The GSI Newsletter/Report

Geosynthetic Institute

Vol. 37, No. 3 **September, 2023**

This quarterly newsletter, now in its 36th 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 George R. Koerner or Jamie Koerner at phone (610) 522-8440; or e-mail at gsigeokoerner@gmail.com or Jamie@geosynthetic-institute.org

Activities of GSI's Officers and Board of Advisors (BOA)

2023-2025 Board of Advisors

The following are the names of the current BOA members and their contact information. We thank them for their time and advice on matters concerning the Geosynthetic Institute. Please reach out to them if you have any questions or comments related to your specific task group. The BOA generally initiates GSI activities via quarterly meetings.

Term Ends 2023

- Te-Yang Soong - CTI Co.
  (Consultants)
  email: tsoong@cticompanies.com
- Brian Fraser - Layfield Group
  (Barrier Group)
  email: brian.fraser@layfieldgroup.com
- Jacek Kawalec – Tensar
  (International - 2)
  e-mail: Jacek.Kawalec@vp.pl

Term Ends 2024

- Burrill (Bo) McCoy - Waste Management Inc.
  (Owners and Operators)
  e-mail: bmccoy2@wm.com
- Rene Laprade - Solmax Geosynthetics
  (Geotextiles and Geogrids)
  e-mail: r.laprade@solmax.com
- Sam Allen – TRI Environmental Inc.
  (Test Laboratories)
  e-mail: Sallen@tri-env.com

Term Ends 2025

- Henning Ehrenberg – NAUE GmbH & Co. KG
  (International-1)
  email: hehrenberg@naue.com
- Miranda Rine – C.P. Chemical
  (Resin and Additives Group)
  email: Miranda.rine@cpchem.com
- David Carson – U.S. EPA
  (Agencies)
  email: carson.david@epa.gov

GSI continues to have virtual quarterly meetings with the Board of Advisors via Zoom. The 3Q BOA meeting was held on September 29, 2023. Elections will be held in Q4 for the BOA positions held by Te-Yang Soong (Consultants), Brian Fraser (Geomembranes/GCLs) and Jacek Kawalec (International). We are actively searching for nominations for the BOA from GSI members who are part of the consultants group. Please email jamie@geosynthetic-institute.org if you are interested in serving on the board of advisors or if you would like to nominate someone for the consultants' group position.

IN THIS ISSUE

Overview of GRI Projects (Research)

The following projects are all funded by GSI membership dues unless specifically noted. Most are long-term projects for which we are well positioned to accomplish. In an attempt not to repeat information in the quarterly newsletters, we will merely list the ongoing projects and new research details. Please contact George or Grace if youhave advice or concerns.
George Koerner (gsigeokoerner@gmail.com)
Grace Hsuan (hsuanyg@drexel.edu)

1. Durability of Exposed Geosynthetics (GM, GT, GG, HPTRM, Turf, WD & GCCM)

GSI is using two outdoor exposure racks and four UV fluorescent devices to estimate the projected exposed lifetime of a litany of different geosynthetics. The newest material added to the repertoire are GCCM which are tested before and after exposure via ASTM D8058 Flexural Strength. Durability of Geosynthetic at GSI (Outdoor versus laboratory exposure) Currently testing 8 GMs, 4 GCCMs, Wind defender, Closure Turf, Miramesh, Tensar BX and 2 HP-TRMs. The goal of the study is to quantitatively illustrate the durability of these materials and to correlate outdoor exposure to accelerated weathering. Study is in its ninth year.

2. GSI wall, pH and durability of PET GGs

We continue to measure the pH between three types of dry cast masonry retaining wall blocks for over fourteen years. Concern here is over PET geogrids which are known to be sensitive to very high alkalinity environments. Indeed, the PH values started high, but over time they are now down below eight. It is nice to know that Mother Nature likes to buffer things from a pH perspective and we are always trying to reach equilibrium. A paper on this topic will be presented at GeoAmericas 2024.

3. EIA = PVC + KEE Specification

GRI-GM34 EIA = PVC +KEE Specification last revision was in March 7, 2023. It was revised (Congo Red test deleted) after consideration of compelling research presented by Seaman Corporation. A webinar on this topic will be given jointly with the FGI on Thursday, November 16, 2023 at 11:00am EST.

4. Beyond GRI GM13 and GM17

GM-13 and GM-17 have achieved acceptance and adaption in many markets and countries throughout the world. The documents have been modified over time with 16 and 14 modifications/revisions, respectively. However, the barrier market has significantly expanded in scope, range and expected performance over the past decade. A “one size fits all” approach, while appropriate in the past, is no longer adequate to address the industry’s needs.

For this reason, GSI has contracted a group of talented engineers and scientist with a wealth of knowledge on formulating and manufacturing PE geomembranes to prepare new specifications for geomembrane barriers based on application requirements including, but not limited to durability, lifespan, barrier properties and other factors. This process would include investigation of existing databases from multiple sources and review and discussion of the proposed levels and values. This process will be somewhat lengthy and, of course, a proposed output will need review by a larger group.

