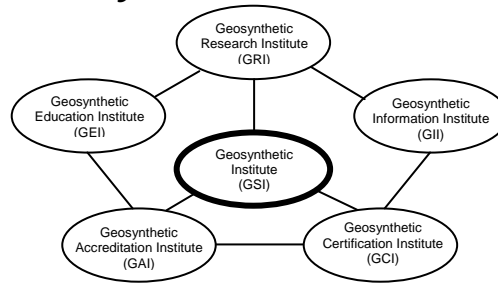


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 21, No. 3

September 2007

This quarterly newsletter, now in its 21th 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 Robert M. Koerner or Marilyn Ashley at phone (610) 522-8440; fax (610) 522-8441 or e-mail at robert.koerner@coe.drexel.edu or mvashley@verizon.net.

Activities of the Institute Directors & GSI Board of Directors

1. White Paper #10 on the topic of "Various Direct Shear Strength Interpretations" is presently on our Home Page. Thanks go to the many consultants, test labs, and agency persons who provided commentary.
2. Due to the interest in the above topic we have sent everyone a power point presentation on the expanded topic. Use (or modify) it as you see fit.
3. The GRI-21 Conference will be embedded in the GeoAmericas 2008 Conference set for Cancun on March 2-5, 2008. Our twin topics are "Geosynthetics in Agriculture" and "Geosynthetics in Aquaculture". The 16-papers to be presented on March 5th promise to be excellent. Specific details will be given in the December Newsletter/Report.
4. At the Cancun Conference we will also have our Annual Meeting, the Board of Directors Meeting, and a Consultants/Test Laboratory Meeting. See the Home Page for details. Regarding the Annual Meeting, if you have topics for us to consider, please advise accordingly.
5. We are also looking forward to the Global Waste Conference set for September 7-10, 2008 near Denver, Colorado. We will have a session on engineered berms at landfills and have also submitted three abstracts for ongoing work with Waste Management Inc. Several focus group meetings are planned.
6. Elections for the BoD will be delayed toward the end of the year since the transition will occur in March of 2008. It is usually in December.

NOTICE: Due to the increasing cost of printing, shipping and handling, this Newsletter/Report will be made available on our Home Page at www.geosynthetic-institute.org. It is in the open section under the heading "Newsletter/Report". Please share it with your friends and colleagues.

7. A listing of your GSI Board of Directors follow. Please don't hesitate to contact any of them with respect to GSI activities and programs.

Term Ends 2007

David Jaros - Corps of Engineers (Government Agencies)
Rex Bobsein - Chevron/Phillips Co. (Resin Producers)
Kent von Maubeuge - NAUE GmbH & Co. KG
(International)

Term Ends 2008

Dick Stulgis - GeoTesting Express (Consultants and Testing
Laboratories)
Gary Kolbasuk - Raven (Geomembranes and GCLs)
Mark Sieracke - Weaver Boos Consultants, Inc. (At-Large)

Term Ends 2009

Tony Eith (Chairman) - Waste Management Inc. (Owners
and Operators)
Boyd Ramsey - GSE Lining Technology, Inc. (Geotextiles
and Geogrids)
Sam Allen - TRI/Environmental, Inc. (At-Large)

Elections for those whose term ends in 2007 will be this winter.

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- The GSI Centers-of-Excellence
- Items of Interest
- Review of GCI's Inspector Certification Program
- Upcoming Events
- GSI's Member Organizations

Overview of GRI Projects (Research)

Each issue of our Newsletter/Report provides a brief glimpse and update of current GRI research projects. Details and full briefings are available to member organizations at their request. Dr. Grace Hsuan, Associate Director of GRI can be contacted for additional information as can the other project managers listed in the following write-ups. **Projects marked with an asterisk have been written up as either short "in-progress" papers or complete papers.** Grace can be reached by phone at (610) 522-8440 or e-mail at <grace.hsuan@coe.drexel.edu>.

- 1. Stress Cracking of Geomembranes and Geopipe*** - Dr. Grace Hsuan is project manager of our ongoing efforts to evaluate stress cracking of geomembrane resins and sheets. In addition to her ongoing evaluations of HDPE geomembranes, Grace is presently focusing on HDPE drainage and duct pipe mainly for the Florida DOT. The goal for both geomembranes and geopipe is to include technically viable test methods and limiting values in generic specifications.
- 2. Durability and Lifetime Prediction*** - Last summer we reconfigured our 20-columns simulating landfill conditions for the purpose of estimating half-life of LLDPE geomembranes. The study was meant to extend the previous lifetime study of HDPE geomembranes which took approximately 10-years to conclude. The study uses elevated temperatures of 85, 75, 65, and 55°C to hasten degradation, followed by Arrhenius modeling to obtain the predicted lifetime. Unfortunately, our master temperature controller went "out-of-control" and became extremely hot with some columns having temperatures of over 100°C. This, of course, was way beyond our desired statistical control of temperature thereby negating all incubation to date. As a result, we have abandoned the present 20-columns and must start over again from "scratch". We will see what the winter brings since there is significant physical work necessary to set up these columns.
- 3. Durability of Polypropylene Geotextile Fibers** - Incubation at temperatures of 75, 65 and 55°C in high oxygen pressure containers is ongoing using PP-woven geotextile fibers. This study periodically measures changes in density, dimensions, mass, morphology, strength, elongation, modulus, melt index, OIT and carbonyl content. Dr. Hsuan is in charge of the project.

