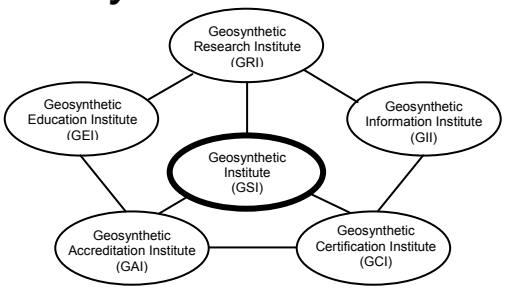
The GSI Newsletter/Report

Geosynthetic Institute



Vol. 18, No. 2 **June 2004**

This quarterly newsletter, now in its 18h 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 mashley@dca.net.

Activities of the GSI Board of Directors & Institute Director

1. A modification of the AASHTO M288 geotextile specification, focusing only on roadway separation, is available. It is free for all to download from the open section of the GSI Home Page as GRI-GT13.
2. The "Hanging Bag" test method for assessing fabrics for geotextile tubes, containers and bags is available for industry use and is posted on our Web Site. It is in the Test Method Section and is identified as GRI-GT14.
3. We have had many meetings and discussions over the GRI-GM18 Specification on flexible polypropylene geomembranes since our initial meeting in December in Las Vegas with various interested organizations. In light of some unfavorable field performance, we have temporarily suspended this specification. We are working with the fPP geomembrane group and doing additional research, with the goal of modifying the specification and bringing it back "on-line" in the future.
4. The 2nd Edition of the Technical Guidance Document on TA/QC of Waste Containment Systems (stemming from a 1990-92 grant from U.S. EPA to Daniel and Koerner has been sent to the printers. If members are in great need of it we will send you a preliminary CD. It's about 390-pages long. Please advise accordingly.
5. GSI has finally obtained a Xenon Arc Weatherometer! It's used, but will hopefully do the job for us. The planned research program is explained later in this Newsletter/Report.

NOTICE: This Newsletter/Report is mailed to the contact persons of the GSI member organizations (~ 100 total). Obviously, we wish you would share it with colleagues and friends. Please recognize, however, that it is always available on our Home Page at www.geosynthetic-institute.org in the open section under the heading "Newsletter/Report".

6. The current BoD members are as follows. Don't hesitate to contact them directly for suggestions, comments, or whatever.

Term Ends 2004
Dave Jaros - Corps of Engineers
Rex Bobsein - Chevron/Phillips Co.
Kent von Maubeuge - Naue Fasertechnik GmbH
Term Ends 2005
Dick Stulgis - GeoTesting Express
Jim Olsta - CETCO
Dave Suits - NY State DOT
Term Ends 2006 (newly elected)
Tony Eith - Waste Management Inc.
Boyd Ramsey (Chairman) -
GSE Lining Technology, Inc.
At Large; Sam Allen - TRI/Environmental, Inc.

IN THIS ISSUE

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 write-ups. Grace can be reached at (610) 522-8440 or e-mail at <grace.hsuan@coe.drexel.edu>.

1. **Stress Cracking of Geomembranes -** Dr. Grace Hsuan is project manager of our ongoing efforts to evaluate stress cracking of geomembrane resins, sheets and seams. In addition to her ongoing evaluations of HDPE geomembranes, Grace is now focusing on HDPE drainage pipe. Her activity is on behalf of the Florida Department of Transportation. The goal for both geomembranes and geopipe is to include technically viable test methods and limiting values in generic specifications. For geomembranes, see GRI-GM13 (and the related GRI-GM10) on the GSI Web Site under *specifications and guides*. There have been recent changes in both. For geopipe, Grace has made recommendations for eventual inclusion in the AASHTO specification on drainage pipe.
2. **Durability and Lifetime Prediction** - This project is based on our previous 8-year long study on the lifetime prediction of HDPE geomembranes. The result of that study being a clearly defined Stage A – antioxidant depletion for HDPE geomembranes. George Koerner has set up 20 replicate columns each of which is subjected to a compressive stress equivalent to a 50-m high landfill. In each of the columns are the following:

   (a) 1.5 mm HDPE geomembrane with no antioxidants (Stage B and C degradation will be evaluated)
   (b) 140 g/m^2 needle punched nonwoven PP geotextile
   (c) 140 g/m^2 woven slit film PP geotextile
   (d) 90 kN/m woven multifilament PP geotextile
   (e) 175 kN/m woven multifilament PP geotextile

