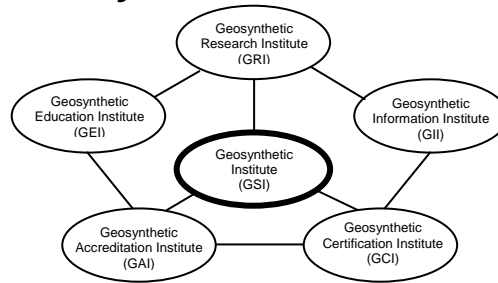


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 19, No. 3

September 2005

This quarterly newsletter, now in its 19th 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 GSI Board of Directors & Institute Directors

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".

1. GSI's Continuous Improvement Survey has been sent to all members. We ask that you fill it out and return to George Koerner. It is important that we have feedback from everyone in order to best chart our way forward. If by chance you did not receive the survey, contact Marilyn Ashley at [<mvashley@verizon.net>](mailto:mvashley@verizon.net) or George Koerner at [<gkoerner@dca.net>](mailto:gkoerner@dca.net). Thank you!
 2. Each of the GRI Specifications are now listed on the GSI Web site [<<geosynthetic-institute.org>>](http://www.geosynthetic-institute.org) in two different formats. One is the actual specification which can always be downloaded in total. The other is an accompanying power point presentation illustrating the test devices along with brief commentary... Please have a look!
 3. During a recent teleconference call of the GSI Board of Directors a possible GSI-CQA Certification Program was discussed. The following were presented and temporarily agreed upon.
 - A two-to-three hour multiple choice test would be given on geosynthetics only, i.e., not soils. It would be one level, pass-or-fail, after applicant submits application form and CQA work experience.
 - The test is to be shared with ad-hoc GSI committee for review and modification before any activity begins.
 - The test is to be given at GSI twice per year; also after QC/QA courses are given by and at credible companies offering such services. In such cases, the individual companies would be the exam proctors.
- Applicants would pay an initial fee (for registration acceptance and taking of the examination). Thereafter, there would be a lower annual maintenance fee.
 - Every fifth year a revised and updated exam would have to be taken for continued certification.
 - A more complete proposal will be sent to the GSI-BoD in a few weeks for continued discussion and formation of the ad-hoc review committee.
 - The entire program will be presented to the membership at the upcoming Annual Meeting in Las Vegas on December 14, 2005.

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4. We are already thinking of our GRI-20 Conference even though GRI-19 is yet to be held. In this regard our thoughts go toward the "use of geosynthetics in combating, or minimizing, terrorism". A call for titles/abstracts has just been announced and we certainly hope that GSI members will be active participants. Our plan is to collect titles and/or abstracts and have a mid-winter workshop at GSI. With this information as background we can plan on the conference itself, to be held in the winter of 2007. Please send your ideas as soon as possible to Marilyn at [<mvashley@verizon.net>](mailto:mvashley@verizon.net).
5. GSI Board of Directors elections will begin in mid-October. Those members whose term ends in 2005 are under consideration.

Term Ends 2005

Dick Stulgis - GeoTesting Express (Consultants and Testing Laboratories)

Jim Olsta - CETCO (Geomembranes and GCLs)

Dave Suits - NY State DOT (At-Large)

Term Ends 2006

Tony Eith - Waste Management Inc. (Owners and Operators)

Boyd Ramsey (Chairman) - GSE Lining

Technology, Inc. (Geotextiles and Geogrids)

Sam Allen - TRI/Environmental, Inc. (At-Large)

Term Ends 2007

David Jaros - Corps of Engineers (Government Agencies)

Rex Bobsein - Chevron/Phillips Co. (Resin Producers)

Kent von Maubeuge - Naue Fasertechnik GmbH (International)

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 short "in-progress" papers.** Grace can be reached by phone at (610) 522-8440 or e-mail at [<grace.hsuan@coe.drexel.edu>](mailto: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 and duct pipe. 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*** - This project is based on our previous 8-year long study on the lifetime prediction of 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/m² needle punched nonwoven PP geotextile
 - (c) 140 g/m² woven slit film PP geotextile
 - (d) 90 kN/m woven multifilament PP geotextile
 - (e) 175 kN/m woven multifilament PP geotextile

Temperatures have been maintained at 85, 75, 65 and 55°C and the samples are being removed presently for subsequent testing. Grace Hsuan and George Koerner are in charge of the project. White Paper #6 on this topic will be available shortly.

