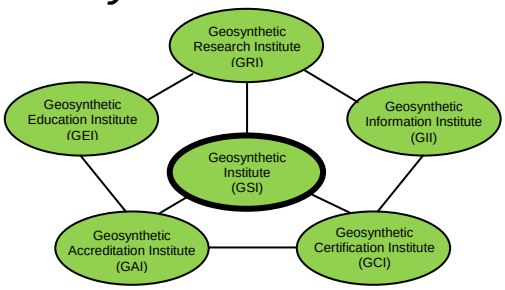
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 28, No. 1 **March, 2014**

This quarterly newsletter, now in its 28th 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 gkoerner@dca.net or mvashley@verizon.net.

Activities of GSI's Directors and Officers

1. We are now in a steady-state insofar as delivering various webinars. For ASCE, we have ten live topics which are also recorded. For GSI we have twelve live topics and those are also recorded. The recorded (hence, "on-demand") ASCE topics are handled by ASCE whereas the GSI topics are being handled through Minerva, Inc.
2. Requests-for-Proposals (RFP's) are out for GSI Fellows for the 2014-'15 academic year. They have been sent to nine magazines and Jamie Koerner will send a copy to all of you. If you know of faculty and/or students who fit the requirements do forward the RFP's to them accordingly.
3. We have been very active in preparing technical papers for the 10th International Conference on Geosynthetics set for Berlin on September 21-25, 2014. There will be four addressing various topics.
4. Director George Koerner will have a GSI Annual Meeting as well as a GSI Board of Directors Meeting in Berlin as well… locations and times to be announced when available.
5. GSI Board of Directors elections for the 2014-2016 cycle are complete. Please congratulate the following in this regard.
   Dr. A. N. Desai – BTRA GSI-India (Agency)
   btra@vsnl.com
   Mr. Edgard Chow – Kuraray (Resin Producers)
   edgard.chow@kuraray.com
   Mr. Kent von Maubeuge (International-1)
   kvmaubeuge@naue.com
6. The board and officers of GSI expressed its sincere congratulations in the form of plaques sent to Dave Jaros and Lili Cui who have graciously served as BoD members in the past; incidentally Dave Jaros served from the very beginning of our BoD in 1996!

IN THIS ISSUE

7. The nine-person GSI Board of Directors is presently as follows:

Term Ends 2014
- Mark Sieracke - Weaver Boos (Consultants and Testing Labs)
  e-mail: msieracke@weaverboos.com
- Boyd Ramsey - GSE (Geomembranes and GCLs)
  email: bramsey@gseworld.com
- Wayne Hsieh - NPUST and GSI-Taiwan (International-2)
  e-mail: cwh@mail.npust.edu.tw

Term Ends 2015
- John Workman - Waste Management Inc. (Owners and Operators)
  e-mail: jworkman@wm.com
- Mark Wayne – Tensar Earth Technology (Geotextiles and Geogrids)
  e-mail: mwayne@tensarcorp.com
- Sam Allen – TRI Environmental Inc. (At-Large)
  e-mail: Sallen@tri-env.com

Term Ends 2016
- A. N. Desai – BTRA & GSI-India (Agencies)
  e-mail: btra@vsnl.com
- Edgard Chow – Kuraray (Resin Producers)
  e-mail: edgard.chow@kuraray.com
- Kent von Maubeuge - NAUE GmbH & Co. KG (International-1)
  e-mail: kvmaubeuge@naue.com

Overview of GRI Projects (Research)

1. **In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills*** - George Koerner is measuring the in-situ temperature behavior of liner and cover geomembranes and has installed 60± thermocouples for long term measurements in both wet and dry municipal solid waste landfills in Pennsylvania. The project has been extended into its 17th-year and has resulted in an extremely authoritative set of real-life data which is being used by many in their geomembrane lifetime predictions.
2. **Flow Behavior of Innovative Leachate Collection and Removal Systems (LCRS's)** – Several new geocomposite drainage systems are being compared to traditional geonet composites. The project is just now beginning and will be a multi-year effort.
3. **Flow Behavior of Fully Degraded Waste*** - This is a field project on investigating the drainage of highly degraded MSW placed directly on leachate collection systems. The leachate collection materials consist of both natural soils and geosynthetic drains. The experimental setup has been dismantled and a paper has been written for the IGS Berlin Conference.
4. **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) is often using a wrap-around configuration leaving the geogrid exposed to the atmosphere. A project being conducted by George Koerner is presently investigating two different geogrid's behavior over time. A 50-year time frame is envisioned. The long-term behavior will eventually be compared to UV laboratory exposed data as noted in Item #7 below.
5. **Laboratory Exposed Lifetime of Geomembranes*** - GSI is using three UV-fluorescent devices to estimate the projected exposed lifetime of many different types of geomembranes. Presently being incubated are HDPE, LLDPE, fPP, PVC (N.A.) and EPDM. Exposure times of 70,000 light hours are now realized at 70°C and a replicate set of samples are being incubated at 60°C. Some will take at least 70,000 light hours (≈ ten years). The third sequence at 80°C was started on 1/1/2010. Ongoing data is being reported to manufacturers and resin producers. GRI Report #42 is available on the 70°C data using a correlation coefficient to estimate field lifetime of the various geomembranes. Furthermore, our GSI-8 Webinar gives preliminary data using the time-temperature superposition and Arrhenius modeling for improved field lifetime prediction.
6. **Laboratory Exposed Lifetime of PVC (European) Geomembranes** - Of late, we have been attempting to distinguish between PVC geomembranes manufactured in North America versus Europe. Of course, the difference is in the type of plasticizers and other additives used in the formulations. In this regard we have been evaluating various European formulations for four 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. (Note that the exposure and lifetime prediction of North American produced PVC GMs has been concluded).
7. **Laboratory Exposed Lifetime of Geogrids** - The UV-fluorescent exposure of two different polypropylene biaxial geogrids which are used at the exposed faces of welded wire mesh MSE structures is ongoing. The various geogrids are now up to 40,000 light hours and data is being generated and sent to the respective manufacturers; Tensar and TenCate. Replicate samples are now being incubated at 60°C for eventual use in Arrhenius Modeling and lifetime