- 4. In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills*** - Dr. 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. Presently data for up to 13-years is available. This is clearly the longest in-situ measurement project in all of geosynthetics.
- 5. Bioreactor (aka, Wet) Landfill Behavior and Properties*** - The above temperature monitoring has segued into a major effort under sponsorship of GSI and Waste Management, Inc. The wet cell under investigation is at field capacity, hence it is a true anaerobic bioreactor. Dr. George Koerner is in charge of considerable monitoring which includes the following:
 - waste moisture content
 - waste temperature
 - leachate chemical analysis
 - waste gas analysis
 - perched leachate within the waste

Data is being collected on a monthly basis. The timeline of the project calls for monitoring for 5 to 10 years. This activity will now extend to an adjacent landfill to see how reproducible the data is with a slightly different waste mass.

- 6. Flow Behavior of Fully Degraded Waste*** - A field project under sponsorship of GSI and Waste Management investigates the drainage of highly degraded MSW placed directly on leachate collection systems. The leachate collection systems consist of both natural soils and geosynthetic drains. The project is now in its second year and is at a landfill in the Philadelphia area.
- 7. Hydrostatic Creep Puncture of Geomembranes*** - The effect of sustained long-term hydrostatic and geostatic pressures on the puncture strength of geomembranes is an ongoing project. A series of tests using 600 g/m² protection geotextiles on 1.5 mm thick HDPE geomembranes is being evaluated; the time is currently 10-years. The four-test setups use truncated cone simulations of coarse subgrade stones against the geotextile protecting the underlying geomembrane. The behavior of the geomembranes under these tests is a combination of creep and stress relaxation. The purpose of these tests is to better define the creep reduction factor used in the design method.
- 8. Long-Term Benefits of Geotextile Separators*** - A full-scale field database of using geotextile separators on firm soil subgrades is being developed and maintained by Dr. George Koerner. Monitoring is proposed for up to 20-

years. The target sites are paved highways, driveways, parking lots, etc., where control sections without geotextiles are also available for comparison purposes. This database will be national and perhaps even international in scope. Included are sites which meet the following criteria:

- sites must have both geotextile and nongeotextile control sections
- known type of geotextile(s)
- known soil conditions
- known traffic conditions
- available hydrologic and environmental conditions
- capability of quantifying the original condition of the pavement surface vs. the aged condition... this will be accomplished visually as well as by using falling weight deflectometers.

There are currently 14-sites included in this program. If you have additional sites to add, please contact George at (610) 522-8440.

9. **UV Exposure of Geomembranes*** - GSI is using UV-fluorescent devices to evaluate the simulated outdoor lifetime of nine different types of geomembranes; HDPE, LLDPE, 4 fPPs, PVC, EPDM and PE-R. The effort is considered as part of GSI's Center for Polymers in Hydraulic Structures (CPHyS), but has relevancy in many other applications as well. A keynote paper will be at the GeoAmericas Conference in March, 2008.
10. **UV Exposure of Geogrids** - We have recently begun the UV-fluorescent exposure of four different biaxial geogrids which are used at the exposed surfaces of welded wire mesh retaining walls. The geogrids are now up to 7000 light hours and ongoing data is being generated and sent to the respective manufacturers.
11. George Koerner is presently testing three different high strength geotextiles from three manufacturers (TC Nicolon, Huesker, and Propex) in preparation of a high strength specification.
12. **Generic Specifications** - A major effort is ongoing with respect to the development of generic geosynthetic specifications. The current status of these specifications is as follows:

Completed and Ongoing

GM13 – HDPE Geomembranes*
GM17 – LLDPE Geomembranes*
GM21 – EPDM Geomembranes
GM22 – Exposed Temporary Covers
GM19 – Geomembrane Seams
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions

GT13 – Geotextile Separators
GCL3 – Geosynthetic Clay Liners

*An important note regarding textured geomembranes was recently added to the effect that direct interface shear testing should always be performed to assure against slope instability.

Working Within Focus Groups

GCXX – TRMs for Erosion Control
GTXX – High Strength Reinforcement Geotextiles

Delayed or Off in the Distance

GGXX – Bidirectional Geogrids
GGXX – Unidirectional Geogrids
GNXX – Geonet Drainage Composites
GCXX – Drainage Geocomposites

Tabled

GM18 – fPP & fPP-R Geomembranes

The completed 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.

These specifications are also available as separate power point CDs which show photos of the test devices and can be used as a presentation to your clients and customers, as well as being an in-house training vehicle... don't hesitate to use and share this information which is on the open part of our Home Page.

Activities within GII (Information)

We are currently supporting 2-Home Pages. The first is the GRI Home Page which is accessed as follows:

<<<http://www.drexel.edu/gri>>>

This home page is very introductory as far as GSI members and associate members are concerned, and is meant to be promotional (for prospective students and potential institute members). It is probably only of nominal interest to most readers of this Newsletter/Report.

The second home page is the primary GSI Home Page and is accessed as follows:

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

It has been reconfigured 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
- CPReS
- CPHyS
- Laboratory Accreditation
- Answers to Your Questions
- Newsletter/Reports
- Geosynthetics Links
- GSI Annual Meeting
- GSI Focus Group Meeting
- GSI Short Courses
- Inspector Certification Exams

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 presented. This includes:

- GRI Test Methods
- GRI Reports (Summaries)
- 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 17,000 citations of all 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 that we (and others we are told) use the most in our entire website.