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 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 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 60± thermocouples for long term measurements in both a wet and dry municipal solid waste landfill in Pennsylvania. Presently data for 10-years is available. This is clearly the longest in-situ measurement project in all of geosynthetics.
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 activity will now extend to an adjacent landfill to see how reproducible the data is.

7. 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 has commenced 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/m² protection geotextiles on 1.5 mm thick HDPE geomembranes is being evaluated; the time is currently 8-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. 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.

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.

10. UV Exposure of Geomembranes* - GSI is using its new Xenon Arc device along with its two existing UV-fluorescent devices to evaluate the simulated outdoor lifetime of nine different types of geomembranes; HDPE, LLDPE, 3 fPPs, 2 PVCs, 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. White Paper #6 will update our efforts in this regard.

11. 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 geogrids, needle punched nonwoven PP geotextiles, and woven slit film PP geotextiles. 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.

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, with the fPP spec being revised using weatherometer testing as opposed to OIT testing for the endurance criteria.

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
GCL3 – Geosynthetic Clay Liners

Working Within Focus Groups

GMXX – Exposed Temporary Covers
GCXX – TRMs for Erosion Control
GNXX – Geonet Drainage Composites

Delayed or Off in the Distance

GGXX – Biaxial Geogrids
GGXX – Uniaxial Geogrids
GCXX – Drainage Geocomposites

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 a separate power point CD which shows 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 Web Site.

13. **Technical Guidance Document on QC/QA of Waste Containment Facilities** - Drs. Dave Daniel and Bob Koerner have completed the Second Edition of this Technical Guidance Document by greatly updating the original 1993 EPA report. Its publication will be through the ASCE Press and will be available this Winter. If members want a preliminary copy on CD (≈ 390 pages) contact us accordingly.

14. **Various Power Point Presentations** - To date we have distributed about 500 copies of three different CDs;

- Introduction to Geosynthetics
- Selected Lectures I (SRWs, LF Expansions, and Dam Waterproofing)
- Selected Lectures II (Bioreactor LFs, GCL Test Plots, and Erosion Control)

Every screen has a short voice-over and each lecture can be presented in about 50-minutes. They are ideal for classroom use or for "brown-bag" seminars, and the like. Ask if you want copies; no charge.

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 geosynthetics knowledgeable people 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 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 Specs, Guides, White Papers
- 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 mvashley@verizon.net. 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 keywords section contains about 7500 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 site.

Progress within GEI (Education)

The following four (each 1-day long) courses will be offered at GSI in January, 2006. They are good and they are also inexpensive!

Course #1 - January 19, 2006

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 #2 - January 20, 2006

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. Dov Leschinsky of the University of Delaware, and
- design of wall and slope drainage systems

Course #3 - January 26, 2006

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 27, 2006

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; \$200 for nonmembers). In addition, continuing education credits are given for each course!

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. These additions are twofold; ISO methods, and plastic pipe related methods. There are currently 157 GAI-LAP methods available for accreditation. Please consult our home page for a current listing.

As of June 2005, 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. (117 tests)
Sam Allen -- (512) 263-2101
- 3^A - Golder Associates (43 tests)
Henry Mock -- (770) 496-8280
- 4^C - Geosynthetic Institute (121 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
- 8^B - Synthetic Industries Inc., Ringgold (19 tests)
Toni Ruppert -- (800) 258-3121
- 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, CA (95 tests)
Ron Belanger -- (714) 520-9631
- 14^A - Geotechnics (61 tests)
Rick Lacey -- (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 (13 tests)
Jim Olsta -- (847) 392-5800
- 23^B - CETCO Fairmount (10 tests)
Derek Reece -- (706) 337-5316
- 24^B - CETCO Lovell (10 tests)
Roger Wilkerson -- (307) 548-6521
- 25^B - TC Nicolon (10 tests)
Beth Wilbanks -- (706) 693-2226
- 26^B - Agru America Inc. (17 tests)
Grant Palmer -- (843) 546-0600
- 27^B - Amoco Fabrics and Fibers Co. (14 tests)
Barbara Barr-Howell -- (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)
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 - SL Limitada (16 tests)
Mauricio Ossa -- 56-2 6010153
- 38^C - Sageos/CTT Group (76 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)
Robert Swan, Jr. -- (770) 931-8222
- 42^C - NPUST (GSI-Taiwan) (38 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 - Polyfelt Geosynthetics SDN Bhd. (23 tests)
C. P. Ng -- (603) 519 28568
- 46^B - Bentofix Technologies (13 tests)
Pat Thiffault -- (705) 725-1938
- 47^A - Precision Laboratories, TX (13 tests)
Ron Belanger -- (866) 522-0843
- 48^B - Tenax Corporation (9 tests)
Tim Bauters -- (410) 522-7000
- 49^B - Engepol Geossinteticos (20 Tests)
George Nastas -- (55) 11-4166 3001
- 50^B - Advanced Drainage Systems, Inc. (7 tests)
Terry McElfresh -- (513) 896-2065
- 51^B - Solmax International Inc. (14 tests)
Guy Elie -- (450) 929-1234