   Temperatures are being maintained at 85, 75, 65 and 55ºC and the samples are being removed on approximate 6-mo. intervals. Grace Hsuan and George Koerner are in charge of the project.
3. **Durability of Polypropylene Geotextile Fibers and HDPE Geogrid Ribs** - Incubation at temperatures of 75, 65 and 55°C in forced air ovens is ongoing using PP-woven geotextile fibers and HDPE geogrid ribs. This 5-year 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. **Durability of Polyester Geotextile Fibers and Polyester Geogrid Yarns** - PET geotextile fibers and coated geogrid yarns are being incubated at temperatures of 65°C, 55°C and 45°C while being immersed in deionized water. Additional parameter variations are crystallinity, molecular weight and CEG content. This 5-year study periodically measures changes in mass, diameter, morphology, strength, elongation, modulus, molecular weight, crystallinity and CEG content. Dr. Hsuan is in charge of the project.
5. **In-Situ Temperature Monitoring of Liner and Cover Geomembranes in Dry and Wet Landfills** - Dr. George Koerner is evaluating the in-situ temperature behavior of geomembranes and has installed 20 thermocouples for long term measurements in a municipal solid waste landfill in Pennsylvania. This is a conventional "dry" landfill with no additional liquids added. Eight are on the GM liner, one is in the gravel, four are in the waste, six are on the GM cover and one is measuring ambient temperature at the site. Envisioned are temperature profiles of the entire system for up to 20 years. After 10 years of data collection, George has measured the following:

LOCATION	Min. Temp. (°C)	Ave. Temp. (°C)	Max. Temp. (°C)
geomembrane beneath waste	17	27	38
leachate collection stone beneath waste	14	17	22
within the solid waste mass itself	15	25	36
geomembrane above waste (it is covered by ~ 1 m of soil)	3	21	40

The data is particularly intriguing since temperatures were constant at 20°C for the first 4-years and then abruptly increased to a 30°C average where they have increased slightly to date. The cover temperatures swing seasonally; higher in summer and lower in winter.

An additional effort in this regard is the monitoring of the geomembrane liner and cover temperatures in a bioreactor landfill in Pennsylvania. It happens to be at the same landfill as the previously described site which is a dry-landfill. The geomembrane beneath the waste was at an average temperature of 25°C (5°C higher than the dry landfill) at the start. It

has gradually risen over the past 2.5-years to an average temperature of 40°C (approximately 10°C higher than the dry landfill). The cover geomembrane has also been instrumented and data is being generated.

A paper on both the conventional and bioreactor landfill cell temperatures has recently been submitted to the Journal of G & G.

6. **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 quarterly basis. The timeline of the project calls for monitoring for 5 to 10 years. This fascinating project will be daylighted at GRI-18 in January 2005.
7. **Flow Behavior of Fully Degraded Waste** - A new 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 are both natural soils and geosynthetic drains. The project will commence this summer at a landfill in the Philadelphia area.
8. **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/m^2 protection geotextiles on 1.5 mm thick HDPE geomembranes is being evaluated; the time is currently 6-years. The 4-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. Results are used in a puncture design method that has been published previously. The purpose of these current tests is to better define the creep reduction factors used in the design method. It will be daylighted at GRI-18 in January, 2005.
9. **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. A paper is available which outlines the procedure and field layout.
10. **NIST Sphere Exposure of Geomembranes** - Dr. Grace Hsuan is on sabbatical from Drexel this academic year at the National Institute of Standards and Technology in Gaithersburg, Maryland. Her project is to work with the NIST Sphere, a simply awesome device, to evaluate the exposed lifetime of geomembranes used in hydraulic applications, e.g., dams, canals, floating covers, tunnels, pipes, etc. She is exposing LLDPE, fPP, PVC and probably others as well… more later.
11. **UV Exposure of Geomembranes** - GSI will use its new Xenon Arc device along with its two existing UV-fluorescent devices to evaluate the simulated outdoor lifetime of six different types of geomembranes. 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. The project compliments and greatly extends the previous item.
12. **High Pressure Incubation for Lifetime Prediction** - Dr. Grace Hsuan has an ongoing National Science Foundation project on this topic. Five high pressure cells are involved: four are at 2.1, 3.5, 4.9 and 6.3 MPa and one is the control at atmospheric pressure. In the cells are HDPE geogrid, needle punched nonwoven PP geotextile, and woven slit film PP geotextile samples. They will be periodically retrieved and tested for OIT and tensile strength. Comparison will then be made to nonpressure incubation to assess the acceleration factor. A paper is available.
13. **Generic Specifications** - A major effort is ongoing with respect to the development of generic geosynthetic specifications. As described at our recent annual meeting, the

current status of these specifications is as follows:

Completed
GM13 – HDPE Geomembranes
GM17 – LLDPE Geomembranes
GM18 – fPP Geomembranes (Temporarily Suspended as of May 3, 2004)
GM21 – EPDM Geomembranes
GM19 – Geomembrane Seams
GT10 – Geotextile Tubes
GT12 – Geotextile Cushions
GT13 – Geotextile Separators (Newly Approved)
Working Within Focus Groups
GCXX – TRMs for Erosion Control
Off in the Distance
GGXX – Biaxial Geogrids
GGXX – Uniaxial Geogrids
GNXX – Biplanar Geonet Drainage Composites
GCXX – Drainage Geocomposites
GCLXX – Geosynthetic Clay Liners

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, please note that this is where the latest modification will always be available.

Also, please note that these specifications are available on a separate power point CD which shows photos of the test methods and can be used as a presentation to clients and customers, as well as being an in-house training vehicle.

14. Technical Guidance Documents on QC/QA of Waste Containment Faciliites - Drs. David Daniel and Bob Koerner have completed the Second Edition of this EPA project by greatly updating the original 1993 report. It will be published by ASCE Press, but if you want a preliminary copy on CD (~ 390 pages) contact us accordingly.

15. The 5th Edition of Designing with Geosynthetics will be "at the printers" by summer -- to be published in early 2005. To those who are interested, here is the track-record of this textbook over the years.

Edition	Date	Books Sold	Units
1	1984	3197	English only
2	1990	2645	English, SI in paren.
3	1994	4194	SI, English in paren.
4	1998	3500	SI only
5	2005	?	SI only

The Geosynthetic Institute Centers-of-Excellence

1. The Center for Polymeric Reinforced Structures (CPReS) 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:

   (a) 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. The first topic was presented at GRI-17 in Las Vegas and a paper and report to GSI is available.
   (b) Grace Hsuan is utilizing the Stepped Isothermal Method (SIM) for assessing the long-term behavior of various geosynthetic reinforcements. Graduate student San-Sik Yeo, is performing the requisite research.
   (c) 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… following is the "The GSI Wall".

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 will focus 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, will focus on drainage behind exposed geomembranes on dams.

(c) George Koerner's activities are within GSI and focus on the Xenon Arc and UV fluorescent devices (see Item 11 previously).

3. In both CPReS and CPHyS, Bob Koerner will act in an advisory manner and as quality assurance! 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. Please contact Bob Koerner with suggestions and ideas.

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 available to everyone (member or nonmember) and has the following menu:

- Background (including members whose home pages are linked to this home page)
- Geosynthetic Materials
- Geosynthetic Applications
- Masters Degree in Geosynthetics
- Prospectus

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

The second home page is the GSI Home Page (which is "terrific") 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 Specifications & Guides**
- **Laboratory Accreditation**
- **CPReS & CPHyS**
- **Laboratory Accreditation**
- **Product Certification**
- **Newsletter/Reports**
- **Internet Courses**
- **Winter 2005 Courses**
- **Geosynthetics Links**
- **GSI Member Meetings**
- **Next GRI Conference**

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 marilyn.ashley@coe.drexel.edu. When you get into this section, a treasure-trove of 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 "Links to the Geosynthetics World" is exactly that. The following is the menu in this file and by clicking on any item you will find all organizations involved in that industry segment. Selecting any one of them will give you their respective Web Site.

Regulatory Agencies
Standards Societies
Resin & Additive Producers
Geosynthetics Products
Geosynthetic Installers
Consultants in Geosynthetics
Geosynthetic Test Laboratories
Geosynthetic Organizations; Centers and Institutes
Universities with Geosynthetic Programs

Both GSI members and nonmembers are included, as are organizations on a worldwide basis. It's a super addition… try it out and advise accordingly.

Progress within GEI (Education)

The following 4 (one day long) courses will be offered at GSI in January, 2005.

Course #1 - January 6, 2005

Geosynthetics in Reinforced Walls and Slopes incl. Computer Design

Goal: This one-day course is focused on the proper design and construction of reinforced retaining walls and steep soil slopes using geogrids or geotextiles. Included are the following:

- overview of concepts, aesthetics, costs, designs and performance,
- actual testing for tension, shear and transmissivity of geosynthetics,
- computer design using MSEWall® and ReSlope® - with Dr. Leschinsky of the University of Delaware, and
- design of wall and slope drainage systems

Course #2 - January 7, 2005

Geosynthetics in Transportation/Geotechnical Applications

Goal: This one-day course is focused on the design, testing and construction of geosynthetics used in transportation and infrastructure facilities such as paved highways, unpaved roads, railroads, walls, steep slopes, embankments, filters, drains, and erosion control. The geosynthetics utilized are the following:

- geotextiles,
- geogrids,
- geonets,
- geomembranes,
- GCLs, and
- geocomposites.