Progress within GEI (Education)

We have scheduled the following sequence of courses for the winter season:

Monday, December 10, 2007 and
Monday, February 11, 2008
Geosynthetic Design in Waste Containment Systems

Tuesday, December 11, 2007 and
Tuesday, February 12, 2008
Quality Control/Quality Assurance of Geosynthetics

The above courses will be held at:
Geosynthetic Institute
475 Kedron Avenue
Folsom, PA 19033
(approx. 4.5 miles from Phila. International Airport)

Course Registration and Fee:
\$250/person for each one-day course (up to one month prior to course)
\$300/person thereafter
\$150/person – GSI Members

Contact: Marilyn Ashley (mvashley@verizon.net)

GSI Courses in Other Locations

Tuesday, October 23, 2007 at ESD in Lansing, MI
Quality Control/Quality Assurance of Geosynthetics

Wednesday, November 14, 2007 at CEC, Inc. in Pittsburgh, PA
Quality Control/Quality Assurance of Geosynthetics
Contact: Marilyn Ashley (mvashley@verizon.net)

Activities within GAI (Accreditation)

The Geosynthetic Accreditation Institute's (GAI) current mission is focused on a Laboratory Accreditation Program (LAP) for all 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.

It should be made clear, however, 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 test methods, usually ASTM or ISO standards. 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. There are currently 168 GAI-LAP methods available for accreditation. Please consult our home page for a current listing.

As of September, 2007, the following laboratories are accredited by the GAI-LAP for the number of test methods listed in parenthesis. Contact personnel and telephone numbers are also listed.

- 1^A - TRI/Environmental Inc. (118 tests)
Sam Allen -- (512) 263-2101
- 3^A - Golder Associates (43 tests)
Henry Mock -- (770) 496-8280
- 4^C - Geosynthetic Institute (114 tests)
George Koerner -- (610) 522-8440
- 6^A - GeoSystems Consultants (27)
Craig Calabria -- (215) 654-9600
- 8^B - Propex, Ringgold (19 tests)
Toni Ruppert -- (800) 258-3121
- 9^B - Propex, Alto (10 tests)
Melvin Wallace -- (770) 532-9756
- 11^A - STS Consultants Ltd. (13 tests)
Bill Quinn -- (847) 279-2500
- 13^A - Precision Laboratories, CA (95 tests)
Ron Belanger -- (714) 520-9631
- 14^A - Geotechnics (61 tests)
J. P. Kline -- (412) 823-7600
- 18^A - EMCON/OWT (55 tests)
Rasheed Ahmed -- (845) 492-3170
- 19^A - HTS Inc. (42 tests)
Larry McMichael -- (713) 692-8373
- 20^A - GeoTesting Express, MA (58 tests)
Gary Torosian -- (978) 635-0424
- 22^B - CETCO Arlington Heights (12 tests)
Jim Olsta -- (847) 392-5800
- 23^B - CETCO Cartersville (10 tests)
Sid Weiser -- (706) 337-5316
- 24^B - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521

- 25^B - Ten Cate, Pendergrass (11 tests)
Beth Wilbanks -- (706) 693-2226
- 26^B - Agru America Inc. (14 tests)
Grant Palmer -- (843) 546-0600
- 29^C - FITI Testing & Research Institute (70 tests)
Moon-Hyun Jeong -- (011-82-2-960-8034)
- 31^D - NYS Dept. of Transportation (9 tests)
James Curtis -- (518) 457-4735
- 32^A - Vector Engineering (6 tests)
Ken Criley -- (530) 272-2448
- 34^B - GSE Richey Road (16 tests)
Jane Allen -- (281) 230-6726
- 37^B - GSE Chile (16 tests)
Mauricio Ossa -- 56-2 6010153
- 38^C - Sageos/CTT Group (82 tests)
Eric Blond -- (450) 771-4608
- 40^B - GSE Lining Technology Inc. (14 tests)
Charles Miller -- (843) 382-4603
- 41^A - SGI Testing Service, LLC (18 tests)
Zehong Yuan -- (770) 931-8222
- 42^C - NPUST (GSI-Taiwan) (39 tests)
Chiwan Wayne Hsieh -- 011-886-8-7740468
- 43^A - Ardaman & Associates (18 tests)
George DeStafano -- (407) 855-3860
- 44^B - BBA Fiber Web, Inc. (9 tests)
Ken McLain -- (615) 847-7575
- 45^B - Ten Cate Malaysia SDN Bhd. (23 tests)
C. P. Ng -- (603) 519 28568
- 46^B - Bentofix Technologies (13 tests)
Colin Murphy -- (705) 725-1938
- 47^A - Precision Laboratories, TX (13 tests)
Ron Belanger -- (866) 522-0843
- 48^B - Tenax Corporation (9 tests)
Andrew Barker -- (410) 522-7000
- 49^B - Engopol Geossinteticos (20 tests)
George Nastas -- (55) 11-4166 3001
- 50^B - ADS, Inc. Hamilton (7 tests)
Terry McElfresh -- (513) 896-2065
- 51^B - Solmax International Inc. (14 tests)
Guy Elie -- (450) 929-1234
- 53^B - Polytex Inquique (13 tests)
Cristian Valdebenito -- 011 56 57 42 90 00
- 54^B - ADS, Inc. Finley (9 tests)
David Gonso -- (419) 424-8377
- 55^B - Atarfil Geomembranes (21 tests)
Isabel Merida Fernandez -- 34 958 439 278
- 56^B - Polytex Santiago (11 Tests)
Jamie Morales -- 56-2-627-2054
- 57^B - Ten Cate Cornelia (11 Tests)
Melissa Medlin -- (706) 778-9794
- 58^B - Propex Nashville (9 Tests)
Tim Smith -- (229) 686-5511
- 59^B - Firestone (9 Tests)
Janie Simpson -- (864) 439-5641

