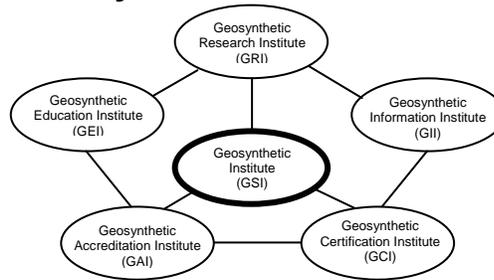


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 20, No. 1

March 2006

This quarterly newsletter, now in its 20th 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. Boyd Ramsey of GSE was voted by the Board of Directors to be its Chairman for another year. Congratulations and thanks go to Boyd in this regard.
2. The Board of Directors have been active in providing guidance for the newly launched CQA Inspectors Certification Program. It will be explained later in this Newsletter/Report.
3. For the past 7 or 8 years, GSI has been performing product usage surveys for geomembranes and geonet/geocomposites. It was decided to stop this activity due to a number of reasons (difficulty in getting complete data, import/export identification problems and not in our mission statement) and leave such activity to a manufacturing organization such as the Geosynthetic Materials Association.
4. The above stated, GSI is definitely in the survey business. Jamie Koerner (George's wife) is nearing completion of a survey of state DOTs insofar as their use of the AASHTO M288 Geotextile Specification. (She has about 40 states to date). The landfill liner and cover update survey is next on her agenda.
5. The present Board of Directors is as follows. Don't hesitate to contact them on GSI matters or matters within a particular focus group.

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.

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)

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)

IN THIS ISSUE

- Activities of the GSI Directors and Board
- Overview of GRI Projects (Research)
- Activities within GII (Information)
- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- Items of Interest
- Initial Feedback on CQA-Inspectors 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 short "in-progress" 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*** - 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 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*** - This project is based on our previous study on the lifetime prediction of HDPE geomembranes which is essentially complete. We are now focusing on 1.5 mm thick LLDPE 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. Temperatures are being maintained at 85, 75, 65 and 55°C and the samples are being removed regularly for subsequent testing. White Paper #6 on HDPE is available.
- 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 measuring 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 9-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 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 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, 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.

11. 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

*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

- GMXX – Exposed Temporary Covers
- GCXX – TRMs for Erosion Control

Delayed or Off in the Distance

- GNXX – Geonet Drainage Composites
- GGXX – Bidirectional Geogrids
- GGXX – Unidirectional 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.

12. 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 summer. If members want a preliminary copy on CD (≈ 390 pages) contact us accordingly.

13. 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 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 | • Laboratory Accreditation |
| • Prospectus | • Product Certification |
| • Associate Membership (Agencies) | • Newsletter/Reports |
| • Members by Focus Groups | • Internet Courses |
| • GSI Publications | • Geosynthetics Links |
| • GRI Specs, Guides, White Papers | • GSI Member Meetings |
| • CPReS | • Courses at GSI |
| • CPHyS | • CQA Insp. Cert. |

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 | • Links to the GSs World |
| • GRI Reports (Summaries) | • Keyword Search for Literature |
| • GRI Technical Papers (Citations) | • Example Problems |
| • Notes of GSI Meetings | • Frequently Asked Questions (FAQs) |

The keywords section contains about 15,000 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)

The following 1-day long courses will be offered in the near future.

Course #1

Thursday, April 26, 2006 @ GSI Folsom, PA

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.

The course comes with a set of notes and is extremely insightful as far as current design is concerned.

Course #2 (given in 3-locations)

Monday April 3, 2006 @ ESD in Landing, MI

Friday, April 27, 2006 @ GSI in Folsom, PA

Tuesday, May 2, 2006 @ AES in Irvine, CA

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 set of notes, are fast-paced, extremely current, and are very interactive with the participants.

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 160 GAI-LAP methods available for accreditation. Please consult our home page for a current listing.

As of March 2006, 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 - Propex (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)
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 - 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 Geosinteticos (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
- 52^A - Geosyntec (1 test)
James Fleck -- (513) 266-6949
- 53^B - Polytex (13 tests)
Cristian Valdebenito -- 011 56 57 42 90 00
- 54^B - Hancor (9 tests)
David Gonso -- (419) 424-8377

^AThird Party Independent ^CInstitute
^BManufacturers QC ^DGovernment

NOTE

The 2006 annual GAI-LAP meeting will be held in Toronto Canada in conjunction with ASTM D35 this June. Date and time will be available shortly.