prediction. The last set at 80°C has just begun incubation.

8. **Laboratory Exposed Lifetime of TRM Fibers** - We are also using UV-fluorescent exposure of four different turf reinforcement mat fibers to assess their lifetime capabilities. They have been incubated at 60°C, 70°C and 80°C. A final report to the manufacturer has just been submitted.
9. **Laboratory Exposed Lifetime of Geotextiles** - We have completed a UV study on a heat-bonded nonwoven PP geotextile used for three dimensional cell structures which are exposed to the atmosphere. The results for the particular geotextile and its specific formulation at 20°C (68°F) average field temperature are 4.9 years for halflife of breaking strength and 4.1 years for halflife of breaking elongation. This study of other exposed geotextile lifetimes has been extended to include a lightweight needle-punched nonwoven. Its lifetime, as expected, is much shorter. The third geotextile is a woven slit film and it is almost finished. A woven monofilament GT will conclude the series. Results will appear in about six months in a GSI Report.
10. **Retaining Wall Failure Evaluations* -** We presently have GRI Reports 38, 39, and 40 addressing mechanical stabilized earth (MSE) walls using geosynthetic reinforcement which document 82-failures. Our data base grew to 141, then 171, and now (thanks to Rick Valentine) 230. *Readers, we have a very serious situation in this regard!* The failures are either excessive deformation or 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. We have just recently presented the findings at two geotechnical conferences; one in Williamsburg and the other in Hershey. A paper was published by the Journal of Geotextiles and Geomembranes in October, 2013 and the publisher (Elsevier) reports that 250 requests have been made to date.
11. **pH Between Masonry Block Wall Units*** - George Koerner has been measuring the pH between three types of masonry blocks for over six years to monitor the values. Concern here is over PET geogrids which are known to be sensitive to high alkalinity environments. Indeed, the values started high, but over time are now down to eight and lower. George Koerner has a paper in this regard.
12. **Landfill Failure Analysis** - Since our originally reported paper on ten landfill failures in a 2000 publication, we have accumulated ten more. All 20-failures have been analyzed using the ReSSA Code and are now available to members and associate members as GRI Report #41. The latest failure in this regard is in Easton, Pennsylvania. It is under investigation presently.
13. **Slow Pressurization of HDPE Geomembranes in Axi-Symmetric Testing* - The** ASTM D5716 method of testing geomembranes in a 3-D axi-symmetric mode uses a pressure rate of 6.9 kPa/min (1.0 psi/min). While such a rate is reasonable for most geomembrane types, it is questionable for HDPE which is semi-crystalline and cannot readily stress relax. To investigate slower rates we have initiated a new project with rates as low as 6.9 kPa/month (1.0 psi/month)! The last test, just now begun, is at a rate of 6.9 kPa/six months (1.0 psi/six months) and it will take about five years to conclude.
14. **Shrinkage of GCLs Under Wet/Dry Cycling** - George Koerner has been evaluating shrinkage of various GCLs in boxes on the overhead roof of GSI. The study is on behalf of one of our members.
15. **Temperature Behavior Under Different Geosynthetic Layers -** Since exposed lifetime of geosynthetics is influenced by sunlight the lifetime of layers directly beneath the uppermost one (heat only, but no sunlight) is of interest. George Koerner has set up such a scenario on behalf of one of our members.
16. **GCL's vs. CCL's in Landfill Covers -** A new effort in trying to convince regulatory agencies to stop using compacted clay liners (CCL's) in landfill coves is being mounted. They simply don't work over degrading (hence settling) solid waste materials. Of course, the alternative of geosynthetic clay liners (GCL's) is an excellent choice. Incidentally, South African regulations are already in place in this regard…
17. **Difficult Q & A's from the Techline** - As many of you know we service GMA's Techline on a daily basis. In so doing we categorize the questions on a five-point scale and have collected the most difficult ones of the 2500 Q & A's to date. These most difficult ones have formed GRI Report #43. We think it is most important in moving our technology forward and gives great insight as to potential future R & D for all of us.
18. **Generic Specifications** - A major continuing effort is ongoing with respect to the development and maintenance of GRI's generic geosynthetic specifications. The current status of these specifications is as follows:

<u>Completed, Available and Regularly Updated</u>
GM13 – HDPE Geomembranes
GM17 – LLDPE Geomembranes
GM18 – fPP and fPP-R Geomembranes
GM21 – EPDM and EPDM-R Geomembranes
GM22 – Exposed Temporary Covers
GM25 – LLDPE-R Geomembranes
GM19 – Geomembrane Seams

GM28 – CSPE-R Geomembranes
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions
GT13 – Geotextile Separators
GCL3 – Geosynthetic Clay Liners
GS15 – Geocells

Working Within Focus Group
GTXX – Turf Reinforcement Mats (tabled)
GMXX – Coated Slit Film Geotextiles

Delayed or Off in the Distance
GGXX – Bidirectional Geogrids
GGXX – Unidirectional Geogrids
GNXX – Geonet Drainage Composites
GCXX – Other Drainage Geocomposites
GSXX – High Strength Reinforcement Geotextiles

The complete set of specifications are available to everyone (members and nonmembers) on the open section of our Home Page. Please download and use them accordingly. Also note that this is where the latest modification will always be available. There is a brief tutorial accompanying each specification. They will be updated shortly. Copies of the above listed draft specification tables are also available to GSI members and associate members.

19. **Other GRI Standards** - There are several GRI Standards in various forms of preparation. These include the following:
    - A practice on field seaming inspection emphasizing the electrical leak location system (ELLS).
    - Three standards on GCL joining so as to prevent/monitor panel separation.
    - A specification on coated geotextile membranes.
    - A practice explaining the use of MARV for geotextiles

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:

- **Introduction to GSI**
- **Prospectus**
- **Associate Membership (Agencies)**
- **Members by Focus Groups**
- **GSI Publications**
- **GRI Specs, Guides, White Papers**
- **Laboratory Accreditation**
- **Product Certification**
- **Newsletter/Reports**
- **Internet Courses**
- **GSI Members Links**
- **GSI Member Meetings**
- **Courses at GSI**
- **Insp. Cert. Programs**

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 get 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 available. This includes:

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

The Keywords Section contains about 35,000 citations which is the majority of the geosynthetics literature published in English. It's quite easy to use 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.

In addition to the information provided in our home page as just mentioned, Jamie Koerner (Special Projects Coordinator) is performing various surveys of pertinent topics in geosynthetics.

Most of these have been turned into GRI White Papers (for the concept please read the writeup on pg. 11-12 in this Newsletter/Report); the following being the most recent.

#26 - Need for Justification of Quality Management Systems for Successful GS Performance
#27 - The Intimate Contact Issues of Field Placed Geomembranes With Respect to Wave (or Wrinkle) Management
#28 - Cold Temperature and Freeze-Thaw Cycling of Geomembranes and Their Seams

Jamie's most recent survey is a retrospective review of the 136 faculty which participated in the Educate-the-Educators week-long courses at Auburn University from 1994-1998. Do ask for a copy if interested.

Progress within GEI (Education)

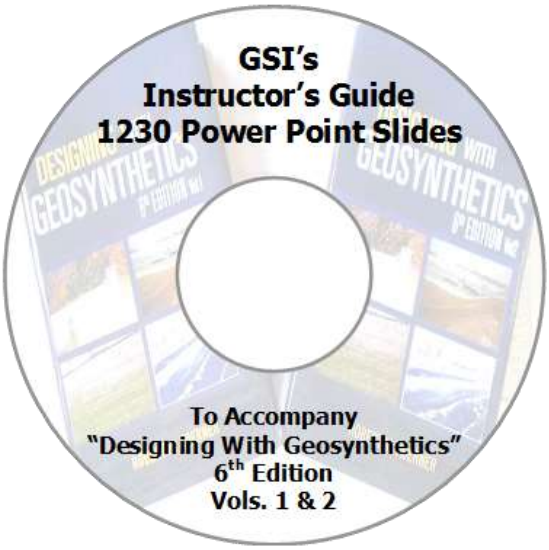
Free CD

We sent a broadcast e-mail to everyone stating that many power point presentations were available and would be sent upon request. Many persons replied asking for all of them. Therefore, we put all 63 presentations on a CD which was sent to all GSI contact persons. That said, we have copies still available so do ask and we will mail it to you immediately. Topic areas are all types of geosynthetics, plus walls/slopes, landfills, specifications, and miscellaneous.