Course #3 - January 13, 2005

Geosynthetics in Waste Containment Applications

Goal: This one-day course is focused on the proper design, testing, and construction of geosynthetics used in liner and cover systems for landfills, surface impoundments and waste piles. Included are the following geosynthetics:

- geomembranes,
- geotextiles,
- geonets,
- geogrids,
- geosynthetic clay liners,
- geocomposites, and
- geopipe.

Course #4 - January 14, 2005

Quality Control/Quality Assurance of Geosynthetics

Goal: This one-day course is focused on the quality control and quality assurance of geosynthetics as placed in permanent and/or critical applications. Specifications and testing are emphasized. It focuses on both the manufactured geosynthetics and on the installation processes. Applications are mainly in the waste containment area, i.e., landfills and surface impoundments, but applicability to walls, slopes, dams, canals, etc., will also be discussed. Included are the following geosynthetics:

- geomembranes,
- geosynthetic clay liners,
- geosynthetic drainage systems (geonets and geocomposites),
- vertical cutoff walls,
- ancillary materials & appurtenances.

All of these courses come with a complete set of notes, are fast-paced, extremely current, come with a great lunch, and are cheap! ($100 for GSI members; $200f or nonmembers)

Activities within GAI (Accreditation)

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

As of June 2004, 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. (96 tests)
Sam Allen -- (512) 263-2101

3[A] - Golder Associates (45 tests)
Henry Mock -- (770) 496-1893

4[C] - Geosynthetic Institute (106 tests)
George Koerner -- (610) 522-8440

5[A] - NTH Consultants, Ltd. (52 tests)
Debra Klinger -- (610) 524-2300

6[A] - GeoSystems Consultants (27)
Craig Calabria -- (215) 654-9600

7[B] - Synthetic Industries Inc., Chickamauga (10 tests)
Steve Thaxton -- (800) 258-3121

8[B] - Synthetic Industries Inc., Ringgold (11 tests)
Toni Ruppert -- (706) 965-6300

9[B] - Synthetic Industries, Inc., Alto (10 tests)
Melvin Wallace -- (770) 532-9756

11[A] - STS Consultants Ltd. (13 tests)
Bill Quinn -- (847) 279-2500

13[A] - Precision Laboratories (78 tests)
Ron Belanger -- (714) 520-9631

14[A] - Geotechnics (61 tests)
Rick Lacey -- (412) 823-7600

18[A] - EMCON/OWT (51 tests)
Rasheed Ahmed -- (845) 351-5100

19[A] - HTS Inc. (42 tests)
Larry McMichael -- (713) 692-8373

20[A] - GeoTesting Express, MA (32 tests)
Gary Torosian -- (978) 635-0424

22[B] - CETCO Arlington Heights (13 tests)
Jim Olsta -- (847) 392-5800

23[B] - CETCO Fairmount (8 tests)
Derek Reece -- (706) 337-5316

24[B] - CETCO Lovell (8 tests)
Noe Garcia (307) 548-6521

25[B] - TC Nicolon (10 tests)
Melissa Medlin -- (706) 693-2226
26[B] - Agru America Inc. (16 tests)
Grant Palmer -- (843) 546-0600
27[B] - Amoco Fabrics and Fibers Co. (14 tests)
Tom Baker -- (770) 944-4718
29[C] - FITI Testing & Research Institute (70 tests)
Moon-Hyun Jeong (011-82-2-960-8034)
31[D] - NYS Dept. of Transportation (9 tests)
Dave Suits -- (518) 457-4704
32[A] - Vector Engineering (6 tests)
Ken Criley (530) 272-2448
33[D] - Arizona DOT (5 tests)
Oscar Mousaui (602) 712-8200
34[B] - GSE Richey Road (16 tests)
Jane Allen (281) 230-6726
35[B] - GSE Hardy St. (12 tests)
Nathan Ivy (281) 230-6726
36[A] - H. C. Nutting (15 tests)
James Fleck (513) 321-5816
37[B] - SL Limitada (16 tests)
Mauricio Ossa 56-2 6010153
38[C] - Sageos/CTT Group (54 tests)
Eric Blond (450) 771-4608
40[B] - GSE Nonwovens Technology Inc. (14 tests)
Charles Miller (843) 382-4603
41[A] - SGI Testing Service, LLC (18 tests)
Robert Swan, Jr. (770) 931-8222
42[C] - NPUST (GSI-Taiwan) (31 tests)
Chiwan Wayne Hsieh 011-886-8-7740468
43[A] - Ardaman & Associates (18 tests)
George DeStafano (407) 855-3860
44[B] - BBA Reemay, Inc. (9 tests)
Mike Zenker (615) 847-7575
45[B] - Polyfelt Geosynthetics SDN Bhd. (23 tests)
C. P. Ng (603) 519 28568
46[B] - Bentofix Technologies (13 tests)
Pat Thiffault (705) 725-1938