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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475 Kedron Avenue
Folsom, PA 19033-1208
Telephone: (610) 522-8440
Fax: (610) 522-8441
E-mail: gkoerner@dca.net

Activities within GCI

(a) Inspectors Certification Program

This new venture for GCI was initiated in January, 2006 and presently consists of a certification program for Construction Quality Assurance field inspectors for installation of geosynthetic materials and for compacted clay liners. It is focused on landfill liner and cover systems, as well as surface impoundments, waste piles, and related geoenvironmental applications.

The requirements are as follows:

1. Candidate must be recommended by a Professional Engineer who knows and can attest

- to at least six months (or equivalent) of acceptable field experience performing CQA activities with geosynthetic materials and/or compacted clay liners.
2. Pay a one-time \$400 fee for either geosynthetic materials or compacted clay liners, or \$500 for both material systems each of which covers a 5-year period upon successful completion of an examination.
 3. Successfully pass a written examination proctored by GCI or a GCI designated individual and subsequently graded by the Geosynthetic Certification Institute.

There are separate examinations for both geosynthetic materials and compacted clay liners.

The GCI Steering Committee is as follows:

Jeff Blum of STS	Jim Olsta of CETCO
Maria Tanase of Earth Tech	Boyd Ramsey of GSE
Rick Thiel of Vector	Te-Yang Soong of CTI
Jeff Fassett of Golder	Steve Wintheiser of CTI
Sam Allen of TRI	Dan Rohe of EPI
Mark Sieracke of Weaver Boos	Jim Goddard of ADS

(b) Product Certification Program

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 GSE Chile, S.A. 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 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 (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 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 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. In particular we are looking to team with a university specializing in CAFO's, i.e., large-scale agricultural operations. Please contact Bob Koerner with suggestions and ideas.

Items of Interest

1. Construction Growth to Continue

Construction of public works in the U.S. will grow this year by roughly 4 to 12 percent. The *2005-2006 U.S. Markets Construction Overview*, released in December, states that construction in the U.S. power industry will experience the strongest increase, growing 12 percent during 2006. Sewage and waste disposal construction should increase by 7 percent. Transportation, highway and road construction, and water supply construction should each grow by 6 percent. Conservation and development construction--which includes brownfield and wetlands projects--will see a 4 percent growth.

(ref. *Civil Engineering*, February 2006)

2. Life Cycle Assessment (LCA)

It is estimated that the construction industry consumes about 40% of all raw materials and energy, making it the largest single user of resources. All stakeholders in the building segment recognize the need to move toward more ecological designs, installations, and materials.

Life cycle assessment may be the solution. LCA provides a methodology for studying a product from the harvesting of the raw materials, through production, use (and reuse), to the end of the product's service life. It can be applied to both individual materials and complete assemblies. The assessments are based on scientific analysis with quantifiable outputs which clearly allow for comparisons among various alternative solutions for a given application. Given that ISO standards governing how LCAs should be conducted already exist, and with sustainability rapidly becoming a key design tenet in many AEC firms, all the elements are in place for LCA to become the environmental assessment tool for the construction industry.

(ref. Building Design & construction, November 2005)

3. Money Isn't Everything

The results of a recent study of the Booz Allen Hamilton Global Innovation 1000 -- the 1,000 publicly held companies from around the world that spent the most on research and development in 2004 -- may provoke a crisis of faith. The study, was made to assess the influence of R&D on corporate performance and it suggests that nonmonetary factors may be the most important drivers of a company's return on innovation investment (ROI). The major findings:

- (a) Money doesn't buy results.
- (b) Size matters.
- (c) You can be too rich or too thin.
- (d) There isn't clarity on how much is enough.
- (e) It's the process, not the pocketbook.
- (f) Collaboration is key.