6th Edition of Designing With Geosynthetics

The 6th Edition of Designing With Geosynthetics continues to sell well in all three of its formats; hardback, softback and e-book… the latter is really cheap; i.e., $3.50 for each volume! The two volume set can be purchased through GSI, Xlibris, Amazon and Barnes and Noble. A special link is available on the cover page of our website. All proceeds go to GSI.

Our most recent activity in this regard is to develop a power point presentation for the entire 914-page book. This is what it looks like and it does indeed contain 1230 nonencrypted ppt slides.



Call or e-mail if you want a copy. It is free to all, but we need your postal address.

GRI Reports

To date, we have 42 GRI Reports available to members and associate members. These reports vary in length from 30 to 200 pages and beginning with Report #25 they are on the password protected section of our home page. Prior to that date only the abstract is available online. All of them, however, are available in hard copy. The most recent reports are as follows:

- #39 – Methods of Stabilizing Excessively Deformed MSE Walls
- #40 – On the Prevention of Failures of Geosynthetic Reinforced MSE Walls and Recommendations Going Forward
- #41 – Analysis and Critique of Twenty Large Solid Waste Landfill Failures
- #42 – Lifetime Prediction of Laboratory UV Exposed Geomembranes Based on a Correlation Factor (due January 2, 2012)
- #43 – An Analysis of the Most Difficult Q & A's of the First 2500 Submittals to the GMA Techline (just published)

Courses

We have scheduled the following two courses here at GSI. They are as follows.

#1 June 19, 2014
QA/QC of Geosynthetics in Waste Containment Systems
(Optional Exam Follows)

#2 June 20, 2014
Construction Inspection of MSE Walls, Berms and Slopes
(Optional Exam Follows)

Each course carries with it 8 PDH's. All are held at GSI so demonstrations by George can illustrate and enliven the respective lectures. GSI is approximately 4.5 miles from Philadelphia International Airport.

Course Registration and Fee:
$350/person for each one-day course (up to one month prior to course)
$400/person thereafter
$250/person – GSI Members
Contact: Marilyn Ashley (mvashley@verizon.net)

Webinars

(Second Wednesday of Every Month)
11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at
www.geosynthetic-institute.org/webinar.htm
1.5 Professional Development Hours; Cost $250

W11 – April 9, 2014 "Lateral and Vertical Expansions"
W12 – May 14, 2014 "Beneficial Uses of Closed Landfills"
W1 – June 11, 2014 "MSE Wall Failures Data Base"
W2 – July 9, 2014 "MSE Wall Back Drainage Design"
W3 – August 13, 2014 "MSE Wall Remediation"
W4 – September 10, 2014 "MSE Wall Inspection"
W5 – October 8, 2014 "GSs in Hydraulic Applications"
W6 – November 12, 2014 "GSs in Heap Leach Mining"
W7 – December 10, 2014 "GSs in Agriculture"
W8 – January 14, 2015 "Lifetime Prediction of Exposed and Nonexposed Geosynthetics"
W9 – February 11, 2015 "Landfill Failures"
W10 – March 11, 2015 "Landfill Bioreactors"

Note: These webinars are recorded and are available "on-demand" anytime and anyplace

More Webinars

11:30 AM – 1:00 PM (Eastern Time Zone)
Registration at www.asce.org/webinars
1.5 Professional Development Hours; Cost $400

ASCE 1 – April 11, 2014 "Geotextile Tubes"
ASCE 2 – April 22, 2014 "Geosynthetic in Basal Reinforcement"

ASCE 3 – June 16, 2014 "Geosynthetic Pond Liners"
ASCE 4 – July 17, 2014 "Geotextile Filter Failures"
ASCE 5 – August 7, 2014 "Geosynthetics in Roads"

GSI Fellowships

As in the past, GSI has been awarding graduate fellowships for students performing geosynthetics research. There were nine new proposals this academic year. These proposals were then reviewed by the GSI Board of Directors along with Bob and George Koerner.

The presently established criteria are as follows:

- Students must be working on a geosynthetics topic which furthers the technology in a proactive manner.
- Students must have completed their candidacy requirements leading to a doctoral degree. (Comment, we hope that some of them will "go academic" and teach and/or do research on geosynthetics in their immediate future)
- Students must be recommended by their advisor or department head.

The fellowships can be renewed for a total of three-years depending upon acceptable annual reports. Funding for each student is $10,000 the first year and $5000 for the second and third years.

The following table identifies the successful recipients, their university, advisor and topic for our year of activity. We congratulate the students and wish them success in their endeavors. If any readers wish to add congratulations or to find greater detail as to specific projects and students please contact us accordingly.