[A]Third Party Independent [C]Institute
[B]Manufacturers QC [D]Government

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:

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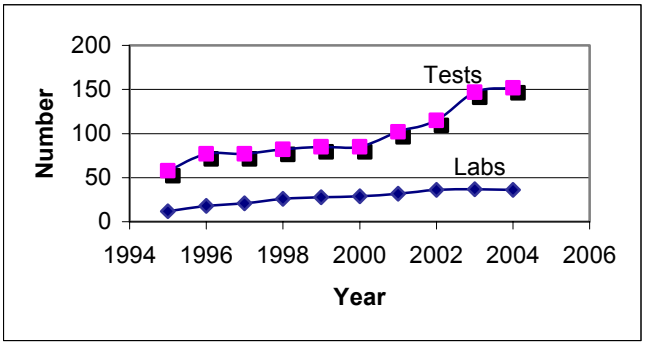
GAI-LAP Annual Meeting Notes
June 16, 2004 in Kansas City, MO

Agenda

1. Background
2. Demographics
3. Proficiency Tests
4. Conflict Resolutions
5. Open Discussion

1. The Background is self explaining and a brief introduction to GAI-LAP services was discussed.
2. The graph below illustrates the ten year trend for both number of tests and 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 showed a steady increase over the first eight years, with a leveling off on the number of labs participating over the past two years.

3. Proficiency testing is still the hallmark of the GAI-LAP. Of the 938 proficiency test results submitted this year, 44 first submittals were outliers (4.6% of total). Root cause for all outliers was identified. Results of the proficiency tests were shared at the meeting in hardcopy and e-mailed to those that could not attend. Problem proficiency tests were as follows;

   (a) ASTM D6693, "dog bone tensile", with strange (very low) break load and elongation values reported by some labs. This was a results of running the test at 20 rather than 2 in./min. All polyethylene, no matter what the density, should be run at 2 in./min. per the standard in Section 9.2.
   (b) We had a bimodal response for several test methods that are generally grouped as fingerprinting methods for polyethylene, namely, ASTM D792, D1505 and D1238. The sample which was provided to the labs was smooth edged textured geomembrane produced on a blown film line. This material is sometimes manufactured with two different resins. One for the core which is feed by the primary extruder, and two secondary extruders which supply material for the outer textured surfaces. The inconsistency arises when different portions of the geomembrane are sampled. Several labs provided results for the smooth edge only. This expedites specimen preparation, but does not yield composite results and is not recommended.

(c) ASTM D4632, “grab tensile behavior of geotextiles” exhibited a large inconsistency with strain. The problem is two-fold; it has to do with how the specimen is placed in the grips (loose or taught), and the grips used for the test. It is recommended that a 0.5 lb preload is placed on the specimen and that the labs try to balance grip slippage and grip failure concerns.

(d) Our most problematic test remains to be ASTM D5321 “direct shear”. Again we experienced double digit coefficients of variation with a relatively standard interface (NPNW geotextile against textured HDPE, wet, normal pressure = 5, 10 and 20 psi). The issues for this poor performance were problems with fixity/clamping, shear strength calibration within the box, and normal pressure validation at the interface. Recommendations for each were given at the meeting and also shared with the ASTM task group on direct shear.

4. The conflict resolution service was used three times within the past six months. The problems and resolutions are summarized below;

   (a) ASTM D3786, “Mullen burst”, with a large discrepancy among labs and their results. It was discovered that the low results were a result of air in the pressure gauge line that had not been bled prior to use. The high results were an artifact of not subtracting the tare from the total pressure as instructed by Section 12.1 of the standard.