The contract is for $100K USD ends on January 1, 2024. A contract was awarded to a group from TRI environmental. The project team consists Rick Thomas, Amber Douglas, Sam Allen and Boyd Ramsey. The team is currently at the ¾ mark and have twenty-two different formulations under incubation for review. We anxiously await their final report which is due at the end of the year so that we can move forward with three new specifications for HDPE. The specifications will include: Super (High temperature and chemical resilient), Colored and Conductive.

5. 31 year old MSW exhumation Case history

A MSW landfill is being exhumed after 31 year of excellent service, (less than 2 GPAD leakage rate into the secondary). The pumps have been off for over a month and still there is nothing to pump in the secondary sump. The composite liner systems have done this job very well.
GSI has tested Primary and Secondary Geomembranes, Fusion and Extrusion Seams, Geotextiles, Geonet, GCL against all of the requisite GRI specification and base line information. The information is under review by the stakeholders. Much more information regarding this effort will be presented in the coming months.

6. Comparing geomembrane stabilized with Graphene rather than carbon black.

According to the United States criteria in OSHA HCS for classifying hazardous substances, Carbon Black is not classified for any toxicological or eco-toxicological endpoint. However, as a combustible dust or a reaction by product it is designated by OSHA as a hazardous chemical particularly when it is airborne. For this reason, some forward-thinking individuals in the

geosynthetic industries are looking for alternatives to carbon blacks to protect the polymer from UV degradation, act as a black pigment and improve the conductivity.

We are currently testing five samples with graphene content from 1 to 5%. We will counterpoint all GRI GM13 properties and report on our findings shortly.

7. Controlling the smooth edge thickness of textured polyolefin geomembranes.

Over the past several years, we have seen a reduction in thickness of the weld edge (smooth edge) of textured geomembranes. This is presenting a challenge for installers when trying to achieve passing trial seams in the field prior to production welding. Seam tests are passing, but just barely (10% above GM19a or less).

As a result, we have written GRI GM-37 "Determining the Weld Edge Thickness of Geomembrane" and added notes to GM13 and GM17 to give a means of evaluating the smooth edge thickness and to try and remedy the situation.

8. HDPE Stress Cracking

As presented in our 12th ICG paper entitled "In search of an alternative surfactant for stress cracking tests for HDPE geomembranes" we have done much work trying to find a replacement for Igepal CO-630 for the ASTM D5397 test. Unfortunately, nothing that we have tried works like Solvay's Igepal CO-630. We have tried the following surfactant is three separate round robin experiments.

1. Igepal CA-630
2. Solvay: Rhodacal (DS-4) also called Siponate
3. Solvay: Rhodasurf
4. BASF: Dehyton PL
5. DOW: Tergitol 15-S-15 (3, 5 & 10%)
6. DOW: Tergitol 15S9-1L

As such we have revised the appendix of ASTM D5397 as follows to address the current situation.

X3. RECOMMENDED DETERMINATION OF SUBSTITUTE-ALTERNATIVE SURFACTANT

X3.1 It has been brought to the attention of the ASTM D5397 task group that the surfactant used in this experiment (Igepal CO-630) is a regulated substance in some countries (i.e., EU REACH directive). For this reason, many labs throughout the world are requesting a substitute-alternative surfactant for determining the stress crack resistance of HDPE via this method.

X3.2 After extensive round robin testing (eight (8) laboratories, over nine (9) substitute-alternative surfactants with seven (7) different HDPE geomembranes), it has been determined that no known REACH directive compliant surfactant has the exact equivalent efficacy of Igepal CO-630.

X3.3 Therefore, if performing this test with a substitute-alternative surfactant, one will have to first determine a correlation between the substitute-alternative surfactant and Igepal CO-630. Comparative experiments will have to show the following for validation;

X3.3.1 a correlation coefficient greater than 0.9,

X3.3.2 a coefficient of variation within any given SP-NCTL data set of less than 5, and

X3.3.3 a specimen set of at least thirty (30) data points.

X3.4 Upon satisfying all the requirements of section X3.3 above, an effectiveness ratio may be used to extrapolate results between the substitute-alternative surfactant and Igepal CO-630. It should be clearly stated that this ratio is only good for the actual HDPE formulation being tested.

Not giving up on this important issue, GSI is working with the ISO task group on this subject. The German committee of Naue, SKZ, Solmax and HKA are currently in round robin testing with three different GRI geomembranes with BASF's Dehyton PL. These three geomembranes are the same materials that GSI used for the ASTM round robins. Hopefully they will find a REACH (EU) compliant surfactant that has the similar SP-NCTL signature as Igepal CO-630 across HDPE geomembrane formulations commonly used in our industry. We will keep you posted.