GSI Fellowship Status for 2012-'13 Academic Year

Class 4 (a) – 2nd Year Funding at $5,000 per student

No.	Name	University	Advisor	Topic
3-11	Felix Jacobs	RWTU-Aachen, Germany	Martin Ziegler	Geogrid Reinforced Soil in Biaxial Compression Tests
4-11	Mahmound Khachan	Syracuse University	Shobha Bhatia	Dewatering Performance of Geotextile Tubes

Class 5 (a) – 1st Year Funding at $10,000 per student

No.	Name	University	Advisor	Topic
1-12	Chuangi Wang	University of Memphis	David Arellano	Properties of Recycled Expanded Polystyrene
2-12	Xunchang Fei	University of Michigan	Dimitrois Zekkos	Biodegradation of Geotextiles
3-12	Jitendra K. Thakur	University of Kansas	Jie Han	Recycled Asphalt Used in Geocells

Note that proposals for the new class for the A.Y. 2014-'15 are presently being accepted by the GSI Board of Directors. Please note Item #2 on "Activities of GSI's Directors and Officers" in this Newsletter/Report.

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. In short, this means that the 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 and documentation for specific standard ASTM, ISO or GRI 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 220 GAI-LAP test methods available for accreditation. Please consult our home page for a current listing.

As of March, 2014, 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. (135 tests)
Jarrett Nalson -- (512) 263-2101
Sallen@tri-env.com

3[A] - Golder Associates (45 tests)
David Alexander -- (770) 492-8280
dalexander@golder.com

4[C] - Geosynthetic Institute (116 tests)
George Koerner -- (610) 522-8440
gkoerner@dca.net

8[B] - Propex Operating Co., Ringgold (18 tests)
Todd Nichols -- (800) 258-3121
todd.nichols@propexglobal.com

9[B] - Lumite (16 tests)
Rebecca Kurek -- (770) 869-1700
rpage@lumiteco.com

13[A] - TRI Env. Inc. (97 tests)
Cora Queja -- (714) 520-9631
cqueja@tri-env.com

14[A] - Geotechnics (49 tests)
J. P. Kline -- (412) 823-7600
JPkline@geotechnics.net

20[A] - GeoTesting Express, MA (47 tests)
Gary Torosian -- (978) 635-0424
gtt@geotesting.com

22[B] - CETCO Hoffman Estates (13 tests)
Barbara Gebka – (847) 851-1500
jim.olsta@cetco.com

24[B] - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
roger.wilkerson@cetco.com

25[B] - Ten Cate, Pendergrass (12 tests)
Beth Wilbanks -- (706) 693-2226
b.wilbanks@tencate.com

26[B] - Agru America Inc. (20 tests)
Grant Palmer -- (843) 546-0600
gp@agruamerica.com

29[e] - FITI Testing and Research Institute (68 tests)
Hong-Kwan Kim -- 82-2-3299-8071
hoganKim@fiti.re.kr

31[D] - NYS Dept. of Transportation (9 tests)
Tom Burnett -- (518) 457-4704
tburnett@dot.state.ny.us

32[A] - Geo-Logic Inc. (6 tests)
Ken Criley -- (530) 272-2448
criley@geologic.com

34[B] - GSE Environmental Richey Road (36 tests)
Rich Schaefer -- (281) 230-6890
r.schaefer@gseworld.com

37[B] - GSE Environmental Chile (19 tests)
Mauricio Ossa -- 56-2 6010153
Mossa@gseworld.com

38[C] - Sageos/CTT Group (103 tests)
Eric Blond -- (450) 771-4608
eblond@GCTTG.com

40[B] - GSE Environmental (14 tests)
Bruce Pressley -- (843) 382-4603
bpressley@gseworld.com

41[A] - SGI Testing Service, LLC (19 tests)
Zehong Yuan -- (770) 931-8222
ZYuan@interactionspecialists.com

42[C] - NPUST (GSI-Taiwan) (61 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
CWH@mail.npust.edu.tw

43[A] - Ardaman & Associates (22 tests)
George DeStafano -- (407) 855-3860
gdestafano@ardaman.com

44[B] - PGI and Fiber Web, Inc. (9 tests)
Kim Thomas -- (615) 847-7155
Kim.Thomas@fiberweb.com

45[B] - Ten Cate Geosynthetics Malaysia SDN Bhd. (23 tests)
Gan Wee Hunn -- (603) 519 28576
wh.gan@tencate.com

46[B] - TAG Environmental Inc. (13 tests)
Colin Murphy -- (705) 725-1938
colin_murphy@tagenv.com

47[B] - GSE Syntec (10 tests)
Andrew Barker – (410) 327-1070
abarker@synteccorp.com

49[B] - Engepol Geossinteticos (14 tests)
Carolina Polomino -- (55) 51 3303-3916
carolina@engepol.com

50[B] - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
terry.mcelfresh@ads-pipe.com

51[B] - Solmax International Inc. (22 tests)
Simon Gilbert St. Pierre -- (450) 929-1234
simonGSP@solmax.com

53[B] - Polytex Inquique (19 tests)
Christian Valdebenito -- 011 56 57 42 90 00
cvaldebenito@polytex.cl
davegonso@ads-pipe.com