^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

With so much activity in the GAI-LAP program, many are asking, what is the procedure to add tests to an existing repertoire?

The following should be submitted to GAI-LAP for review and comment:

1. Standard operating procedure (SOP)
2. Laboratory reports for each test identifying the respective ASTM or ISO standard requirements in addition to the report requirement of ISO 17025.
3. Copy of the correct revision of the standard test method.
4. Updated Document Control Checklist showing new entries.
5. Equipment inventory showing new or existing equipment covering the new method(s).

6. An internal reference material (IRM) file for the new test. Such an IRM usually identifies the method, description, IRM reference material or gauge standard, units, average upper control limit, lower control limit, and frequency for each GAI-LAP accredited test.

After comment on the documentation, proficiency samples will be sent to the laboratory for testing. If the results are within two standard deviations of the data base mean, the laboratory will be granted accreditation for the additional test method(s). A maximum of seven tests a year can be added annually without an on-site audit.

These are exciting times for the GAI-LAP and we look forward to your continued participation. 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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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 continues to be approved and can mark its HDPE geomembrane.

GRI-GM13 Certified

Our sincere congratulations go to the following who is the principal involved:

Mauricio Ossa - Technical Manager

The GSI Affiliate 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:
 - (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 and a paper is available. The second topic will be presented at GRI-19 in December, 2005.
 - (b) 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, is performing the requisite research. A paper will be presented at GRI-19 in the Student Paper Session.
 - (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... 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 Xenon Arc and UV fluorescent devices.
3. In both CPRoS 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.

Items of Interest

1. Growing Market for Smart Textiles

A new study from Businessinfo.ws puts the U.S. market for smart and interactive textiles at some \$64.4 million in 2004 and anticipates an AAGR (average annual growth rate) of 36 percent to \$299.3 million in 2009.

To date, the U.S. military has been the leader in developing Smart of Interactive Textiles (SMIT) technologies and applications for such areas as body armor, artificial muscles, biochemical hazard protection, physiological status monitoring, location, and embedded communications and computing. Many of these same technologies also have potential civilian and commercial applications.

For more about the report's conclusion, visit www.businessinfo.ws/archive/BIAABYZR.htm, (from *Ind. Fabric Products Review*, Aug., 2005)

2. Our Nation's Highway

In light of the New Orleans tragedy are disasters involving highways and bridges next? The abstract of a 1996 paper by Jerry DiMaggio and Molly Cribbs follows. It is as current, perhaps moreso, than when we published it 10-years ago.

"The highway system of the United States is vital the Nation's economy. Economic, time and environmental restrictions and constraints continuously make the highway professional's job more difficult in delivering a safe, long lasting and cost effective highway network to its users. The implementation of new and emerging technologies enable highway engineers and managers to keep pace with this very complex and enormous system. Geosynthetics, have been consistently demonstrated to be cost effective tools to assist in the design, construction, rehabilitation and maintenance of all forms of roads and highways. In spite of this huge success many individuals question why the impact of this proven technology hasn't been more widespread. This paper addresses this important question by examining the current trends in the highway system, the complex maze of main streaming technology within the highway community, and lastly identifies some fatal flaws which must be remedied in order to optimize the acceptance of this proven technology."

