Mukhopadhyay has replaced Dr. Desai on GSI's Board of Directors to fill out his term.

Why Does GSI Publish Geosynthetic Failures?

To begin with, let us unequivocally state that we owe a tremendous sense of gratitude to the geosynthetic industry in general, and members/associate members of the Geosynthetic Institute (past and present) in particular. Furthermore, we hope that all of your projects are successful and that they function as planned, designed and constructed. In this regard, successful projects are regularly investigated by us, and others, and are often published in various outlets. In the past, we have published in journals, conferences and magazines the following 42-articles, all of which were success stories. Congratulations to all of those that were involved.

- geotextile related – 8
- geogrid related – 3
- geonet/geospacer related – 4
- geomembrane related – 14
- GCL related – 3
- geocomposite related – 7
- general geosynthetics related – 3

Regarding the publication of unsuccessful (aka, failure) projects, the situation is markedly different. We fully sympathize with the companies and individuals who are involved in such failures, not to mention the costs involved as well as possible insurance and legal involvement. As such, it is a sensitive undertaking to publish failures in any situation. Such publications are not taken lightly by any stretch of the imagination. For example, in 1988, we wrote an “innerview” note in GFR magazine (the forerunner of Geosynthetics) which stated, “For every failure, there is a lesson to be learned. For every success, there is not necessarily a lesson to be learned”. It is indeed in this context why failures are important to highlight for the simple reason that others, who were not directly involved, can learn accordingly. As such, GSI has published failures in those situations which have occurred repeatedly. In this regard, the applications involved and the number of failures in each situation that we are familiar with are as follows:

- drainage composite connections and outlets (7)
- veneer cover slides (11)
- solid waste landfill failures (20)
- bubbles in pond liners (30)
- geotextile filter failures (82)
- retaining wall and slope failures (338)

As suggested from the above categories of failures, our focus has been on repeat failures which seems to suggest that some aspect of improper practice is ongoing and sometimes by more than one entity. In these failure situations the specific project is completely sanitized as far as location, parties involved and specific geosynthetics that were used. Hopefully, root causes of such failures are properly identified and can then be used by others to avoid the same, or similar, issues from occurring in the future. Hopefully, the situations can be minimized or cease to exist altogether. The old adage "a wise person learns from the mistakes of others" will then be implemented accordingly and to the benefit of everyone.

Bob and George Koerner

GSI's Member Organizations

We sincerely thank all of our sponsoring organizations. Without them, GSI simply could neither happen nor exist. The current GSI member organizations and their contact members are listed below. **Our newest members are (i) the Thrace Group with James Brown/Stella Karavasili, (ii) SKAPS Industries with Edward Zimmer, Nilay Patel and Anurag Shah (iii) Chesapeake Containment Systems (CCS) with Steven Mayes and (iv) Duke Energy with Evan Andrews and Ken Karably as main contact persons. Thanks to all and welcome to GSI!!!**

U.S. Environmental Protection Agency

David A. Carson

Federal Highway Administration

Silas Nichols/Daniel Alzamora

Golder Associates Inc.

Frank Adams/Paul Whitty/Linda Grover

Tensar International Corporation

Mark H. Wayne/Joseph Cavanaugh/Doug Brown

TenCate Geosynthetics

John Henderson/John Lostumbo/Chris Lawson

CETCO

Dave Chiet/Michael Donovan/Rob Valorio

Huesker, Inc.

Flavio Montez/Andreas Elsing/Lilma Schimmel

NAUE GmbH & Co. KG

Kent von Maubeuge [BoA]

Propex Operating Company LLC

Drew Loizeaux/David Andrews [BOA]

Berry Global Inc.

Keith Misukanis

TRI/Environmental Inc.

Sam R. Allen [BoA]/C. Joel Sprague

U. S. Army Corps of Engineers

Kevin Pavlik/Richard DePasquale

Chevron Phillips Chemical Co.

Ashish Sukhadia [BoA]/ Vergil Rhodes

AECOM (formerly URS Corp.)

John Volk/John Bove/Michael Stepic

Solmax Géosynthétiques

Jacques Cote/Simon Gilbert St-Pierre/Jimmy Youngblood [BOA]

CARPI, Inc.

Alberto M. Scuero/John A. Wilkes

Civil & Environmental Consultants, Inc.

Tony Eith [BoA]

Agri America, Inc.

Nathan Ivy [BoA]/Markus Haager

INHA (GSI-Korea)

H.-Y. Jeon

Waste Management Inc.

Greg Cekander/John Workman [BoA]

NPUST (GSI-Taiwan)

Chiwan Wayne Hsieh

GeoComp/GeoTesting Express

W. Allen Marr/Gary T. Torosian

GEI Consultants

Michael A. Yako/Michael Ruetten/Helen Robinson/John Trast

Atarfil, S. L.

Emilio Carreras Torres/Tamara Jurado Corrasco

Republic Services Inc.

Joe Benco/Mike Beaudoin/Dave Vladic

GSE Europe

Catrin Tarnowski

InterGEO Services Co.

Şükrü Akçay/Archie Filshill

Raven Industries, Inc.

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CTI and Associates, Inc.

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Advanced Earth Sciences, Inc.

Kris Khilnani/Suji Somasundaram

Carlisle Syntec, Inc.

Paul Markel/Brinda Mehta

EPI, The Liner Co.

Daniel S. Rohe/Ryan Whalen

Geo-Logic Associates

Monte Christie

Weaver Consultants Group, Inc.

Mark Sieracke

Aquatan (Pty) Ltd.

Piet Meyer/ Sanet van der Merwe

Jones Edmunds, Inc.

George Reinhart/Tobin McKnight

Afitex-Textel

Pascal Saunier/Stephan Fourmont/Jocelyne Grenier

Eval Americas (Kuraray)

Edgar Chow

BTRA (GSI-India)

Anjan K. Mukhopadhyay [BoA]

Watershed Geosynthetics LLC

Michael Ayers

Maccferri

Moreno Scotto [BoA]/Sachin Mandavkar/Pietro Rimoldi

Jones & Wagener (Pty) Ltd.

Riva Nortje

Ardaman & Assoc.

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Tecnologia de Materials (TDM)

José Ferreyros/Augusto Alza/Roberto Diaz

American Wick Drain

Scott Morris/Craig Phelps/Seth Marlow

INOVA Geosynthetics/AERO Aggregates

Archie Filshill/Theresa Loux

Sotrafa S. A.

Jose Miguel Munoz Gomez/Rosa Ruiz

Kaytech Fabrics Group Ltd.

Garth James

Owens Corning Science & Technology LLC

Steve Thaxton/Clive Mills/Jason Woodall

Thrace Group

James Brown/Stella Karavasili

SKAPS Industries

Edward Zimmer/Nilay Patel/Anurag Shah

Duke Energy

Evan Andrews/Ken Karably

Chesapeake Containment Systems (CCS)

Steven Mayes

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- Dept. of Water Affairs of South Africa**
Kelvin Legge
- Pennsylvania Dept. of Transportation**
Beverly Miller

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- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- A 40-Year Anniversary of the 1st Book on Geosynthetics
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