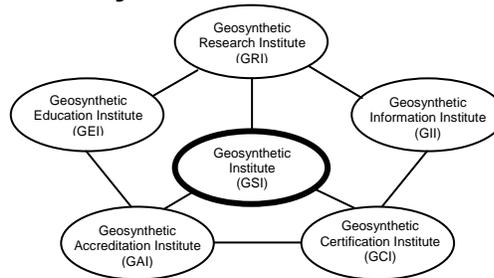


The GSI Newsletter/Report

Geosynthetic Institute



Vol. 19, No. 4

December 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.

*Happy Holidays and a Healthy
and Prosperous New Year*

Activities of the Institute Directors & GSI Board of Directors

1. Fundamental differences between GRI Specifications and CE Marking in Europe were discussed by Sam Allen, Dave Suits, and George Koerner at the Annual Meeting. We will do our utmost to harmonize test methods and minimize specification differences as we go forward.
2. Strong, but constantly changing, membership in GSI was presented. Our technology is very active and still evolving.
3. The Construction Quality Assurance-Inspectors Certification Program (CQA-ICP) was described and will have its "dry-run" on Saturday, January 28, 2006 at GSI. If you are interested in taking the test, please advise accordingly.
4. Results of GSI's Continuous Quality Improvement survey were discussed. Also, GSI's outreach programs and future conference activities were decided upon.
5. Congratulations and plaques for outgoing Board of Directors, Jim Olsta and Dave Suits were given at the Annual Meeting.
6. The Board of Directors met in Las Vegas on December 14, 2005 immediately after the Annual Meeting.
7. 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 - STS (At-Large)

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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. 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 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. 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

Working Within Focus Groups

- GMXX – Exposed Temporary Covers
- GCXX – TRMs for Erosion Control
- GNXX – Geonet Drainage Composites
- GGXX – Bidirectional Geogrids
- GGXX – Unidirectional Geogrids

Delayed or Off in the Distance

- 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 Winter. 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 | • Winter 2005 Courses |
| • GRI Specs, Guides, White Papers | • Geosynthetics Links |
| • Laboratory Accreditation | • GSI Member Meetings |
| • CPReS & CPHyS | • 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, 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 over 10,000 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 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!

Note - January 28, 2006

On the day following Course #4 (a Saturday) on QC/QA of Geosynthetics, we will offer the first examination of the new CQA-Inspectors Certification Program. If you want to take this test, contact us immediately. There is no cost and it will count toward certification if you pass. The test will be given at GSI in Folsom, PA, about 3-miles from the Philadelphia International Airport.

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) (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 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
- 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

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.

NOTES

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

The GAI-LAP directory is kept current on our home page at:

www.geosynthetic-institute.org

The conflict resolution service was used twenty one (21) times the past year in the following manner/situations;

- ASTM D5994 Core Thickness (four times), the vast majority of problems resulting from interpretation of search technique section of standard. One should follow the standard and not search for absolute minimums.

- GRI-GM12 Asperity height (three times), where maintenance of the points and apparatus are critical. Search technique again needs to follow the standard
- ASTM D5397 Stress Crack notching problems can be avoided by verifying notch depth through a microscope.
- ASTM D4595 WWT of Geotextiles where uneven loading of a difficult PET geotextile resulted in a premature rupture. Lengthy specimen preparation with aid of frictionless sheets between wraps on the rollers helped the situation but never totally rectified the situation.
- ASTM D6637 Single Rib Geogrid Test (two times), with uneven loading of light geogrids as a result of including outside ribs in the specimen per the standard. We need to update this standard to address this issue for it results in a liberal result that can not be substantiated with wide width tensile testing.
- ASTM D4833 GT Grab Tensile, where slit film woven geotextiles need padded grip faces. Duct tape works well in a pinch. Serrations on steel faces were knifing through geotextile yarns prematurely.
- ASTM D4833 Puncture where the probe needs to conform to the standard (no burrs) and grip slippage needs to be minimized during testing.
- ASTM D4533 Trap Tear (two times), geotextiles greater than 500 lb/in. are difficult to test via this method. Again duct tape works in conjunction with large clamping pressures.
- ASTM D5887 GCL Flux, where testing GCLs with thin films is difficult. RTV adhesives are recommended with much patience.
- ASTM D5891 Fluid Loss needs to use distilled deionized water and follow procedure exactly.
- ASTM D 5321 Direct Shear, where clamping/gripping problems and mode of failure needs to be consistent and verified after the test is completed.
- ASTM D 6566 M/JA of TRM, turned out to be a traceability problem with a single TRM product manufactured in two different plants.
- ASTM D 4716 Transmissivity, where geotextiles should not be tested via this method. The radial method ASTM D6574 is required for geotextile transmissivity.
- ASTM D4751 AOS, where woven geotextiles with changing warp and weft yarn locations are difficult to test. Standard deviation for some material is larger than others where the openings are fixed.
- ASTM D5885 HP OIT by DSC, PE stabilized with HALS gives a double peaked exotherm and is difficult to analyze. No resolution was reached on this issue. We need to define the onset of the exotherm by setting a threshold of perhaps 10W/g in a revision to the standard per a manufacturer's recommendation.