^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

If you are interested in this program and would like a copy of the GAI-LAP directory, please advise accordingly. A directory is published annually in December, and is also kept current on GRI's Home page at <http://www.geosynthetic-institute.org>. For additional information on the GAI-LAP program contact:

George R. Koerner, Ph.D., P.E., CQA
Geosynthetic Institute
475 Kedron Avenue
Folsom, PA 19033-1208
Telephone: (610) 522-8440
Fax: (610) 522-8441
E-mail: gkoerner@dca.net

The annual GAI-LAP meeting was held in Norfolk, Virginia USA in conjunction with ASTM D35. It was held from 6:45 to 7:30 PM on June 27, 2007. Seventeen people attended representing 11 of 43 GAI-LAP labs (26%). GAI-LAP thanks those who made the effort to attend. The agenda for the meeting was as follows;

Agenda

1. Background
2. Demographics
3. Proficiency Tests
4. Customer Survey Results
5. ISO Standards
6. Conflict Resolutions
7. MARV draft white paper
8. Open Discussion

Results of the meeting itself follows:

1. A brief introduction and background of the GAI-LAP services was discussed.
 - (a) Program started in 1995
 - (b) Accredited only geosynthetic labs
 - (c) ISO 17025 is our model
 - (d) On-site audits (years 1, 5, 10 etc...)
 - (e) Proficiency tests every year
 - (f) Our Goal is to get Cv < 5

New members are as follows:

- Atarfil Geomembranes SL (Spain) - Isabel Fernandez
- Industrial Polytex Ltda. (Santiago, Chile) - Christian Valdebenito
- TenCate (Cornelia, GA) - Melissa Medlin
- Propex (Nashville, GA) - Tim Smith
- Firestone (Wellford, SC) - Janie Simpson

2. The Demographics of the current GAI-LAP organizations are summarized as follows:

15 independent labs
23 manufacturer QC labs
5 centers (research or government)
43 = total

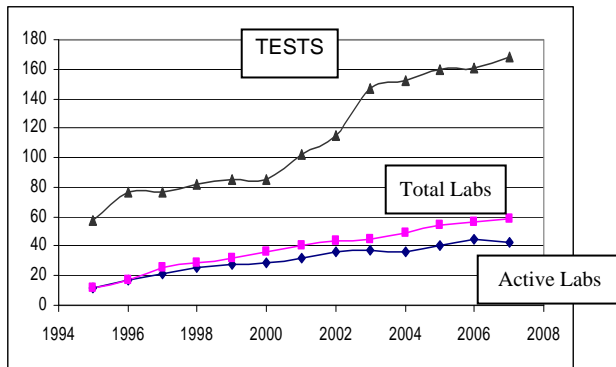
Also:

31 are GSI members
12 nonmember labs
(11 international labs)

There are 168 possible tests for accreditation (125 ASTM, 1 FTM, 8 GRI, 34 ISO). The number of accredited tests per lab are as follow;

5 min., 28 ave. 118 max.

The graph below shows the trends for both number of possible accredited tests and the number of laboratories participating in the program.



The graph clearly shows that there has been a rapid rise of new test methods, with a near tripling of methods covered in a ten year period. The number of labs enrolled shows a steady increase in both overall labs and labs currently participating in the program.

3. Proficiency testing is still the hallmark of the GAI-LAP. Of the 815 proficiency test results submitted this year, zero first submittals were outliers (congratulations to all that participated). Results of the proficiency tests were shared at the meeting. A hardcopy of the 2007 proficiency test results is available.
4. The GAI-LAP Customer Survey was again sent out to all program participants and the results were reviewed at the meeting. The results were as follows;
 - (a) 31% return; following are results (5 best to 1 poorest)
 - (b) Information exchange = 3.8
 - (c) Conflict resolution = 4.2
 - (d) Proficiency Testing = 4.3
 - (e) Directory and Internet = 3.0
 - (f) Overall = 3.9
 - (g) Overall results to date: 2006 (3.9), 2005 (4.0), 2004 (4.1), 2003 (4.1), 2002 (4.2)

We are slipping a bit in customer satisfaction and will make a better effort going forward. Individual comments that we find very helpful are listed below;

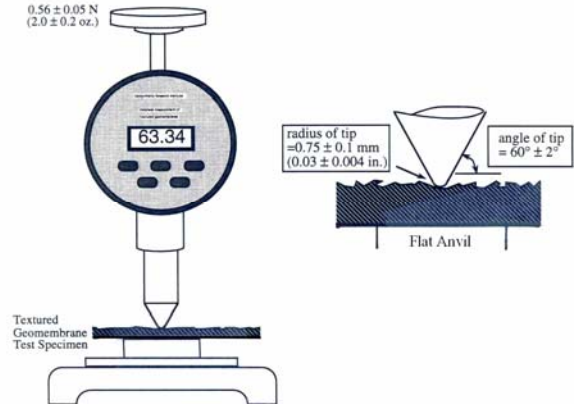
- Request greater information exchange (dialog)
- Correct mistakes in directory
- Website links are requested
- Update internet list
- Conflict resolution poorly documented and no root cause identified in a few cases
- One of the third party lab who does primarily geotechnical testing stated that they are not

doing enough geosynthetic work to justify accreditation. Hence they dropped the accreditation.