55[B] - Atarfil Geomembranes (19 tests)
Gabriel Martin Sevilla -- 34 958 439 200
gmartin@atarfil.com

56[B] - Polytex Santiago (13 tests)
Christian Valdebenito -- 56-2-627-2054
cvaldebenito@polytex.cl

57[B] - Ten Cate Cornelia (13 tests)
Melissa Medlin -- (706) 778-9794
m.medlin@tencate.com

58[B] - Propex Operating Co.Hazelhurst (16 tests)
Tim Smith -- (229) 686-5511
Tim.Smith@propexglobal.com
SimpsonJanie@firestone.com

60[B] - Polytex Lima (12 tests)
Elias Jurufe -- 51 16169393
Ejarufe@polytex.cl

61[B] - Raven Industries (17 tests)
Justin Norberg -- (605) 335-0288
Justin.Norberg@ravenind.com

62[B] - Solmax International Asia (14 tests)
Teoh Pei Ching – (450) 929-1234
pcteoh@solmax.com

63[A] - TRI Environmental, Inc.; DDRF (5 tests)
Joel Sprague -- (864) 242-2220
JSprague@tri-env.com

64[B] - Agru America (NV) (14 tests)
Chris Adams -- (775) 835-8282
ca@agruamerica.com

65[C] - Bombay Textile Rsearch Assoc. (BTRA) (24 tests)
Riyaz Shaikh
(0) 022-25003551
btra@vsnl.com

66[B] - Rowad International Geosynthetics Co. Ltd (14 tests)
Asad Ullah Khan -- +966-3-812-1360
asad@rowadplastic.com

67[A] - MicroBac Hauser Division (10 tests)
Heather Smalley – (720) 406-4806
heather.smalley@microbac.com

68[B] - Glen Raven Technical Fabrics LLC (4 tests)
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[A]Third Party Independent [C]Institute
[B]Manufacturers QC [D]Government

If you desire more information on the GAI-LAP, its test methods, and the associated laboratories, a directory is published annually in December of each year. It is available on GSI's home page at http://www.geosynthetic-institute.org (Accreditation).

George R. Koerner

Activities within GCI (Certification)

GSI presently has two 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 other (begun in 2011) is focused on MSE Wall, Berm and Slope field inspection. See our website at www.geosynthetic-institute.org under "certification" for a description and information on both of them. They are both similar in that a perspective candidate must…

- Be recommended by a professional engineer who knows, and can attest to, at least six months of acceptable experience performing CQA activities with either geosynthetic liner or cover systems or MSE walls, berms, or slopes using geosynthetic reinforcement.
- 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.
- 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.

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

This program now in its eighth year has been recommended, and in some cases required, by solid waste owners, state regulators, and design consultants for proper QCA in field installation of both geosynthetic materials and compacted clay liners. The statistics to date are as follows.

Inspector Certification Test Results
2006 – 2014

Year	Geosynthetic Materials		Compacted Clay Liners		Commentary
	No. of people taking exam	No. of people failing exam	No. of people taking exam	No. of people failing exam	No. of people failing both exams
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	10	0	9	0	0
TOTAL (to date)	**543**	**75 (14%)**	**500**	**60 (12%)**	**34**

The 5-year renewal period for those having taken the exam in 2009 is ongoing and about 60% have renewed accordingly. This is felt to be encouraging from our perspective.

Note that a GSI course on this topic will be offered on June 19, 2014 with the exam following directly.

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

The official launch of the program was on December 1, 2011 with a course and the examination afterward. More recently a somewhat revised course on November 29, 2012 was presented. There are now eighteen persons certified by GCI for the inspection of MSE Walls, Berms and Slopes.

This one-day course and subsequent examination were developed by GSI and reviewed by a steering committee consisting of the following individuals:

- Kent von Maubeuge – NAUE Group
- Mohammed Karim – Virginia DEQ
- Bob Sabanas – NTH Consultants
- John Conturo and Maria Tanase – AECOM, Inc.
- John Lostumbo – TenCate Geosynthetics
- Mike Yako – GEI Consultants
- Steve Poirier – Geosyntec Consultants
- Willie Liew – Tensar International
- Doug Clark – CEC Consultants
- Dick Stulgis – Geocomp, Inc.
- Frank Adams, Paul Whitty, Rafael Ospina – Golder Associates
- Daniel Alzamora - FHWA
- Sam Allen – TRI Environmental Inc.
- Greg Cekander – Waste Management Inc.
- Greg Fedak – CETCO Contracting Services

Our thanks go to them in this regard.

While a field inspector cannot require proper design or instruct a contractor how to build the 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. Please contact George Koerner at gkoerner@dca.net or Jamie Koerner at jrkoerner@verizon.net for questions or additional information.

Note that a GSI course on this topic will be offered on June 20, 2014 with the exam following directly.

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 two countries (Korea and Taiwan), 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 in the transition of being 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 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 an 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.