It should be noted that the conflict resolution service is free of charge to GSI and GAI-LAP members. You are encouraged to use the service.

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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Fax: (610) 522-8441
E-mail: gkoerner@dca.net

Activities within GCI

(a) 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 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

(b) Inspectors Certification Program

The framework of what we are trying to do in this new program is as follows:

Goal

To setup, administer, and maintain a credible CQA certification program for geosynthetic materials used in waste containment, and related, applications.

Requirements

1. Candidate must be recommended by a Professional Engineer who knows, and can attest to, at least one season of acceptable field experience performing CQA activities with geosynthetic materials.
2. Successfully passing a written examination proctored by GCI or a GCI designated organization and graded by the Geosynthetic Certification Institute.
3. Pay a one-time \$250 fee which covers a 5-year period upon completion of the above two items.

General Comments

1. The listing of successful candidates will be kept by GCI and only company names and number of certified personnel will be advertised and/or acknowledged.
2. This listing will be posted on GSI Website at <<[geosynthetic-institute.org](http://www.geosynthetic-institute.org)>> and updated as newly certified personnel are added, or whenever certified personnel change employment.
3. The examination will consist of 140 multiple-choices questions; twenty each in the following seven categories; geosynthetics, geotextiles, geogrids, geonets/geocomposites, geomembranes, GCLs, geo-others (pipe, sumps, etc.). They will be arranged in gradually increasing sophistication.
4. The test will have a maximum three-hour time limit. The passing grade will be targeted at 70%. Questions will be changed periodically and selected from a large data bank of questions and answers.
5. Tests will be held at GSI in Folsom, Pennsylvania twice per year typically after CQA courses are given at the institute. Tests can also be taken and proctored by companies giving such courses, or companies which have a sufficiently large number (typically greater than five) taking the test at one place and time. Tests results will be sealed and sent to GCI for grading.
6. Geosynthetic Certification Institute certificates will be given to applicants which are successful in gaining CQA-ICP status.
7. The initial trial date is Saturday, January 28, 2006 which happens to be the day after GSI gives its CQC/CQA course. Contact us if you are interested in participating.

GCI Steering Committee

Sam Allen - TRI	Rick Thiel - Vector
Mark Sieracke - STS	Maria Tanase - Earth Tech
Jim Olsta - CETCO	Te-Yang Soong - CTI
Boyd Ramsey - GSE	Jeff Fassett - Golder
Jeffrey Blum - STS	

The GSI Affiliated Institutes

It has long been realized that the information generated within the GSI group should have a timely outlet to all countries, and in all languages. To this end, GSI has created affiliated institutes in two countries (Korea and Taiwan), and potentially many others in the future. These affiliated institutes are full members of GSI and are empowered to translate and use all available information so as to create similar institutes and activities in their respective countries. We introduce these institutes to you in this Newsletter/Report and will present ongoing details of their respective activities.

GSI-Korea was formed on February 9, 1998 as a collaborative effort between FITI Testing and Research Institute (a quasi-government organization) and INHA University (through its Geosynthetics Research Laboratory).

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

INHA University is located in Incheon (50 km west of Seoul) and the geosynthetics laboratory is led by Professor Han-Yong Jeon. Dr. Jeon has 10-students working on geosynthetic-related projects and is extremely active both nationally and internationally. The ongoing efforts of both FITI and INHA will be described in future Newsletter/Reports.