(from *GRI-19 Conference, Philadelphia, Pennsylvania, 1996*)

3. 2004 Fiber Production Smashes Records

World fiber production reached an unparalleled level in 2004—nearly 74 million tons—according to Saurer Management AG, Winterhur, Switzerland. This figure equates to a global 6.7 percent increase compared to 2003. Put another way, more than 2.3 tons of fiber was processed into yarns and nonwovens every second. Nearly all fiber types and end uses contributed to the record production, Saurer says. Manmade fibers witnessed a 7.7 percent increase to around 41 million tons, occupying 56 percent of the global fiber market. Cotton, wool and silk have increased by 6.5 percent to 26.5 million tons. The company found that the manmade fiber segment shows no decline in production for any polymer. For example, polypropylene fiber production increased by 2.7 percent to 3.4 million tons. Despite rising usage of staple fibers in nonwovens, growth has solely come

from the yarn segment, which rose by 4.8 percent to 2.1 million tons. For more detailed analysis of world fiber market and final production figures, look for the publication "The Fiber Year 2004," which will be published in May.

(from *Ind. Fabric Products Review*, March, 2005)

4. Vapor Barriers; A Growing Market

The draft document, *Guidance for Evaluating Vapor Intrusion to the Indoor Air Pathway From Groundwater and Soils*, explains the steps regulators should take to determine if there is a vapor intrusion pathway and whether the intrusion represents an unacceptable risk to public health. (Superfund Report, 12/9/02. P14).

The guidance is supposed to be used at Superfund, Brownfields and Resource Conservation & Recovery Act (RCRA) sites and is part of EPA's effort to implement a measure for RCRA correction actions. EPA uses such measures, known as environmental indicators (EI), as a way to determine when a cleanup has cleared a site of the most threatening contamination. For vapor intrusion, the Agency is required to have current human exposures under control at 95 percent of RCRA sites by 2005.

(from *RT Review*, May, 2003)

Preview of the GRI-19 (and NAGS '05) Conference

GRI-19 will be held in Las Vegas, Nevada on December 14-16, 2005 at the Flamingo Hotel Conference Center. We will team with the North American Geosynthetic Society (NAGS), with GSI handling the three morning sessions and NAGS handling the three afternoon sessions. The three GSI sessions are as follows:

Wednesday 12/14/05 Morning Session ***"Use of Low Permeability Backfill Soils in Geosynthetic Reinforced Walls and Slopes"***

- 1.1 Barry Christopher; Consultant: State-of-the-Practice in North America
- 1.2 Chris Lawson of TC Nicolon: State-of-the-Practice Internationally
- 1.3 Dick Stulgis of H & A: NCHRP Test Walls and Performance-to-Date
- 1.4 George Koerner/Bob Koerner of GRI/Drexel: Back Drainage Design and Geocomposite Drainage Materials

- 1.5 Dean Sandri of Soil Retention Systems: Best Practices Involving Low Permeability Backfilling

Thursday 12/15/05 Morning Session ***"Use and Design of Geosynthetics in Heap Leach Systems"***

- 2.1 John Lupo of Golder Assoc.: Design of Heap Leach Pad Geomembranes
- 2.2 Rick Thiel/Mark Smith of Vector Engineering: Design of Heap Leach Pad Drainage Systems
- 2.3 Alan Brietenbach/Rick Thiel of Vector Assoc.: "A Tale of Two Conditions: Landfill versus Heap Leach Pad Liner Strengths"
- 2.4 Pedro Repetto of URS Inc.: Seismic Design of Heap Leach Pads
- 2.5 Mauricio Ossa of SL Chile, Ltda.: Geomembrane Manufacturing Considerations With Regard to Heap Leach Pad and Reservoir Systems

Friday 12/16/05 Morning Session ***"Continued Hot Topics in Geosynthetics"***

- 3.1 Han-Yong Jeon of Inha University: Activities of GSI-Korea
- 3.2 Chiwan Wayne Hsieh of National Pingtung University: Long-Term Plastic Pipe Stiffness
- 3.3 Jorge Zornberg of University of Texas at Austin: Advances on the Use of Geosynthetics in Hydraulic Systems
- 3.4 Mark Sieracke of STS Consultants: "Geosynthetic Manufacturing Concerns from a Consultant's Perspective"
- 3.5 Te-Yang Soong of CTI: "Pressurized Liquid Distribution for Landfill Liquids Addition and Augmentation"
- 3.6 Sam Allen of TRI: "Various Methods to Assess Geosynthetic Installation Damage"
- 3.7 Bob Denis of Solmax: Geosynthetic Questions and Answers of Pressing Interest to Everyone

In the first two sessions we will ask all speakers to present one after another, followed by a break and then form a panel of themselves to answer Q & A's from the audience. The third session will be presentations only with a few Q & A's after each speaker.