9. 9090 TESTING

We are asked over and over again about the Chemical resistance of HDPE Geomembranes. The following is our general response to such a question. Chemical resistance is the ability of the polymer to resist an attack from certain chemicals for a specific period of time while maintaining its physical, mechanical, chemical and hydraulic properties. When exposed materials with poor chemical resistance will see a change in properties causing blistering, swelling and cracking, until the polymer becomes nonfunctional. The molecular structure of the polymer, the additives added along with the solvents and chemical reagent concentration, exposure time, and temperature are the primary variables determining chemical resistance.
The rate of the chemical attack is reduced by crystallization. It is increase by the presents of fillers, cross-links and solvent concentration. Polymers are more readily attacked by high temperatures above the glass transition temperature. Chemical resistance is enhanced by the types and quality of polymers and additives included in the formulation.

It's essential to evaluate the environment in which a plastic will function in order to choose the right polymer for a specific application. Chemically inert plastics, or those that exhibit a wide range of pH and chemical-type resistance, won't be able to withstand all chemical agents. Therefore, in order to select the proper polymer and guarantee its chemical compatibility, it is crucial to examine the agent(s) in question with respect to a specific HDPE geomembrane formulation.

HDPE is chemically compatible with many chemicals and resistant to strong acids and bases. The polyethylene resins (PEs) have an extremely high resistance to chemicals and other media because of their non-polar nature. Aqueous solutions of salts, acids, and alkalis have no effect on it. PEs are not resistant to strong oxidizing agents such as nitric acid, fuming sulfuric acid, or halogens. High density polyethylene is a material that is well known for being robust, stable, and simple to weld. It also exhibits outstanding resilience to acidic solutions.

Testing for polymer chemical resistance assures that interactions between polymers and the chemicals won't lead to field failures. Some of the common test methods accepted for chemical resistance of geomembranes are:

ASTM D5322 – Standard Practice for Laboratory Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids

ASTM D5496 – Standard Practice for In-Field Immersion Testing of Geosynthetics

ASTM D5747 – Standard Practice for Tests to Evaluate the Chemical Resistance of Geomembranes to Liquids

Most tested methods involve immersion of the geomembrane in the chemical at either room temperature or at elevated temperatures for a set duration and evaluating the properties before and after exposure. The common test involves:

- Changes in mass/volume/dimensions
- Mechanical properties – tensile strength, elongation, tear resistance
- Visual appearance change
- Changes in permeation

Geomembranes are made of high quality, virgin polyethylene which demonstrates excellent chemical resistance. HDPE geomembranes are resistant to a great number and combinations of chemicals. It is this property of (HDPE) high density polyethylene geomembranes that makes it the lining material of choice for waste containment facilities.

The chemical resistance of polyethylene has been investigated by many people over the past few decades. We are able to draw from that work when making statements about the chemical resistance of today's polyethylene geomembranes. In addition, many tests have been performed that specifically use geomembranes and certain chemical mixtures. However, every mixture of chemicals has not been evaluated. As a result, published chemical resistance chart with general guidelines are commonly used. Below are a list of links and references that may be helpful in evaluated the chemical compatibility of HDPE to your particular application.

https://www.ineos.com/globalassets/ineos-group/businesses/ineos-olefins-and-polymers-usa/products/technical-information--patents/ineos-hdpe-chemical-resistance-guide.pdf

https://www.tapplastics.com/image/pdf/HDPE_CRCWB.pdf

https://www.astisensor.com/HDPE_Chemical_Compatibility_Resistance_Chart.pdf

https://www.descoeurope.com/PDF/ChemicalResistanceChart.pdf

https://www.braskem.com.br/Portal/Principal/Arquivos/html/boletm_tecnico/PE%20Chemical%20Resistance.pdf

https://www.plasticsintl.com/chemical-resistance-chart

Haxo, H. (1993) US EPA Technical Manual: "Solid Waste Disposal Facility Criteria," EPA A530-R-93-017

The above information is provided for reference purposes only and is not intended as a warranty or guarantee for your specific site.. GSI assumes no liability in connection with the use of this Information in regards to compatibility or incompatibility of a specific geomembrane for a specific application. For that, one needs to test the actual geomembrane with site specific leachate .

10. Fingerprinting Multicomponent Geomembranes

Multicomponent geomembranes present a challenge in regards to finger printing. If desired, the test sample may be dissected into discreet layers prior to test and analysis. An individual layer may be separated from the sample as a whole by cutting sections from the surface or the core of the sample. The following describes several methods which might be helpful in this process.

A challenge is that the individual components of the geomembrane material cannot be evaluated by blending the entire formulation, molding or melting them, and then

testing the composite material. Hence, when one wants to test individual components of the geomembrane and not the entire cross section, there needs to be a method to isolate individual components of the cross section. Options for dissection include milling on an x-y table, cutting with a sharp knife or straining the material and then separating it.

We have found that a rotary tool (router) or a disk grinder works well for preparing test material as long as the temperature is controlled and the polymer is not overheated. As seen in Figures 1 a-c below, one can set up a miniature milling machine (on very slow speed) with an X-Y table to accomplish the task at hand.