Henry Mock of Golder Associates graciously volunteered to audit the GSI/GAI lab in the near future to help with our continuous improvement efforts.

5. Discussion about conflict resolution activities dominated the remainder of the meeting. Conflict resolutions were conducted on the following test methods over the course of the past year;

- (a) ASTM D6693, ASTM D638, and ISO 527, Dogbone Tensile, Two labs were arguing that results of these three methods are interchangeable. They are not, due to different specimen size and geometry, the use of an extensometer for ASTM D638 and ISO 527 where ASTM D6693 makes use of cross head movement to calculate strain, and D6693 uses a default gage length of 50mm for break strain where D638 and ISO 527 use the actual measured value of 25 mm.
- (b) ASTM D5994, Measurement of core thickness for one sided textured HDPE was discussed. It resulted in a new draft GRI standard GRI-GMXX, which utilizes an tapered tip and a flat anvil as shown below;



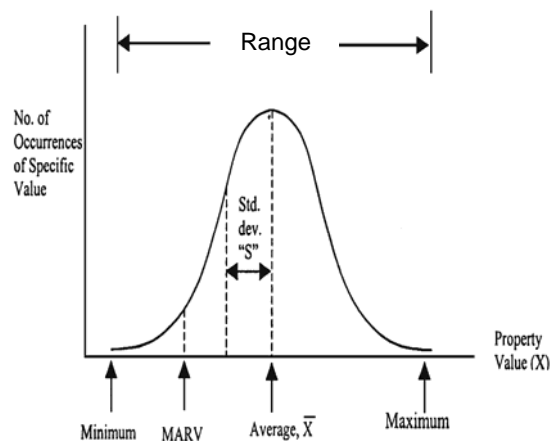
- (c) ASTM D1693, Stress Crack determination of Plastic pipe via the Bent Strip Method. There is currently no suggestion on how to monitor this method 24 hours a day 7 days a week. This is yet another issue with the test (stress relaxation being the major issue). Hence GAI-LAP promotes the use of ASTM F2136 which is the NCTL for plastic HDPE pipe.
- (d) There were two conflicts with ASTM D4632, Grab Tensile this year. Again most of the issues centered on low breaking loads. High resulting variability was a result of testing fewer specimens than recommended in the standard (5 rather than 10), material variability of lightweight NPNW geotextiles, and grip face

padding issues. It appears that most manufacturers are now using rubber faced grips while running the grab tensile test. This results in higher breaking load than testing with serrated or smooth face steel grips.

- (e) Some ASTM D5885, HP-DSC tests result in a double peaked exotherm. The identification of which is key to the definition of the OIT. The double peak can be a result of many things in the formulation of the material. However, it was decided that the exotherm onset should be defined by the initial peak and not subsequent peaks regardless of the formulation. This position is conservative but recommended by several DSC equipment manufacturers and experts in the industry.
- (f) There were two issues with ASTM D5887, GCL Flux. The first was specimen preparation for GCL which contains a geomembrane. J. Boschuk has brought a suggestion to ASTM utilizing a RTV adhesive around the perimeter of the specimen that seems to work. It has also been found that air bubbles can be trapped under the specimen which may retard flow. A procedure was also suggested to ASTM through Jim Olsta (Task Group Leader) on this issue.
- (g) There continues to be ongoing arguments about interpretation differences of ASTM D 5321, direct shear results. Such arguments go beyond the use of peak versus post peak data, but rather the interpretation of the Mohr Coulomb curve itself. Instead of making a universal recommendation, GSI has written a white paper on the subject to enable a design engineer several choices to make, prior to contracting conformance testing. It is presently available as White Paper #10 on the GSI Home Page.
- (h) We had a very curious complaint about ASTM D1204, Dimensional Stability of 30 mil PVC. Apparently 5 Labs (3 GAI-LAP accredited) tested 4 samples with an Ave.= -2.1%, and a Std. Dev. = 1.6%. The party entering the complaint said that the Labs wanted to remain anonymous. I replied that each lab needed to be identified and that the GAI-LAP Conflict Resolution SOP needed to be followed. At this suggestion the issue was disappointedly dropped and never heard from again.
- (i) In ASTM D5994, Core Thickness, the search procedure continues to be an issue with a material of high variability as can be with blown film textured geomembranes.
- (j) GRI GG-2, GG junction strength. The grips continue to be a concern with the standard. Both supported and unsupported grips are addressed in the standard. Results differ depending on the type of grip used. When using supported grips on geogrids constructed

with dual transverse ribs, a wedge is formed that creates unrealistically high results.

- 6. DRAFT GRI White Paper #10 on MARV tried to discuss if materials meet specifications. It tried to address the question; "Is there a minimum (lowest) value upon which no conformance test result should go below"? Comments from H. Mock, D. Bright, R. Belanger, B Ramsey, G. Yazdani, T. Eith etc. suggest that a MARV compromise between manufacturers and specifiers for geotextiles is fine. We are trying to avoid it for other geosynthetics and in particular geomembranes where minimum average is in order. This effort tried to avoid a comparison of the means by defining values on the following graph. While the draft White Paper attempted to keep this as its focus it apparently failed. As a result the effort was tabled.



- 7. The open discussion portion of the meeting was highlighted by the following housekeeping items;
 - (a) The next GAI-LAP annual meeting will be held in June 2008 in conjunction with ASTM D-35 in Denver CO.
 - (b) GAI thanked Polyflex, CETCO and Propex for contributing geomembrane, GCL and geotextile, respectively to the GAI-LAP proficiency cause. We also solicited manufacturers for geosynthetic materials for 2008 proficiency testing.