All presentations will be accompanied by a written (and reviewed) paper which will be included in the Conference CD, along with all of the NAGS papers.

Arrangements for the conference (registration and hotel rooms) are being handled by NAGS. See their Web Site at <<www.nagsigs.org/conferences.html>>. A registration brochure has been mailed to interested persons as well as information appearing in many magazines and Web Sites.

GSI Focus Group Meetings will be on Tuesday afternoon, December 13, 2005. They are as follows:

- (i) Geomembrane Mfgs./Resin Producers
December 13, 2005 @ 1:30 to 3:00 PM
- (ii) Consultants and Testing Laboratories
December 13, 2005 @ 3:00 to 4:30 PM
- (iii) Geotextile and Geogrid Mfgs.
December 13, 2005 @ 4:30 to 6:00 PM

Also to be noted is that the GSI Annual Meeting will be held on the evening of December 14, 2005 and the joint conference banquet will be held on the evening of December 15, 2005.

Upcoming Events

- November 30 - December 2, 2005 - CEDEX
Symposium on Construction with Impermeable Barriers
Seville, Spain
Contact: <fgarcia@cedex.es>
- December 14-16, 2005 - NAGS '05/GRI-19
Combined Conference in Las Vegas, NV
Contact: <janeharris@nagsigs.com>
- One Day Courses at GSI
January 19, 2006 - GSs in Transportation
January 20, 2006 - Walls and Slopes
January 26, 2006 - GSs in Waste Containment
January 27, 2006 - QA/QC in Waste Containment
Contact: <mvashley@verizon.net>
- February 2-3, 2006
ASTM D35 Committee
(location to be decided)
Contact: <csierk@astm.org>
- April 4-5, 2006
Conference on Geosynthetic Durability
Würtzberry, Germany
Contact: <hzaninger@skz.de>
- Sept. 8-22, 2006 8th
8th Intl. Conf. on Geosynthetics
Yokohama, Japan
Contact: <www.8icg-yokohama.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 CTI and Assoc., Inc., with Drs. Te-Yang Soong and P. D. Deo as our contact members, Advanced Earth Sciences Inc. with Mr. Kris Khilnani as our contact member, the Florida Department of Transportation with Mr. Rod Powers as the contact member, and Polytex, Inc. of Chile with Mr. Jaime Morales as the contact member... thanks to all and welcome!

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

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Tensor 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. OIsta [BoD]

Huesker, Inc.

Thomas G. Collins/Dimitter Alexiew/Steven Lothspeich

Innovene

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Naue GmbH & Co.

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SI Geosolutions, Inc.

Deron N. Austin

STS Consultants

Mark Sieracke

BBA Nonwovens

William M. Hawkins/William Walmsley

NTH Consultants, Ltd.

Jerome C. Neyser/Robert Sabanas

TRI/Environmental Inc.
Sam R. Allen [BoD]

U. S. Army Corps of Engineers
David L. Jaros [BoD]

Chevron Phillips Co.
Rex L. Bobsein [BoD]

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John DiGenova/Dave Schoenwolf

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John C. Volk/Robert B. Wallace

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Robert Denis

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Douglas E. Roberts

CARPI, Inc.
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Jay Roberts

Civil & Environmental Consultants, Inc.
Richard J. Kenter

Agru America, Inc.
Paul W. Barker/Peter Riegl

Firestone Building Products Inc.
H. Joseph Kalbas/John Heathcote

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*Anthony W. Eith [BOD]/Greg Cekander/
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Stefan Baldauf/Mike Everest

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Archie Filshill

Raven Industries, Inc.
Gary M. Kolbasuk

CTI and Associates, Inc.
Te-Yang Soong/P.D. Deo

Advanced Earth Sciences, Inc.
Kris Khilnani/Suji Somasundaram

Polytex, Inc.
Jaime Morales

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V. Wesley Sherman

Environmental Agency of U. K.
Rob Marshall

Florida Dept. of Transportation
Rodney G. Powers

IN THE NEXT ISSUE

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- Activities within GAI (Accreditation)
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- The GSI Affiliate Institutes
- The GSI Center-of-Excellence
- Items of Interest
- Postscript of the GRI-19 Conference in Las Vegas
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