GSI-Taiwan was formed on August 18, 2000 and is wholly contained within the National Pingtung University of Science and Technology in Nei Pu, Pingtung (southern Taiwan). It completely parallels GSI in that it has specific units for research, education, information, accreditation and certification. The Director is Dr. Chiwan Wayne Hsieh who is a

Professor in the Department of Civil Engineering and Director of the Computer Center. GSI-Taiwan has an Taiwanese consortium of geogrid/geotextile manufacturers who work toward producing quality products according to the draft GRI geogrid specifications and the associated test methods. As such, GSI-Taiwan is a GAI-LAP accredited laboratory for 32 geosynthetic test methods. Dr. Hsieh has 10-students working on geosynthetic-related projects and is extremely active nationally and internationally. The ongoing efforts of GSI-Taiwan will be described in future Newsletter/Reports.

The Geosynthetic Institute Centers-of-Excellence

1. The Center for Polymeric Reinforced Structures (CPRoS) was formed on Dec. 27, 2002 for the purpose of proper use of geosynthetics in walls, slopes, and foundation reinforcement. It involves Dov Leshchinsky of Delaware, Grace Hsuan of Drexel and George Koerner of GSI as Co-Directors. The mission statement and goals are available on the GSI Home Page at <geosynthetic-institute.org>. Ongoing projects are the following:
 - (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. 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. The need for water in the world and the worldwide opportunity for geosynthetics

On the global scale, water (or blue gold as it is more and more often called) is a business worth 800 bn USD (World Bank data), with about 200 bn USD concentration in municipal services. Despite the huge

size of this market, water is still a dream or a nightmare for a large part of the population, and future needs are even more challenging. According to UN data, 1.1 billion of the 6 billion people living in the world have no access to water, and 2.4 billion have no adequate sanitation. Regarding waste-water the figures are even more staggering, as 4 billion people lack sound wastewater disposal. As in many other sad situations, there is a human cost and 3.5 million children die every year from waterborne diseases. (ref. Paper by M. Raynaud of BP Solvay Polyethylene)

2. Expected Geomembrane Use in China

Application Area	Est. annual geomembrane use
Hydraulic and hydroelectric projects	52.5 million m ²
Environmental protection	37.5 million m ²
Transportation	27 million m ²
Construction	18 million m ²
Mining plants	6 million m ²
Miscellaneous	9 million m ²

(ref. C. Jing-Kui and X. Qi-Xing article in GFR, November 2005, pg. 31-333)

3. U. S. Technical Units Becoming More Entrenched

"Metrication: NCMA recently persuaded Congress to pass a permanent extension of the law that protects concrete masonry producers to convert to buy metric molds and convert to hard-metric production in order to access the huge federal construction market." (ref. CM News, September, 2005, pg. 18)

4. The Gypsum Board Issue

"In December 2003, two schools near a landfill in northeastern Pennsylvania temporarily shut down when an overwhelming stink made it impossible for students to concentrate in class. Investigators blamed the stench on decaying gypsum board and made adjustments to a system that extracts vapors from the trash and burns them off." (ref. URL: <http://www.msnbc.msn.com/id/8550386/>)

5. Long Hauls for Solid Waste

"The trains that rumble from the Harlem River rail yard in the South Bronx are sealed tight, but there is no mistaking what lies inside them. The stench gives it away. The trains, some a mile long, are filled with garbage. The railcars are part of an armada that performs a nearly constant exodus of waste from the nation's largest city. Each day, trains and trucks carry 50,000 tons of trash from New York to huge landfills and incinerators in New Jersey, Ohio, Pennsylvania, Virginia and South Carolina.

Waste management experts say these types of long hauls have become the norm for big cities as homegrown landfills fill up and close. In 2003, nearly a quarter of all municipal trash in the United States crossed state lines for disposal, according to the Congressional Research Service. Ten states imported at least 1 million tons of trash that year, up from only two states in 2001.

(ref. URL: <http://www.msnbc.msn.com/id/8550386/>)

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

As some of you know, our GRI-19 Conference is now history. The event was in Las Vegas on December 14-16, 2005 and it was teamed with the North American Geosynthetics Society, thus NAGS 2005/GRI-19 was the description. GRI hosted the three morning sessions with invited lectures and NAGS hosted the three afternoon sessions with unsolicited lectures. Regarding the three GRI sessions; they were on low permeability backfill soils in reinforced walls and slopes, heap leach pads and behavior, and topics being researched by GSI members.

The low permeability soil session was opened by consultant Barry Christopher (practice in the USA), with Chris Lawson of TC Nicolon (international practice), Dick Stulgis of GeoComp (details of the NCHRP test walls), and Bob Koerner of GSI/Drexel (on back drainage design) in the middle. The session was concluded with Dean Sandri of Anchor (construction practices and details). The five speakers nicely knit together the situation and guidance as to best practice. A 90-minute panel session was lively and indeed worthwhile.