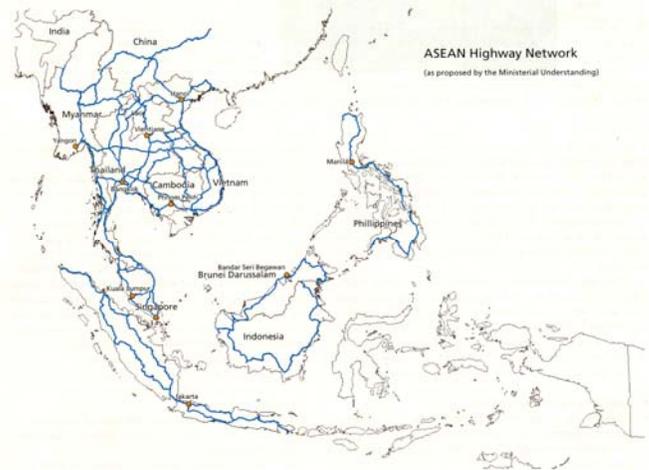
(ref. <http://www.strategy-business.com/resilience>)

4. Linking Southeast Asia

To improve trade and encourage development, ten Southeast Asian nations are pursuing an ambitious plan to create a network of integrated highways. To succeed, however, the project will require the expertise of an array of engineering interests and the backing of public and private investors.

As proposed, it would consist of 26 national routes totaling approximately 37,000 km. Of this total, however, approximately 8,400 km need to be upgraded or constructed to make the highway network functional. Although the time frame for finishing the network remains uncertain, its completion clearly will require a tremendous amount of effort in terms of highway design and construction.

(ref. Civil Engineering, September 2005)



Initial Feedback on CQA-Inspectors Certification Program

Over the course of three summers (1988, 1990, and 1992) a team of speakers was put together by Bob Landreth of the U.S. Environmental Protection Agency to travel to each of the EPA's ten regions to teach and/or explain the agency's regulations on landfill design. The core group was Bob Landreth who opened the 1 ½-day long sessions, followed by Dave Daniel on compacted clay liners, Bob Koerner on geosynthetic materials, Greg Richardson on systems design, and Paul Schroeder on HELP Modeling. Each event was ended by a panel session consisting of all of the speakers. An issue that frequently arose was essentially a challenge to the credibility and expertise of both construction quality control and construction quality assurance personnel, i.e., CQC and CQA personnel. With this in mind, the group subsequently explored existing certification institutes and eventually went with the National Institute for Certification of Engineering Technologists, i.e., NICET. They are a well established group certifying engineering technologists in approximately 30-different application areas. We worked with them forming advisory experts in geosynthetics and they started with examinations and the granting of certifications in about 1994 at three different levels for geosynthetic materials (CCLs never were developed under NICET auspices).

Over the subsequent few years progress was made, however, it became apparent that the CQC personnel did not fit the mold of taking written examinations. For example, some excellent installers don't speak English. To compensate for this unfulfilled need, the International Association of Geosynthetic Installers (IAGI) was formed. This "hands-on" testing organization is functioning well and certainly filling the

need for certified installation personnel. For further information see their website at <<www.iagi.org>>.

In the approximate 10-years since the NICET-CQA examinations were first crafted, little has been done in upgrading the questions and/or answers of the exams and the "fit" for geosynthetics CQA inspectors was felt to be marginal, at best. The suggestion was made in 2005 that GSI might provide such a service since we are presently doing both laboratory accreditation (the GAI-LAP program) and product certification (the GCI-PCP program). Furthermore, GSI has a vested interest in geosynthetics, per se, and thus program maintenance is assured. The GSI Board of Directors gave the green-light and we formed an ad-hoc Steering Committee. They presently consist of the following:

- Jeff Blum of STS
- Maria Tanase of Earth Tech
- Rick Thiel of Vector
- Jeff Fassett of Golder
- Sam Allen of TRI
- Mark Sieracke of Weaver Boos
- Jim Olsta of CETCO
- Boyd Ramsey of GSE
- Steve Wintheiser of CTI
- Dan Rohe of EPI
- Jim Goddard of ADS

Working in a very efficient manner we decided upon the following basic criteria:

- (a) The candidate must be recommended by his/her supervisor, preferably a Professional Engineer.
- (b) The candidate's resume must be submitted which must include at least six-months experience in CQA of like materials.
- (c) The fee was established at \$400 for 5-years certification for geosynthetics materials. (Subsequently it was modified to be \$500 for 5-years of certification for both geosynthetic materials and compacted clay liners).
- (d) The candidate must pass a multiple choice geosynthetics examination of 140 questions with a grade of 70%, or higher. (The compacted clay liner examination is an additional 55 questions, with 70% again being the passing grade).