*Both of these affiliated institutes are currently under re-organization. Details will be forthcoming.

GSI-India under the direction of Dr. A. N. Desai is presently being formed. 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. Desai has just been elected to GSI's Board of Directors.

Items of Interest

1. **Reshaping Hydrophobic Textiles**
   A team of scientists led by Professor Kripa Varanasi from the Massachusetts Institute of Technology is testing super hydrophobic materials that work by reshaping the surface of textiles so water droplets can bounce faster and are 40 percent less likely to reach the fabric surface. If less water reaches the fabric, the surface dries much faster. Chemical coatings currently being used to waterproof fabrics have raised safety concerns under examination by the U.S. Environmental Protection Agency. Altering the material surface used for protective, outdoor and recreational clothing may be an attractive alternative to chemical treatment. The research is published in the journal *Nature at www.nature.com*.

2. **Coal Ash Disposal Regulations in America**
   The U.S. Environmental Protection Agency has agreed to take final action by December 19, 2014, on coal ash disposal regulations under the Resource Conservation and Recovery Act ("RCRA") – setting the stage for conclusion of rules that were proposed in June of 2010 and have been the center of significant lobbying, congressional activity and the activities of the Geosynthetic Materials Association (GMA).

   The agreement is contained in a Consent Decree signed by all of the parties to a federal lawsuit that sought to compel a deadline for EPA. In the Consent Decree, EPA continued to signal that its final regulation would be promulgated under the "non-hazardous" Subtitle D of RCRA.
   "The EPA Administrator shall, by December 19, 2014, sign for publication in Federal Register a notice taking final action regarding EPA's proposed revision of RCRA subtitle D regulations pertaining to coal combustion residuals," the Consent Decree said. EPA has indicated in a related rulemaking on Effluent Limitation Guidelines that the Agency's "current thinking" is that a Subtitle D regulation will be appropriate.
   (from IFAI's GMA press release)

3. **The Future of Wikipedia**
   "In 2012, after 244 years in print, Encyclopedia Britannica became online-only. Now a group of German fans of Wikipedia, an online, user-generated encyclopedia, are raising money for a move in the opposite direction. A print version of

the English Wikipedia-1,000 bulky volumes and 1,193,014 pages-will be on show at a gathering of Wikipedians later this year. A world tour will probably follow: a global victory lap for the itnernet's most impressive crowd-sourced creation."

The same article also is investigating the current "volunteer-only model", expanding to yet-more languages, making it easier to edit articles on mobile devices, or be supplied by voice or wearable devices like Google Glass.
(from The Economist, March 1, 2014)

4. **Example of a "Bad" Regulation**
The New Mexico oil and gas industry wishes to use produced water from exploration and production activities (i.e., hydraulic fracturing) in lieu of fresh water. In order to accomplish this goal, large impoundments (lined pits) are required. Under NM Rules, the largest of these geomembrane pits is called a Multi-Well Fluid Management Pit and can have a lifespan of 2-7 years!* As such, they are considering disallowing geomembrane lined pits and only allowing steel tank containment systems. Activity is current ongoing.
*(Ed. note… *Make lifetimes 20 to 70 years and they were reminded that steel tanks corrode in the same time frames, or sooner!)*

The Importance of Geosynthetic Performance Testing

Most people would agree that the analysis of failures is of considerable importance. The basic reasoning being that each such case history represents a situation where the designed factor-of-safety value has fallen below unity. Conversely, each case of nonfailure represents a factor-of-safety value of one or higher. How much higher is, of course, not known. Thus failures (while indeed unpleasant for everyone involved) are instances where "lessons learned" should be meaningfully explored.

The above said, we often hear of geosynthetic failures and are sometimes asked to participate in forensic analyses. Such failures are sometimes one-of-a-kind, however, there are several common geosynthetic application areas where they occur somewhat frequently. Invariably the importance of laboratory test results play a critical role in the design and subsequent performance. In this regard, we have grouped four application areas which have similar failures and have written about them in various publications. They are the following:

- Mechanically stabilized earth (MSE) wall failures
- Geotextile filter failures
- Solid waste landfill failures
- Veneer cover soil failures

In all of these cases, design using both conventional (limit equilibrium) and emerging (load reduction and factor design) methods requires a resistance value for a factor-of-safety calculation and it must be obtained experimentally. The necessary laboratory experiments fall under the category of performance tests. There are five of them in these categories of failures which have major significance in arriving at a reliable factor-of-safety value. They are indicated in the following table and are contrasted to the application areas just mentioned. Also in the table is the perceived relative importance of the test method results to the particular application.