   (b) ASTM D5995, “textured geomembrane core thickness”, continues to haunt us and is considered a poor test with too much operator freedom. As described in the standard in Section 9.3.
   “Lift the presser point and insert the test specimen. While allowing the presser point to come slowly into contact with the test specimen, adjust the test specimen to locate the gage points in the “low spots” or “valleys,” in between the projections, or into the indentations, of the textured surface(s) to obtain the local minimum thickness reading. Repeat the above so that a total of three measurement readings are obtained for each specimen. Record only the lowest vale of the three readings to the nearest 0.025 mm or 0.001 in. as the thickness for that specimen.”
   These instructions specifically state that the technician should not search endlessly for the absolute lowest reading. (It was curious that the third party lab identified the absolute lowest spot on all 30 specimens tested). Labs are instructed to follow the search procedure in the standard rigorously.

   (c) ASTM D5321 Direct Shear was cited again. A lab reported an unrealistically low friction angle as a result of the shear force load cell being out of calibration. It appears that the “S” type load cell was calibrated in isolation not attached to the box. Upon reconnecting to the box it was mounted horizontally and over tightened. Both actions negated the calibration factors and threw off the results. In box verification with a near frictionless interface and an interface of known strength, the error was highlighted so that it could be rectified. This mistake illustrates the importance of regular IRMs.

5. The open discussion portion of the meeting was highlighted by the following housekeeping items;

   (a) Next GAI-LAP annual meeting will be held in June 2005 in Reno, NV in conjunction with ASTM D-35.

   (b) GAI thanked Polyflex and TC Nicolon for contributing geomembrane and geotextile respectively to the GAI-LAP proficiency cause. We also solicited manufacturers for geosynthetic rolls for 2005 proficiency testing.

   (c) In closing it was announced that all future GAI-LAP proficiency results will have to be submitted in SI (metric) units. This action was taken so that we can remain compliant with ISO 17025.

   (d) Thanks for working with us in this regard!

George Koerner, Ph.D., PE, CQA
Associate Director - GSI

Activities within GCI (Certification)

We have an ongoing product certification program for all geosynthetics which have a generic specification. The program has as its target, conformance to a specific GRI specification such as GRI-GM13 for HDPE geomembranes. This specification has been in use for approximately 4 years with generally good reviews and considerable exposure. The specification is seen referenced in many project plans, specifications and quality assurance documents around the world.

The GCI certification program using this specification is based on ISO 9000 audits conducted on a 6-month cycle wherein the manufacturer's quality control plan and statistical data base are evaluated, along with sampling of the product. Upon testing by an accredited laboratory, the results are assessed and certification is granted, postponed or rejected. Certification carries with it the right to identify products as "GRI- Certified"; in this case “GRI-GM13 Certified”.

We are delighted to report that SL Limitada of Chile is approved to mark its HDPE geomembrane.

GRI-GM13 Certified

Our sincere congratulations go to the following people who are the principals involved:

Enrique Saavedra - General Manager
Mauricio Ossa - Technical Manager
Michael Mathieson - N.A. Representative
(WASEW Technologies Inc.)

Items of Interest

1. CAFOs and Legislation

The National Pollutant Discharge Elimination System (NPDES) and permit regulations for large Confined Animal Feeding Operations (CAFOs) was issued by the U.S. EPA as a final ruling and became effective in April 2003. This federally mandated ruling will ensure that CAFOs take action in managing animal waste, which includes the lining of waste lagoons. The U.S. EPA estimates that the new regulations will affect 15,500 of the largest live-stock operations. This means that all CAFO waste lagoons and evaporation ponds must be lined and many must be covered for odor control. Many small farm operations will also be affected.
(GFR, March 2004)

2. World to Add 2.6 Billion People by 2050

It took from the beginning of time until 1950 to put the first 2.5 billion people on the planet. Yet in the next 50 years, an increase that exceeds the total population of the world in 1950 will occur, according to public health scientist Dr. Joel Cohen, professor and head of the Laboratory of Population at The Rockefeller University and Columbia University.
In a Viewpoint article in the November 14 issue of the journal "Science" Cohen says by the year 2050, the Earth's present population of 6.3 billion is estimated to grow by 2.6 billion.
(RT Review, February, 2004)

3. EPA to Study 15 Hazards in Sludge

EPA has identified 15 pollutants in sewage sludge for possible regulation, as part of the agency's efforts to address public concerns over the use of sewage sludge as fertilizer.
A notice in the December 31, 2003 Federal Register said these pollutants will undergo a more redefined risk assessment and risk characterization, which may lead to a notice of proposed rulemaking under the Clean Water Act. According to the agency, the 15 chemicals are already considered hazardous enough to be a potential threat to human health and wild life.
(Water & Wastewater Products - 1/9/04)