Note that each lab can add up to seven tests per year and the directory is kept current on our home page:

www.geosynthetic-institute.org

It is a pleasure working with you and thanks for participating in the GAI-LAP program. If you have questions, please call to discuss.

George Koerner

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 many 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. We introduce these institutes to you in this Newsletter/Report and will present ongoing details of their respective activities.

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).

FITI is a 30-year old testing organization located in Seoul focusing on interlaboratory proficiency; environmental protection; safety and flammability; hazardous substances; in-house quality control; consumer protection; complaint analysis; quality marking; procurement; household and industrial applications; and materials approval. It employs 120 people (8 with doctoral degrees) and 42 engineers. The geosynthetics testing group within FITI has 12 people (2 with doctoral degrees) and 10 engineers. The geosynthetic laboratory is GAI-LAP accredited for 70 geosynthetic test methods. Dr. Jeonghyo Kim is the general manager within FITI's geosynthetics activities.

INHA University is located in Incheon (50 km west of Seoul) 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. The ongoing efforts of both FITI and INHA will be described in future Newsletter/Reports.

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 Director of the Computer Center. 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 32 geosynthetic test methods. Dr. Hsieh has 10-

students working on geosynthetic-related projects and is extremely active nationally and internationally. The ongoing efforts of GSI-Taiwan will be described in future Newsletter/Reports.

The Geosynthetic Institute Centers-of-Excellence

1. The Center for Polymeric Reinforced Structures (CPRoS) was formed on Dec. 27, 2002 for the purpose of proper use of geosynthetics in walls, slopes, and foundation reinforcement. It involves Dov Leshchinsky of Delaware, Grace Hsuan of Drexel and George Koerner of GSI as Co-Directors. The mission statement and goals are available on the GSI Home Page at <geosynthetic-institute.org>. Ongoing projects are the following:
 - (b) Dov Leshchinsky is modifying and incorporating two important aspects of reinforced walls into his widely-used computer program "MSEWall". They are; design to accommodate short reinforcement lengths when full space is unavailable, and the incorporation of drainage geocomposites in accommodating low permeability backfill soils.
 - (c) Grace Hsuan is utilizing the Stepped Isothermal Method (SIM) for assessing the long-term behavior of various geosynthetic reinforcements including geofoam. Graduate student Sang-Sik Yeo, has performed the requisite research and he successfully defended his dissertation in August.
 - (d) George Koerner has supervised the construction of a segmental retaining wall at GSI which has 3-different masonry block types. He is measuring the pH-values directly between block surfaces and will do so for many years into the future... the following photograph is of the "GSI Wall". Data is currently available. [As a comment, this wall has geogrid reinforcement between every block layer and is backfilled completely with AASHTO #57 stone. It will not collapse or even deform!]



2. The Center for Polymers in Hydraulic Structures (CPHyS) was formed on June 20, 2003 for the purpose of proper use of geosynthetics in dams,

canals, reservoirs, tunnels, pipes and related hydraulic systems. Jorge Zornberg of the University of Texas at Austin, Grace Hsuan of Drexel, and George Koerner of GSI are Co-Directors. The mission statement and goals are available on the GSI Home Page at <<geosynthetic-institute.org>>. Initial projects are being decided upon, but two are certain.

- (a) Grace Hsuan is focusing on exposed geomembrane durability and lifetime. (See Item 10 previously). This issue is critically important to gain confidence regarding polymer lifetime in the minds of owners, regulators, designers and specifiers in the focused application areas.
 - (b) Jorge Zornberg's activity, via a GSI funded graduate student, Christine Weber, will focus on drainage behind exposed geomembranes on dams.
 - (c) George Koerner's activities are within GSI and focus on the UV fluorescent device.
3. In both CPReS and CPHyS, Bob Koerner acts in an advisory manner and as a peer reviewer. In both centers existing GSI Members and Associate Members are fully entitled to the information that is developed and their interaction is encouraged. No additional funding is anticipated. We will keep the membership advised as to progress in this regard. We sincerely hope that the membership is supportive of these initiatives and your comments/suggestions are always solicited.
 4. There is a distinct possibility for additional centers of this type. In particular we are looking to team with a university specializing in CAFO's, i.e., large-scale agricultural operations and possibly aquaculture and mining operations as well. Please contact Bob Koerner with suggestions and ideas.

Items of Interest

1. Heat Mining!

A comprehensive new MIT-led study of the potential for geothermal energy within the U.S. has found that mining the huge amount of heat that resides as stored thermal energy in the earth's hard rock crust could supply a substantial portion of the electricity the U.S. will need in the future, probably at competitive prices and with minimal environmental impact.

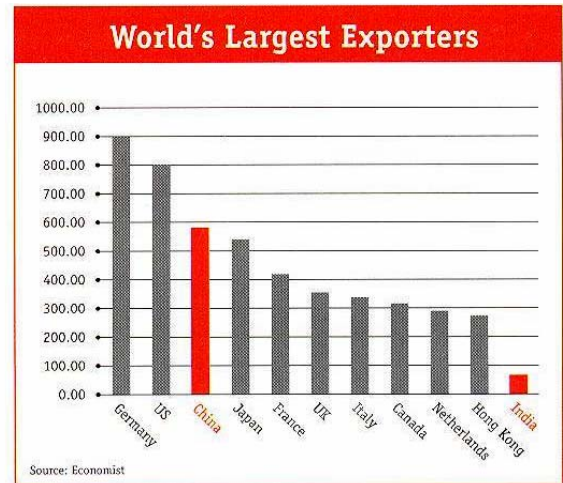
An 18-member panel led by MIT prepared the 400-plus page study titled "The Future of Geothermal Energy." Sponsored by the U. S. Department of Energy, it is the first study in some 30 years to take a new look at geothermal, an energy resource that has been largely ignored.