FIG. 1a Fix GS to substrate


FIG. 1b Mill

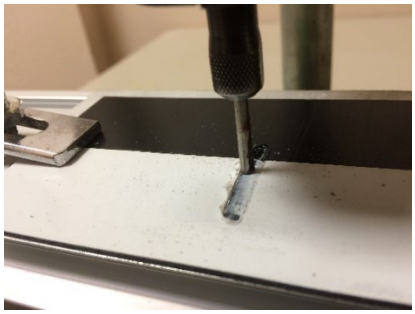


FIG. 1c Rotary tool tip

Milling is the machining process of using rotary cutters to remove material from a workpiece (geomembrane mounted to a rigid substrate with contact adhesive) by advancing the specimen in one direction and at an angle with the axis of the tool, which is rotating. Milling covers a wide variety of different operations and types of machines. It is a common process and can be performed on a small scale. In our particular case, we are interested in the filings (the scrap or waste being trimmed away from the geomembrane) and not the piece mounted to the x-y table. Note that the filings need to be collected and kept free of contamination if they are to be used as a test specimen. The technique has the advantages of being fast, precise and safe. With a variable speed rotary tool, the cutting speed can be controlled so that little heat would be generated during the process. This technique is also important for precisely removing over laminate or substrate material. With the X-Y table horizontally leveled, a layer can be removed precisely to a specific depth.

Procedural options for this activity include shaving the skin off the material for testing (top and or bottom and core) with a sharp bladed knife or scalpel. When larger pieces of material are needed, a cheese cutter or sharp plane can be used for dissecting the components from one another. These procedures are shown in Figures 2 and 3. Note that it is important to cut out 12 mm by 15 mm (0.5 in. by 6.0 in.) strips of geomembrane. This strip is typically taped to a rigid flat surface so that is can be dissected cleanly. This procedure is fast, clean, and generates no heat, which could change the morphology of the material.

FIG. 2 Photo of mini plane removing skin


FIG. 3 dissecting with sharp knife

An “out of the box” technique on how to separate multicomponent geomembrane layers might be to strain them prior to dissection. Adjacent layers may have very

different strain compatibilities, as shown in figure 3. Hence, when strained either quickly or slowly, the tie layers holding the different components together may break and then relinquish the component in isolation. This is self-evident when the material is strained rapidly. However, some multilayered geomembranes with scrim reinforcement can be delaminated under dynamic sustained loads. Experimenters have set up test rigs that place the geomembrane in simple shear application and then oscillate a hanging weight on the material.

Unfortunately, both ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement and ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique only report an average density calculated for geosynthetics. However, it is possible that different parts or layers of a geosynthetic sample may differ in density due to differences in crystallinity, thermal history, porosity, and formulation/composition. Hence, layers may need to be separated to obtain a discreet density determination.

Materials that are generally tested are solid plastic products such as sheets, rods, molded items or pellets. Both ASTM D792 and ASTM D1505 clearly state that the test specimen shall be a single piece of the material of any size and shape that can conveniently be prepared and tested. The thickness of the specimen should be at least 1mm for each 1g of weight. A specimen weighing 1g to 5g is ideal and convenient, but specimens up to approximately 50g may be used. Care should be taken in cutting specimens to avoid changes in density resulting from compressive stresses or frictional heating. Certain plastics require a particular method of specimen preparation and should be determined whether applicable. The specimen needs to be free from oil, grease, and other foreign matter.

The standard methods also state that sampling used for the determination of relative density shall be representative of the quantity of product for which the data is required. If it is known or suspected that the sample consists of two or more layers or sections having different densities, complete dissection of the specimens shall be taken and each layer tested. The density of the total part cannot be obtained by adding each layer's density together, unless relative percentages of the layers are taken into account.

Progress within GII (Information)

The bylaws are available to anyone upon request.

As you can see by the listing below, we are still disseminating a lot of new information at the institute.

- GRI Methods, Specifications, Guides & Practices
- Quarterly Newsletters
- White papers
- GSI Website
- Bimonthly GMA Techline
- Bimonthly GSI News Column in Geosynthetics Magazine
- Conference Papers
- GRI Reports

IGS Geosynthetic Handbook

A new effort for GSI is the IGS GS handbook. This handbook will be a dynamic document that will continue to evolve over time, updating as new information and technologies develop. George R. Koerner will be the first editor of the handbook. This practical text is intended to serve as a general reference document in the field of geosynthetics. Polymeric construction materials used in civil applications are now commonly accepted as solutions to geotechnical and environmental engineering challenges. This handbook offers a comprehensive overview of geosynthetics and their various applications. The chapter breakdown and authors of the handbook are as follows:

I **Introduction to Geosynthetics** (George Koerner)
(geomembranes, geotextiles (filters, cushions, reinforcements), geosynthetic drains (including PVDs), geogrids, geofoam, erosion control, pipe)

II **Geosynthetics in Roads and Pavements** (Eli Cuelho)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Separation and Subgrade Stabilization
b) Base Reinforcement
c) Asphalt reinforcement/Overlays
d) Roadway drainage / subgrade dewatering / wicking / road base drainage

III **Geosynthetics in Subsurface Drainage/Water Storage** (Barry Christopher)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Land mass dewatering/consolidation
b) Structure drainage
c) Subsurface water reservoirs/water holding facilities
d) Structural Root boxes