4. European Industrial Textile Projections (Note, the "geosynthetics" segment)

Segment	Main end-uses	Market Size (billion euros)	Annual Growth Rate (2003-2012)
Agriculture	Woven and nonwoven crop cover, land netting, baler twine	1.2	0% perhaps negative
Construction	Tarpaulins, textile structures, roofing fabrics, concrete reinforcement, composites	1.7	3 to 4%
Geosynthetics	Geotextiles for stabilization, reinforcement, erosion	0.5	>5%
Filtration/ Industrial	Filtration for air, dust and liquid, abrasives, wipes, electrical composites, coated fabrics	2.6	>4%
Medical	Wipes, cotton wool, wound care, sterile packaging, medical mattresses	2.2	3 to 4%
Transportation	All textiles used in cars and trucks, transport and marine composites	3.7	2 to 3%
Cargo Control	Sacks and bags, miscellaneous packaging, netting and strapping	0.9	>3%
Safety and Protective	Protective fabrics against heat, fire, foul weather, chemicals; military uses	1.7	3%
Sporting Goods	Substrates for leather goods, equipment composites, marine and air-sport fabrics, tents and covers	0.3	>3%
Others	Only textiles with specific technical end-use	2.2	<2%

(Industrial Fabric Products Review February 2004)

Call-for-(in Progress) Papers for GRI-18 at Geo-Frontiers

Note to all GSI Members: This item is repeated from the March Newsletter/Report since so few of you responded the first time??? Is anyone out there doing R & D??? We think this is an excellent opportunity to air-out some ideas and get valuable feedback. Please read the following and respond to us.

After seventeen annual stand-alone conferences we are breaking with tradition by incorporating GRI-18 into the upcoming Geo-Frontiers Conference in Austin, Texas. Geo-Frontiers is a joint Geo-Institute/ Geosynthetic Materials Association (G-I/GMA) activity set for January 24-26, 2005. Our activity in this regard is to embed GRI-18 into the last day of the main conference, i.e., on Wednesday, January 26, 2005. We plan for something quite new and admittedly bold; let us explain…

The main conference is currently soliciting customary complete papers from the geotechnical and related communities, including those on geosynthetics. For work that is at a completion stage, please proceed accordingly and submit an abstract to the conference

technical committee. What GRI-18 hopes to accomplish is to provide a platform for geosynthetics R & D that is "in-progress". Thus, geosynthetics work that is anywhere from 15% to 85% complete is hereby solicited. We would like to daylight these ongoing efforts via short papers of 2-to-6 pages in length. There will be two separate tracks:

1. Geosynthetics in Transportation and Geotechnical Engineering (morning)
2. Geosynthetics in Geoenvironmental and Hydraulics Engineering (afternoon)

We anticipate at least 50 papers in each of these above categories. (As of the writing we only have 40 titles… 15 of which are GSI). They will be reviewed by the GSI-team and published in the conference proceedings. Approximately 15 in each group will be selected for short oral presentations. We also will assemble two panels of experts to tell us, "Where are the Unfulfilled Voids in Geosynthetics R & D?" Thus, the structure of what we will provide for GRI-18 is as follows:

R & D "In Progress" Morning Session:
January 26, 2005
Geosynthetics in Transportation & Geotechnical Engineering
(Dr. George Koerner - Moderator)
(a) fifteen 7-minute presentations
(b) 60-minute panel discussion on "Future Needs"

R & D "In Progress" Afternoon Session:
January 26, 2005
Geosynthetics in Geoenvironmental & Hydraulics Engineering
(Dr. Robert Koerner - Moderator)
(a) fifteen 7-minute presentations
(b) 60-minute panel discussion on "Future Needs"

We plan to tape-record the "panel sessions" and provide the results on several Web Sites, including G-I's, GMA's, GSI's, NAGS' and others. This latter effort should set-the-tone for future R & D in geosynthetics. We think it will be extremely valuable as the road-map for future activities for academics, manufacturers and practitioners alike.

If this "in-progress" activity interests you please e-mail us at <mashley@dca.net> and we will supply you with required information on writing format and style. Please send titles (as many as you like) no later than July 31, 2004. We will select the papers for oral presentations after viewing the entire set of submittals with the goal of giving the audience an accurate picture of "in-progress" geosynthetics research and development.

We ask everyone involved in geosynthetics, whatever your position or association, to participate in this activity. Thank you in advance and if you have questions or comments let us hear from you… the GRI-18 activity promises to be a unique and extremely worthwhile experience.