(from Foundation Drilling, June/July 2007)

(Eds Note: Looks like many lined surface impoundments with floating covers will be necessary)

2. World's Export Economy

In 2005, China's international trade dwarfed that of India, according to World Trade Organization (WTO) figures. Roughly 91 percent of China's exports were manufactured goods, vs. 75 percent for India. While India is better known for its exports of services, even in that area, China is leading. A large share of India's service exports were related to information technology (IT) and IT-related services. See following data from the Economist.



3. Now Available: LRFD Design Bridge Specifications, 4th Edition

The American Association of State Highway and Transportation Officials (AASHTO) have announced the availability of this new text. This edition includes newly updated seismic and foundation specifications. Based on the load and resistance factor design (LRFD) philosophy, this book is the result of a five-year research effort under AASHTO's National Cooperative Highway Research Program, Project 12-42.

(ref., Foundation Drilling, February 2007)

4. Construction Market in USA to Grow Substantially

Percentage Increases Compared with 2006

- Healthcare = 2%
- Sewage and waste disposal = 10%
- Water supplies 9%
- Conservation and development = 9%
- Commercial construction = 8%
- Office = 7%
- Transportation = 8%
- Highways and streets = 7%
- Power = 5%

(Source: 2007 Markets Construction Overview, FMI Corporation, Denver)

5. Top 10 Materials Moments in History Announced

The Material Society has prepared a Top 10 Greatest Materials Moments in History list. The results are in. The winners are:

1. The periodic table of elements, devised by Dmitri Mendeleev in 1864
2. Iron smelting, first accomplished around 3500 B.C. by the Egyptians.
3. The transistor, invented in 1948 by John Bardeen, Walter H. Brattain and William Shockley.
4. The invention of glass in approximately 2200 B.C. in northwestern Iran.
5. Optical microscopy, developed in 1668 by Anton van Leuwenhoek.
6. Modern concrete, invented in 1755 by John Smeaton.
7. Crucible steel making, developed around 300 B.C. by metal workers in south India.
8. Copper extraction and casting, invented approximately 5000 B.C. in the region of modern Turkey.
9. X-ray diffraction, discovered in 1912 by Max von Laue.
10. The Bessemer process, patented in 1856 by Henry Bessemer to melt low-carbon iron.

More information about the Greatest Materials Moments can be found online at www.materialmoments.org.

(Editor's Note: I think that the day I married Paula should be on the list somewhere!)

Review of Inspector's Certification Program

The Geosynthetic Certification Institute's – Inspectors Certification Program, or "GCI-ICP" began operations in January 2006. It was initiated at the request of landfill owner/operators, not the least of which was Waste Management, Inc. The structure and requirements of the GCI-ICP were presented earlier in this Newsletter/Report as were the names of the Steering Committee. Our thanks are expressed to them in this regard. This short note is meant to report to the members and associate members of the program's progress to date.

1.0 Overall Performance

As of this summer the overall performance of the two separate certification programs; namely, geosynthetics and compacted clay liners is as follows:

(a) Total People Taking Geosynthetics Exam = 196

Passed = 188 (96%)

Failed = 8 (4%)

(b) Total People Taking Compacted Clay Liner Exam =175

Passed = 156 (89%)

Failed = 19 (11%)

The steering committee has assessed this data and concludes the following:

- 4% failing GS exam indicates that the exam is too lenient. Need to increase degree of difficulty of exam questions.
- 11% failing CCL exam indicates that the degree of difficulty is about right.

2.0 Experience Level

The experience level of persons failing the exams is as follows:

- (a) People Failing Geosynthetic Exam = 2.7 Years Average Experience (6 had \approx 1.2 yrs. experience; 1 had 5 yrs.; 1 had 10 yrs.)
- (b) People Failing CCL Exam = 4.5 Years Average Experience (2 had < 1.0 yrs. experience; 6 had 1-2 yrs.; 11 had > 3 yrs.)

The steering committee observes the following:

- Experienced people are failing both the geosynthetic and CCL exams.
- Need to challenge the nature and type of experience expressed in the application.

3.0 Overall Test Scores on Exams (70% is passing)

- (a) For the Geosynthetic Exam
 - 24 people \geq 90 score (12%)
 - 114 people between 89 and 80 score (58%)
 - 50 between 79 and 70 score (26%)
 - 8 people < 70 score (4%)
- (b) For the CCL Exam
 - 16 people \geq 90 score (9%)
 - 100 people between 89 and 80 score (57%)
 - 39 people between 79 and 70 score (23%)
 - 19 people < 70 score (11%)

The steering committee makes the following recommendations in light of this data.

- Gaussian distribution of scores can be clearly seen in statistics to date.
- Mean is near 85% for both exams.
- Question of raising passing grade above 70% was met with the suggestion of increasing difficulty of test.