IV **Geosynthetics in Erosion and Sediment Control**
(Joel and Jay Sprague)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Hard Armor Systems
b) Slope and Channel Protection
c) Silt Fence
d) River Bank Protection
e) Coastal Shoreline Protection

V **Geosynthetics in Reinforced Soil Systems**
(Chris Lawson)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Overview
b) Embankments over soft foundations
c) Reinforced steeped slopes
d) Mechanically stabilized earth walls and berms

VI **Geosynthetics in Seepage Control Systems**
(Kent von Maubeuge)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Ponds
b) Reservoirs
c) Canals

VII **Geosynthetics in Environmental Protection**
(Kerry Rowe)
(summary of design and design resources (example global specifications; installation best practices/lessons learned; relevant MQC/MQA testing practices; contracting considerations; sustainability considerations)
a) Landfills
b) Remediation Sites
c) Industrial Effluent Impoundment
d) Mining

VIII **Geosynthetics Support Systems**
(George Koerner)
MQC/MQA
CQC/CQA
Prefabricated Systems
On-Site Fabrication
Standardization
Specification / Regulations
IGS
GSI
Accreditation Programs

IX References / Links

We feel fortunate to have such an esteemed team participating in this effort. We look forward to collaborating with these colleagues and anticipate updates on the handbook which is targeted for release in 2024.

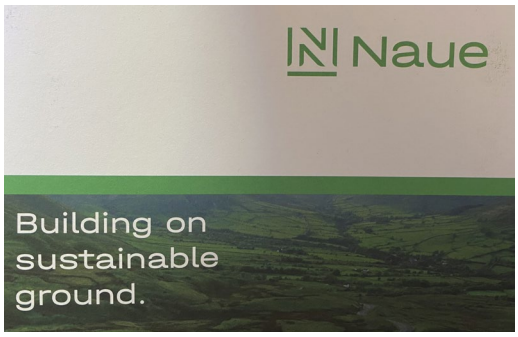
September 17-21, 2003 Rome, Italy

The 12th ICG in Roma Italy held at the Auditorium Parco della Musica was a stellar success. The theme of the conference was “Geosynthetics, Leading the Way to a Resilient Planet”. The four-day conference had a sold out exposition. The event addressed topics related to geosynthetics with keynote and parallel technical sessions. Resent developments in geosynthetics, stimulating fruitful technical and scientific interaction with professionals from all over the world. The 12th ICG provided an excellent opportunity to network and discuss technical issues. In attendance were an audience of engineers, geologists and consultants, public and private contractors, local national and international authorities, and many involved in research and practice related to geosynthetics. Congratulations to co-conference chairs Daniele Cazzuffi and Nicola Moraci for a job very well done. As you can see by the pictures below, like most people at the conference, we enjoyed the food, wine, music and environment of “Eternal City” with old and new friends.

George, Jamie Koerner, Daniele, Suzanne Cazzuffi

Couples Thiel, Christopher, Koerner, Watn,
with Sam Allen and John Cowland

GSI authored two papers at the conference entitled "Alternative Surfactant for Stress Cracking tests for HDPE Geomembranes" and "Geosynthetic damage due to installation stresses in ultra-light weight foamed glass aggregate versus conventional aggregate." We also contributed a presentation for ISO TC-Barriers entitled "Interpretation of Geosynthetic Barrier Test Results during Quality Assurance." All were well received and made the trip technically worthwhile.



Geosynthetic Barrier Performance Seminar
Bucharest, Romania 2023

Naue, SRGF and Klarwin jointly held a seminar on "Landfills: performance of the lining system, actual regulations and guides, monitoring, common practice and case studies." The event was held in Bucharest Romania of September 25th, 2023. It was held at a beautiful downtown conference center with over one-hundred in attendance. The agenda for the event was as follows:

George Koerner: "Essential characteristics of geosynthetic barriers (geomembrane and GCL) used in landfill applications."

Loretta Batali: "Slope Stability aspects for landfills"

Kent von Maubeuge: "Risks related to improper GCL specifications and wrong/design/installation of GCLs in landfills"

Darren Bland: "State of the art landfill building and operation – based on experience from United Kingdom"

Henning Ehrenberg: "Quality of geosynthetics; CE marking; specific quality requirements for landfill applications and performance confirmation by testing"

Lucian Pavel: "Geoklast – a smart instrument for sustainable and safe landfill operation"

George Koerner: Landfill case histories – consequences and lessons learned"

The audience was packed with engineers from the Romanian environmental agencies, landfill owners and private practice. They were active and engaged throughout the well-run event. Professor Loretta Batali from the Technical University of Civil Engineering Bucharest commented during the discussion that she had not been challenge to this extent in public conversation since her dissertation defense. Congratulations to Bogdan Tronac and his entire Naue team for an outstanding event. It was a great pleasure to share the podium with such and esteemed group of colleges and friends.