The Steering Committee then crafted the geosynthetics examination which is presently 20 questions on geosynthetics; 20 questions on geotextiles; 10 questions on geogrids; 20 questions on geonets; 35 questions on geomembranes; 20 questions on GCLs; and 15 questions on geopipe. The first examination was held at GSI on January 28, 2006 with eleven people taking (and all passing) the examination. There were subsequent modifications made to the exam, however, and some poorly worded or possible multiple answer questions were revised.

At that point in time Sam Allen suggested to add compacted clay liners (CCLs) to the program. Of course, soils are beyond the mandate of GSI, so our Board of Directors was brought back into the discussion and eventually approved of the idea. The

logic of this decision is that CCLs have no "home" and that for liner systems, geosynthetics and CCLs truly go together and are often inspected by the same CQA personnel. Fortunately, Sam with the aid of John Allen and Bob Gilbert (with eventually the Steering Committee mentioned earlier) had a set of questions and answers and offered them to us for the purpose of the certification examination in CCLs. There are 55 Q & As in this particular test. Testing times are two hours for geosynthetic materials and one hour for CCLs, with a half hour break in between the two exams.

The first offering of both exams was in Richmond, Virginia at Golder Associates on March 1, 2006 with an independent Proctor overseeing the exams; GSI does all of the grading. Nine candidates took the two examinations and they all passed with 70%, or above, and are certified accordingly.

Presently, both examinations are being offered in Fairmount, West Virginia on March 17, 2006; Austin, Texas on March 24, 2006; Richmond, Virginia on April 1, 2006; Lansing, Michigan on April 3, 2006; Grass Valley, California on April 7, 2006; Folsom, Pennsylvania on April 22, 2006; Irvine, California on May 3, 2006; and Pittsburgh, Pennsylvania on May 13, 2006.

As can be inferred from the number of sites and the nice geographic distribution of locations, the program has stared out well beyond our expectations. Landfill owners, particularly Waste Management, Inc., are firmly behind the program and we sense that the regulatory community is as well. George Koerner is project manager, Jamie Koerner is handling the considerable bookkeeping that is involved and Bob Koerner is providing oversight. Please visit us on our website at <www.geosynthetic-institutue.org> under the heading of "Inspector Certification - GCI-ICP" for information on further background details, application forms, Proctor details, and scheduled examination dates and locations. Also, please don't hesitate to give us feedback as to your thoughts and ideas in regard to ongoing improvement in the examination or on the program's organization.

George and Bob Koerner

Upcoming Events

- March 20, 2006
IGS- Italy Seminar
Milan, Italy
Contact: <mvashley@verizon.net>
- April 4-5, 2006
Conference on Geosynthetic Durability
Würtzberg, Germany
Contact: <hzaninger@skz.de>
- April 3, 2006
QC/QA of Geosynthetics Course
Lansing, MI

- Contact: <mvashley@verizon.net>
- April 20-21, 2006
GSI Courses (GS Design & QC/QA)
Folsom, PA
Contact: <mvashley@verizon.net>
- May 2, 2006
QC/QA of Geosynthetics Course
Irvine, CA
Contact: <mvashley@verizon.net>
- May 10, 2006
Solid Waste Conference of NY-DEC
Sagamore, NY
Contact: <rjphaneu@gw.dec.state.ny.us>
- 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 Pétromont (Sylvie Coulange-Suarez and Nathalie Legros), EPI (Daniel S. Rohe and Mark Wolschon), Vector Engineer (Vince Suryasmita and Richard Thiel), and Weaver Boos Consultants, Inc. (Mark Sieracke). A sincere 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

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EPI, The Liner Co.
Daniel S. Rohe/Mark Wolschon
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Vince Suryasmita/Richard Thiel
Weaver Boos Consultants, Inc.
Mark Sieracke [BoD]

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IN THE NEXT ISSUE

- Activities of the GSI Directors and Board
- Overview of GRI (Research) Projects
- Activities within GII (Information)
- Progress within GEI (Education)
- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
- The GSI Affiliate Institutes
- The GSI Centers-of-Excellence
- Items of Interest
- Focus on European GS Practice
- GSI's Member Organization