The heap leach pad session was opened by Mauricio Ossa of SL Chile (the process itself and geomembrane manufacturing details), with Russell Brown of Golder (pregnant liquid collection systems), Alan Brietenbach and Rick Thiel of Vector (differences between landfill liner systems and heap leach pads), and Abigail Bell of Vector (collection pipe research) forming the middle of the session. Ellen Rathje of Texas-Austin presented seismic behavior including liquefaction and stability. The six speakers complimented one another perfectly and the 90-minute panel session was "awesome". Truly, a tutorial on this segment of the geosynthetic industry was offered to the attendees.

Regarding topics being researched by GRI member organizations Professor Jeon of GSI-Korea and Professor Hsieh of GSI-Taiwan gave details of geogrid certification and pipe behavior respectively, followed by Professor Zornberg of UT-Austin describing his CPHyS work on geosynthetics in hydraulic structures. An interesting point-and-counterpoint on manufacturing versus design was given by Boyd Ramsey of GSE and Mark Sieracke of STS. Both agreed that consistency in properties from roll-to-roll throughout a project is necessary. Te-Yang Soong of CTI gave a very nice pipe design guide for introducing liquids into wet landfills and Sam Allen of TRI presented a large-scale test method to assess installation damage of geosynthetics.

All of the above papers along with the 32-NAGS papers are available on CD for \$50.00. Contact us, or Dave Suits of NAGS, for copies. Also, thanks to the 220 people in attendance, as well as exhibitors and sponsors.

Upcoming Events

- 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
(Phoenix, Arizona)
Contact: <csierk@astm.org>
- February 16, 2006
Florida DER Seminar
Contact: <mvashley@verizon.net>
- March 20, 2006
IGS- Italy Seminar
Milan, Italy
Contact: <mvashley@verizon.net>
- April 4-5, 2006
Conference on Geosynthetic Durability
Würtzburg, 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 Polytex, Inc. of Chile (Jaime Morales), Carlisle Syntec, Inc. (Brian Gish/Chris Taylor), Ring Ind. (Al Schnitkey), Pétromont (Sylvie Coulange-Suarez and Nathalie Legros), Natural Resources Conservation Service (Stephen D. Reinsch) and Virginia DEQ (John Gersbach). 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

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

Tenax, S.p.A.

Aigen Zhao/Caesar Baretta

Basell USA, Inc.

Robert G. Butala

TC Nicolon USA

John Henderson/Chris Lawson

CETCO

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Huesker, Inc.

Thomas G. Collins/Dimitri Alexiew/Steven Lothspeich

Naue GmbH & Co.

Georg Heerten/Kent von Maubeuge [BoD]

SI Geosolutions, Inc.

Deron N. Austin

STS Consultants

Mark Sieracke [BoD]

BBA Nonwovens

William M. Hawkins/William Walmsley

NTH Consultants, Ltd.

Jerome C. Neyer/Robert Sabanas

TRI/Environmental Inc.

Sam R. Allen [BoD]

U. S. Army Corps of Engineers

David L. Jaros [BoD]

Chevron Phillips Co.

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Haley & Aldrich Consultants

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URS Corp.

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Civil & Environmental Consultants, Inc.

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Paul W. Barker/Peter Riegl

Firestone Building Products Inc.

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FITI (GSI-Korea)

Jeonhyo Kim/H.-Y. Jeon

Waste Management Inc.

Anthony W. Eith [BOD]/Greg Cekander/

Charles P. Ballod

NPUST (GSI-Taiwan)

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Gary M. Kolbasuk [BoD]

CTI and Associates, Inc.

Te-Yang Soong/P.D. Deo

Advanced Earth Sciences, Inc.

Kris Khilnani/Suji Somasundaram

Polytex, Inc.

Jaime Morales

Carlisle Syntec, Inc.

Brian Gish/Chris Taylor

Ring Industrial Group

(Al Schnitkey)

Pétromont

Sylvie Coulange-Suarez/Nathalie Legros

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Rob Marshall

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Rodney G. Powers

National Design, Construction & Soil Mechanics Center

Stephen D. Reinsch

Virginia Dept. of Environmental Quality

John Gersbach

IN THE NEXT ISSUE

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- Activities within GAI (Accreditation)
- Activities within GCI (Certification)
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- Items of Interest
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