Speakers seated – Tronac, Koerner, Batali
Speakers standing- Bland, Ehrenberg,
von Mauberge and Pavel

Bogdan Tronac (Sales Director Central and South-Eastern Europe (Director) at ***Naue*** GmbH & Co. KG), Geo Koerner (GSI), Viorel Revenco (Naue Sales Manager) and Dan Enachesco (Naue Director General Romania)

Geosynthetic Institute's upcoming Activities:

- 2023 October 11th Geo Virginia
- 2023 October 18 GIGSA GCI-ICP Exams
- 2023 November 7th – 9th Geo "U", Austin, TX USA
- 2023 November 16 FGI Webinar
- 2023 November 28 Villanova at GSI
- 2023 December 12th CETCO GCL University, Irvine, CA USA
- December 22nd Q4 Zoom GSI BOA meeting
- 2024 January 24-26th ASTM D35 Louisville, KY USA
- 2024 April 19-26th ICGEE Busan, South Korea (Information on pg. 13)

Members Only Section on Website

Accessible with a members-only password. Your contact person/persons (names listed beneath member company) must obtain a password from Jamie Koerner to access the members-only section of the Geosynthetic Institute website. Jamie can be reached by e-mail at Jamie@geosynthetic-institute.org. When you get into this members-only section, the following information is then available.

- **GRI Test Methods (all)**
- **GRI Reports**
- **GRI Technical Papers (419 Citations)**
- **Notes of GSI Meetings**
- **Links to the GSs World**
- **Keyword Search for Generic Papers**
- **Example Problems**
- **Frequently Asked Questions (FAQs)**

GRI Reports

To date, we have 48 GRI Reports available to members and associate members. These reports vary in length from 30 to 200 pages. They are in the password protected section of our home page at www.geosynthetic-institute.org/member/reports.html.

White papers are available for free to everyone, however GRI reports are only free to members (located in the member's only section of the website). Non-members can purchase the reports from the online GSI bookstore.

Progress within GEI (Education)

Fellowships - 2023

The Geosynthetic Institute, along with its Board of Advisors (BOA) agreed to try a different approach this year. Instead of awarding $5000 fellowships to individual graduate students, the fellowship money was allocated to four (4) institutions for use in Geosynthetic related research. The four award recipients for the 2023-'24 academic year are:

Drexel University
Villanova University
American Society for Testing and Materials (ASTM)
International Geosynthetic Society (IGS)

Please note that individual student fellowship awards will resume again for the 2024-'25 Academic Year with proposals due on Monday, August 19, 2024.

Free Webinar Wednesdays

From January 4. 2023 until March 15, 2023, the Geosynthetic Institute gave **FREE 15 minute webinars** every Wednesday. This was open to everyone (members and non-members). The purpose was to educate everyone, even those not familiar with geosynthetics. The links are still posted on the Geosynthetic Institute's website and anyone who is interested in viewing the recorded webinars can do so at no cost. The following link provides access: https://geosynthetic-institute.org/free.html

Webinar Wednesday Schedule 2023

The "live" webinar schedule will resume in April, with one webinar per month. These GSI webinars (1 ½ hours in duration) will be available for purchases on our website.

www.geosynthetic-institute.org/webinar.htm

Date	GSI No.	Title
April 19	W-35	Geosynthetics used as Hydraulic Barriers - Description
May 31	W-31	Laboratory Testing of Geosynthetics- Description
June 21	W-32	Sustainability of Geosynthetics - Description
July 19	W-33	Ultraviolet Resistance of Geosynthetics- Description
August 16	W-23	Geosynthetic Filters: Concerns and Issues - Description
September 6	W-36	Geosynthetics used in Canal Linings - Description
October 11	W-26	Applications and Design of Geotextile Tubes- Description
November 15	W-34	Geosynthetics in Roadways- Description
December 13	W-6	Geosynthetics in Heap Leach Mining - Description

Each webinar provides 1.5 Professional Development Hours available upon completion of a short quiz

GSI Members Cost - $200
(unlimited number of attendees for GSI Members)
Nonmembers Cost - $250

Courses

The following pre-recorded courses are available through our online bookstore to both members and non-members.

1. Quality Assurance/Quality Control of Geosynthetic in Waste Containment Facilities
   (Recordings are available)

2. Construction Inspection of Mechanically Stabilized Earth (MSE) Walls, Berms and Slopes (Recordings are available)

The third and newest of GSI courses is an On-Line "Designing with Geosynthetics (DwG)" course. Please go to www.geosynthetic-institute.org/courses.htm and scroll down to Course #3. Here you will see the requisite details. The course itself is completely synchronized with the 6th Edition of the DwG textbook. It consists of 1540 slides with ~ 18 hours of voice over; about one minute for each slide.

Contact Jamie Koerner at jamie@geosynthetic-institute.org if you want additional information.

Activities within GAI (Accreditation)

This program is growing steadily with much interest internationally and with the proficiency test program (PTP)

- Began in 1995 w/ISO 17025 as model. GSI operates under 17011.
- 123 labs, 24 different countries, 265 possible tests

The following laboratories are accredited by the GAI-LAP for the number of test methods listed in parenthesis.