4.0 Geosynthetics Examination Performance

Performance by Geosynthetic Exam Section of those with < 80% Correct on the GS Exam; (58 people total). Please recall that the present GS-exam is subdivided as follows:

1. CQA and GS: 20 questions (14.3%)
2. Geotextiles: 20 questions (14.3%)
3. Geogrids: 10 questions (7.1%)
4. Geonets: 20 questions (14.3%)
5. Geomembranes: 35 questions (25%)
6. GCLs: 20 questions (14.3%)
7. Geopipe & Misc.: 15 questions (10.7%)

In light of the above data, the steering committee recommends the following:

- Make GS exam somewhat more difficult.
- Remove ambiguous questions from both exams.
- Submitted written experience record for application should list jobs, duration of job involvement, and nature of work conducted while on site at that specific job.
- Emphasize quality of inspectors not the number of program participants.
- Internet advertisement is enough with short course publications. People in the business know of the program and can avail themselves of it. No need to do additional advertising.

5.0 Effect of Taking a Course Before Taking the Exam

- (a) People Failing Geosynthetic Exam = 8
No Course Before = 1 (13%)
Took Course Before = 7 (87%)
- (b) People Failing CCL Exam = 19
No Course Before = 5 (26%)
Took Course Before = 14 (74%)

The steering committee's response to this somewhat surprising set of data was as follows:

- Course is not helping some.
- Worry that the course instructors are teaching the exam is unfounded.

6.0 General comments and/or recommendations by the steering committee are as follows:

- (a) Registration forms should not require social security numbers.
- (b) More detailed work experience should be required of all applicants.
- (c) Steering committee conference calls should be approximately semi-annually.
- (d) Examinations (and courses) should be from late fall to early spring.

- (e) The examination schedule should be posted on the GSI Home Page as early as possible.

Bob & George Koerner

Upcoming Events

- October 1-5, 2007
Sardinia Landfill Conference
Cagliari, Italy
Contact: <info@sardiniasymposium.it>
- October 23, 2007
QA/QC of Geosynthetics Course
(followed by exams for GS & CCLs)
Lansing, Michigan
Contact: <mvashley@verizon.net>
- November 14-16, 2007
IS Kyushu '07
Earth Reinforcement Conference
Contact: <junotani@gpo.kumamoto.u.ac.jp>
- November 28, 2007
QC/QC of Geosynthetic Course
(followed by exams for GS and CCLs)
Pittsburgh, Pennsylvania
Contact: <mvashley@verizon.net>
- December 10, 2007
Landfill Design Course
December 11, 2007
QC/QA of Geosynthetics Course
December 12, 2007
GS and CCL Exams
Above are at GSI, Folsom, Pennsylvania
Contact: <mvashley@verizon.net>
- January 29-31, 2008
ASTM D35 on Geosynthetics
Tampa, Florida
Contact: <csierke@asmt.org>
- February 11, 2008
Landfill Design Course
February 12, 2008
QC/QC of Geosynthetics Course
February 12, 2008
GS and GCL Exams
Above are at GSI, Folsom, PA
Contact: <mvashley@verizon.net>
- March 2-5, 2008
GeoAmericas
Cancun, Mexico
Contact: <jmrutledge@ifai.com>
- June 17-20, 2008
Geosynthetics Asia 2008
Shanghai, China
Contact: <ccigs@4acq-2008sh.com>
- September 7-10, 2008
Global Waste Mgmt. Symposium
Cooper Mountain, CO
Contact: <www.wastesymposium.com>

- September 7-10, 2008
EuroGeo 4
Edinburgh, Scotland
Contact: <eurogeo4@eurogeo4.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. The newest member organizations are the Massachusetts Department of Environmental Protection and Aquatan (Pty) Ltd. of South Africa. A sincere thanks to both of them and welcome!

MEMBERS

GSE Lining Technology, Inc.

Boyd Ramsey [BoD]

Earth Tech Consultants, Inc.

Kevin McKeon/Ken Bergschultz

U.S. Environmental Protection Agency

David A. Carson

E. I. DuPont de Nemours & Co., Inc.

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Federal Highway Administration

Albert F. DiMillio/Jerry A. DiMaggio

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NAUE GmbH & Co. KG

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Propex

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STS Consultants

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BBA Nonwovens

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NTH Consultants, Ltd.

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TRI/Environmental Inc.

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U. S. Army Corps of Engineers

David L. Jaros [BoD]

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URS Corp.

John C. Volk/Robert B. Wallace

Solmax Géosynthétiques

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Envirosource Technologies, Inc.

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CARPI, Inc.

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Agri America, Inc.

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Waste Management Inc.

Anthony W. Eith [BOD]/Greg Cekander/

Charles P. Ballod

NPUST (GSI-Taiwan)

Chiwan Wayne Hsieh

GeoTesting Express

W. Allen Marr/Richard P. Stulgis [BoD]

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Ring Industrial Group

Ben Berteau/Jeffrey Karl

Pétromont

Sylvie Coulange-Suarez/Nathalie Legros

EPI, The Liner Co.

Daniel S. Rohe/Mark Wolschon

Vector Engineering, Inc.

Vince Suryasmita/Richard Thiel

MEMBERS (cont.)

Weaver Boos Consultants, Inc.

Mark Sieracke [BoD]

Aquatan (Pty) Ltd.

Morne Breytenbach/Piet Meyer

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Delaware Solid Waste Authority

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Nebraska Department of Environmental Quality

Gerald Gibson

New York State Dept. of Environmental Conservation

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Maine Department of Environmental Protection

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E. Paul Farrell, Jr.

Massachusetts Dept. of Environmental Protection

Paul Emond

IN THE NEXT ISSUE

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- Progress within GEI (Education)
- Activities within GAI (Accreditation)
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- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- Items of Interest
- Preview of the GRI-21 Conference
- GSI's Member Organization