Table 1 – Laboratory Performance Tests Contrasted to Application Area and Relative Importance to Design

Application Area	Interface Shear Test ASTM D5321 or ISO 12957	Wide Width Tensile Test ASTM D4595 or ISO 10319	Transmissivity Test ASTM D4716 or ISO 12958	Permittivity ASTM D4491 and AOS ASTM D4751 Tests or ISO 11058 and ISO 12956
MSE walls	primary	primary	secondary	secondary
GT filters	tertiary	tertiary	secondary	primary
Landfills	primary	secondary	primary	primary
Veneer slides	primary	primary	primary	primary

Unfortunately, these five test methods are those which have the highest statistical variation of all geosynthetic tests. Using George Koerner's Geosynthetic Accreditation Institute's-Laboratory Accreditation Program (GAI-LAP) *Proficiency Test Program,* the uncertainty in this regard indicates the following.

Table 2 – Uncertainty in Five Performance Test Method Results per 2013 GAI-LAP Proficiency Testing

ASTM/ISO Test Number	Description of Tests	Proficiency Test Uncertainty Values
D5321/12957	interface shear	16
D4595/10319	wide width tension	12
D4716/12948	transmissivity	16
D4491/11058	permittivity	23
D4751/12956	apparent opening size	24

These values of uncertainty include both reproducibility and repeatability per the following equation:

$$U = (r^2 + R^2)^{1/2}$$

where (according to ASTM terminology)

U = uncertainty—an indication of the variability associated with a measured value that takes into account two major components of error: *(1)* bias, and *(2)* the random error attributed to the imprecision of the measurement process.

r = repeatability—an established value, below which the absolute difference between two "within-laboratory" or "within test-site" test results may be expected to lie with a specified probability.

R = reproducibility—the precision of a test method expressed in terms of agreement expected between measurements made in different laboratories using similar apparatus and the same procedure.

As a single example of how values of uncertainty affect a numeric factor-of-safety design, assume that a laboratory submits to a client a 30° interface shear value. The range of this value taking the uncertainty of this test into consideration is as follows:

$$\pm 0.16(30) = \pm 4.8°$$
or
$$25.2° \; to \; 34.8°$$

Considering this variation of possible values (aka, the uncertainty) leads to the purpose of this column which is to bring awareness to all involved in geosynthetic design that the reliability of a given factor-of-safety value can be greatly influenced by its laboratory procedures and testing protocol. The variation in such experimental values can easily dominate the accuracy of the design models (which are often computer codes), live load estimates, geometric characteristics, other engineering properties, etc.

What can be done to control or mitigate this situation is really in the hands of standards setting agencies (like ASTM, ISO and GSI) and of course the testing laboratories themselves. We need to sharpen our standards and craft clearer and more succinct test methods where the procedures and equipment are unequivocal and straightforward to implement. It then follows to have high quality laboratories with trained technicians performing the testing.

Bob & George Koerner

Upcoming GSI Events

GSI Webinars
(2nd Wednesday of Every Month – see following website)
Contact: www.geosynthetic-institute.org/webinar.htm

ASCE Webinars
(see following website)
Contact: www.asce.org/webinars

GSI Courses in Folsom, PA
#1 June 19, 2014
QA/QC of Geosynthetics in Waste Containment Systems
(Optional Exam Follows)
#2 June 20, 2014
Construction Inspection of MSE Walls, Berms and Slopes
(Optional Exam Follows)
Contact: mvashley@verizon.net

- April 23-25, 2014
  Central PA-ASCE
  Hershey, PA
  Contact: robert.koerner@coe.drexel.edu
- July 2014
  ASCE Shale Conference
  Pittsburgh, PA
  Contact: www.asce.org/conferences
- September 21-25, 2014
  10th Intl. Geosynthetics Conf.
  Berlin, Germany
  Contact: www.geosyntheticssociety.org

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 ThermaGreen with Tim Walter/Blu Alexander/Ken vander Velden, Maccaferri with Massimo Ciarla and Pietro Rimoldi, and Jones and Wagener (Pty) Ltd. with Anton Bain, Ardaman & Assoc. with Nadim Fuleihan/Thomas S. Ingra/Jan Wildman and Tecnologia de Materiales (TDM) with José Ferreyros as contact persons. Thanks to all and welcome to GSI.**

GSE Environmental
Boyd Ramsey [BoD]/Aigen Zhao
U.S. Environmental Protection Agency
David A. Carson
E. I. DuPont de Nemours & Co., Inc.
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Federal Highway Administration
Silas Nichols/Daniel Alzamora
Golder Associates Inc.
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Bonar Inc. (Colbond)
Richard Goodrum
Geosyntec Consultants
Steve Poirier
LyondellBasell Industries
Fabio Ceccarani/Rob Olivero
TenCate Geosynthetics
John Henderson/Chris Lawson
CETCO
Chris Athanassopoulos/James T. Olsta
Huesker, Inc.
Sven Schröer/Dimiter Alexiew
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Propex
Andy Burran/Judith Mulcay
Polymer Group Inc.
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NTH Consultants, Ltd.
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Tecnologia de Materials (TDM)
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IN THE NEXT ISSUE

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- Progress within GEI (Education)
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- The GSI Affiliate Institutes
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- Items of Interest
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