1[A] - TRI/Environmental Inc. (155 tests)
Jarrett Nelson -- (512) 263-2101
jnelson@tri-env.com

3[A] - WSP (43 tests)
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4[C] - Geosynthetic Institute (108 tests)
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8[B] - Solmax Geosynthetics (Propex) - Ringgold (18 tests)
Todd Nichols -- 438-553-3757
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9[B] - Lumite (17 tests)
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13[A] - Precision Geosynthetic Labs (TRI Env.) (75 tests)
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14[A] - Geotechnics (55 tests)
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20[A] - GeoTesting Express, MA (63 tests)
David Norton - (978) 635-0424
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22[B] - CETCO Hoffman Estates (11 tests)
Minerals Technologies Inc.
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24[B] - CETCO Lovell (12 tests)
Minerals Technologies Inc.
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25[B] - Solmax (TenCate), Pendergrass (13 tests)
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26[B] - Agru America Inc. (27 tests)
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29[e] - FITI Testing and Research Institute (80 tests)
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31[D] - NYS Dept. of Transportation (8 tests)
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[B]Manufacturers QC [D]Government

We have 4 new laboratories to date for this year. If anyone desires more information on the GAI-LAP program, its test methods, the associated laboratories, etc., please go to our website www.geosynthetic-institute.org/gai/lab.htm or contact George Koerner.

Activities within GCI (Certification)

GSI presently has three separate inspector certification programs. One (began in 2006) is focused on QA/QC of field inspection of waste containment geosynthetics and compacted clay liners. The second (began in 2011) is focused on MSE Wall, Berm and Slope field inspection. The third, on Geosynthetic Designer Certification began on September 1, 2016. See our website at www.geosynthetic-institute.org under "certification" for a description and information on all three of them.

Applications to sit for the GCI-ICP exams need to be submitted to the Geosynthetic Institute for approval prior to taking the exams. Applications and payment information for the exams can be found at: https://geosynthetic-institute.org/applications.htm

Program #1 - Inspection of Liner Systems for Waste Containment Facilities

Geo U – Austin, Texas

Geo U will be holding several in-person courses at the Sonesta Bee Cave Austin Texas Hotel staring on November 7 – 9. The QA/QC course and GCI-ICP inspector certification exams will be given at the educational event. For more information and registration, please go to:

https://events.eventzilla.net/e/geou-2023-2138571979

Inspector Certification Test Results 2006-2023

Year	Geosynthetic Materials		Compacted Clay Liners	
	No. of people taking exam	No. of people failing exam	No. of people taking exam	No. of people failing exam
2006	141	5 (3%)	128	12 (9%)
2007	82	11 (13%)	73	12 (16%)
2008	95	25 (26%)	89	20 (22%)
2009	36	7 (19%)	36	2 (5%)
2010	59	12 (20%)	54	7 (13%)
2011	54	6 (11%)	53	3 (6%)
2012	34	5 (15%)	28	3 (11%)
2013	32	4 (12%)	30	1 (3%)
2014	45	1 (3%)	42	3 (7%)
2015	56	6 (11%)	51	6 (12%)
2016	36	3 (10%)	35	5 (18%)
2017	78	5 (6%)	66	3 (4%)
2018	53	5 (10%)	51	1 (3%)
2019	114	20 (18%)	119	15(13%)
2020	100	14 (14%)	92	10 (11%)
2021	70	14 (20%)	61	8 (13%)
2022	89	15 (17%)	80	13 (16%)
2023	27	3 (11%)	27	5 (18%)
Total	**1201**	**161(13%)**	**1124**	**129(11%)**

TRI Environmental Inc. teaches two courses, "Construction QA/QC for Geosynthetic Installation" and Construction QA/QC for Compacted Clay Liners and GCL Installation" in preparation for taking the Inspector Certification exams.

The Geosynthetic Institute has a pre-recorded "QA/QC of geosynthetics in waste containment facilities" course that can be purchased by anyone wanting to take the course online (accommodates your schedule) in preparation for the GCI-ICP certification exams. More information can be found at: www.geosynthetic-institute.org/courses.htm

Program #2 - Inspection of MSE Walls, Berms and Slopes

While a field inspector cannot require proper design or direct a contractor how to build a wall, flaws can be identified for possible design modification or mitigation action. Furthermore, and at minimum, construction practices can be observed and corrected if inadequate or improper. The official launch of this inspection program was on December 1, 2011 with a course and the examination afterward. A somewhat revised course on November 29, 2012 was presented. Presently, the corresponding course for this certification program has been transferred into a series of six presentations that have been recorded and can be viewed at your leisure.

Program #3 - Geosynthetic Designer Certification

Please see www.geosynthetic-institute.org/gdcpintro.pdf for the requisite details. Included are introduction (rationale behind the program was given in a recent GSI Column called "We're Losing the Battle"), disclaimer, requirements, application, reference material, sample questions, proctor manual and proctor application. You must have six-months geosynthetic designer experience to take the exam.

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 three countries (Korea, Taiwan and India), and potentially 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.

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). **INHA University** is located in Incheon and the geosynthetics laboratory is led by Professor Han-Yong Jeon.