George R. Koerner - Assoc. Director - GSI
Y. (Grace) Hsuan - Assoc. Professor - Drexel
Robert M. Koerner - Director & Professor

Upcoming Events

- July 27-31, 2004 – Geo-Trans 2004, UCLA Campus, Los Angeles, CA
  Contact: Geo-Institute of ASCE (703) 295-6350, fax (703) 295-6351.
- September 5-8, 2004 - Use of Geosynthetics in Soil Reinforcement and Dynamics, Dresden, Germany
  Contact: Professor Herbert Klapperich at <klapperi@ifgt.tu-freiberg.de>
- September 13, 2004 - Koerner Research Symposium at Drexel University, Philadelphia, PA
  Contact: <gkoener@dca.net>
  <www.drexel.edu/coe/conferences/Koerner/>
- One Day Courses at GSI:
  January 6, 2005 - GSs in Transportation
  January 7, 2005 - Walls and Slopes
  January 13, 2005 - GSs in Waste Containment
  January 14, 2005 - QA/QC in Waste Containment
- January 24-26, 2005 – GeoInstitute's GeoFrontiers '05 Conference in Austin, Texas
  Contact:
  <www.asce.org/confernces/geofrontiers05>
- January 26, 2005 - GRI 18 Conference at GeoFrontiers in Austin, Texas.
  Contact: <mashley@dca.net>

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 *STS Consultants* (Mark Sieracke), *GSE Europe* (Stefan Baldauf/Mike Everest), *Precision Geosynthetics Laboratory* (Ron Belanger), *Geotechnics Inc.* (Rich Lacey), *InterGeo Geosynehtics* (Archie Filshill) and Raven Industries (Gary Kolbasuk). We welcome each of them to our growing family of geosynthetic-interested organizations.

GSE Lining Technology, Inc.
Boyd Ramsey [BoD]
Earth Tech Consultants, Inc.
Kevin McKeon/Ken Bergschultz
U.S. Environmental Protection Agency
David A. Carson
Polyfelt, GmbH
Gernot Mannsbart/Philippe Delmas

E. I. DuPont de Nemours & Co., Inc.
John L. Guglielmetti/David W. Timmons
Federal Highway Administration
Albert F. DiMillio/Jerry A. DiMaggio
Golder Associates Inc.
Daniel E. Ponder/Mark E. Case
Tensar Earth Technology, Inc.
Donald G. Bright/Steve Valero
Poly-Flex, Inc.
James Nobert/George Yazdani
Colbond Geosynthetics
Wim Voskamp/Joseph Luna/Dennis Wedding
NOVA Chemicals Ltd.
Judy Webb-Barrett
Tenax, S.p.A.
Aigen Zhao/Caesar Baretta
Basell USA, Inc.
Robert G. Butala
TC Nicolon USA
John Henderson/Chris Lawson
CETCO
James T. Olsta [BoD]
Huesker, Inc.
Thomas G. Collins/Dimiter Alexiew/Steven Lothspeich
BP Solvay Polyethylene N.A.
J. (Mike) Killough/Wayne Dickson
Naue Fasertechnik GmbH
Georg Heerten/Kent von Maubeuge [BoD]
SI Geosolutions, Inc.
Deron N. Austin
STS Consultants
Mark Sieracke
BBA Nonwovens
William M. Hawkins/William Walmsley
NTH Consultants, Ltd.
Jerome C. Neyer/Robert Sabanas
TRI/Environmental Inc.
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U. S. Army Corps of Engineers
David L. Jaros [BoD]
Chevron Phillips Co.
Rex L. Bobsein [BoD]
Haley & Aldrich Consultants
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URS Corp.
Pedro C. Repetto/John C. Volk
S. D. Enterprise Co., Ltd.
Bill Collier/Nick Tsui
Solmax Géosynthétiques
Robert Denis
Envirosource Technologies, Inc.
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CARPI, Inc.
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Civil & Environmental Consultants, Inc.
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GSE Europe
Stefan Baldauf/Mike Everest
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Ronald Belanger
Geotechnics, Inc.
Rich Lacey
InterGeo Geosynthetics
Archie Filshill
Raven Industries, Inc.
Gary M. Kolbasuk

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Rob Marshall

In The Next Issue

- Activities of the GSI Board and Directors
- Overview of GRI (Research) Projects
- Activities within GII (Information)
- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- Items of Interest
- Driving Equipment on Geomembranes
- Upcoming Events
- GSI's Member Organizations