Dr. Jeon is happy to announce and chair the **2nd International Conference on Geosynthetics and Environmental Engineering (ICGEE2024)** to be held on April 19–20, 2024, in Busan, South Korea. The ICGEE2024 combines Academia with Industry to adapt scientific achievements into practical applications in the field of Geosynthetics and Environmental Engineering. The 2nd ICGEE will continue to promote relevant engineering research and applications in a vast range of topics, including Geosynthetic applications and sustainability, Civil and Structural Engineering, Environmental Engineering and Science. The event will give researchers and engineers from around the world the opportunity to present and discuss recent developments in the field. The call for papers is open. Please choose one of the following links to submit your contributions:

https://www.icgee.com/openconf/openconf.php
Email: cfp@icgee.com

Important Dates for 2nd ICGEE Conference:
Submission Deadline: February 20, 2024
Notification Date: March 10, 2024
Registration Deadline: April 15, 2024

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). The Director is Dr. Chiwan Wayne Hsieh who is a Professor in the Department of Civil Engineering and Dean of the R & D Office.

GSI-India under the direction of Dr. T.V. Sreekumar was formed in 2015. The hosting organization is the Bombay Textile Research Association (BTRA) which is a premier textile research institute providing testing, research, training and consultancy services. BTRA is located in Mumbai, India and is accredited as per ISO 17025. The Geosynthetic test lab is also GAI-LAP accredited. Testing at BTRA is performed as per the latest EDANA, ASTM, INDA, AATCC, ISO, EN and AASHTO international standards. BTRA is known for its excellence in textile R & D and is currently branching out into all forms of geosynthetics with a fantastic R & D laboratory.

GSI Member Organizations

We Sincerely Thank all 63 (47 full and 16 associate) Members Organizations of the GSI family for their continued guidance and support. Without members, GSI could not exist. The current GSI member organizations and their contact members are listed below.

Solmax
Mark Harris/Jacques Cote/Simon Gilbert St-Pierre/ Jimmy Youngblood/Guillaume Beaumier
U.S. Environmental Protection Agency
David A. Carson (BOA)
Federal Highway Administration
Silas Nichols/Daniel Alzamora
Golder Associates Inc.
Frank Adams/Paul Whitty/Linda Grover
Tensar International Corporation
Mark H. Wayne/Joseph Cavanaugh/Jacek Kawalec [BOA]
TenCate Geosynthetics
John Henderson/John Lostumbo/Rene Laprade [BOA]
Minerals Technology/CETCO
Reza Gorakhki/Stacy Byrd/Michael Donovan/Hilary Walker
Huesker, Inc.
Flavio Montez/Andreas Elsing

NAUE GmbH & Co. KG
Alexander Naue/Henning Ehrenberg [BOA]
Propex Operating Company LLC
Drew Loizeaux/Noah Nichols
Berry Global Inc.
Keith Misukanis/Monica Baker
TRI Environmental Inc.
Sam R. Allen [BOA]/C. Joel Sprague
U. S. Army Corps of Engineers
Kevin Pavlik/Richard DePasquale
Chevron Phillips Chemical Co.
Ashish Sukhadia/Lawrence Szmutko/Miranda Rine [BOA]
CARPI, Inc.
Alberto M. Scuero/Massimo Bugliosi/John A. Wilkes
Civil & Environmental Consultants, Inc.
Tony Eith
AGRU America, Inc.
Tom Nichols/Markus Haager
INHA (GSI-Korea)
H.-Y. Jeon
Waste Management Inc.
Greg Cekander/Burrill (Bo) McCoy [BOA]
GeoComp/GeoTesting Express
W. Allen Marr/Gary Torosian/Joe Tomei
ATARFIL
Emilio Carreras Torres/Jorge Fernandez Lopez/
Gabriel Martin/Alejandro Carreras Torres
Republic Services Inc.
Joe Benco/ Mike Beaudoin/Dave Vladic
InterGEO Services Co.
Şükrü Akçay/Archie Filshill
Viaflex
Clint Boerhave/Stacy Coffin/Greg Anderson
CTI and Associates, Inc.
Te-Yang Soong [BOA] / Kevin Foye
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Kris Khilnani/Suji Somasundaram
Carlisle Syntec, Inc.
Paul Markel/Vivian Zhang
EPI, The Liner Co.
Daniel S. Rohe/Paul Livingston
Weaver Consultants Group, Inc.
Mark Sieracke
Aquatan (Pty) Ltd.
Piet Meyer/ Sanet van der Merwe
Jones Edmunds, Inc.
George Reinhart/Tobin McKnight
Afitex-Texel
Pascal Saunier/Stephan Fourmont
BTRA (GSI-India)
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Moreno Scotto/Sachin Mandavkar/Knight Piesold
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Mohamad Al-hawaree/Thomas S. Ingra
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INOVA Geosynthetics/AERO Aggregates
Archie Filshill/Theresa Loux
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SKAPS Industries
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Lance Reed/Ray Peebles
Doha
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Dell Doyle/ Rhythm Chokshi
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