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GRI White Paper #16

“Status of Geosynthetics Conformance Testing in the United States”

by

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QUALITY IN GEOSYNTHETICS

Geosynthetics, being manufactured products, have four levels of quality to address insofar as an acceptable material is concerned

- (i) Quality control in manufacturing (MQC); which is, oftentimes, organized around the ISO 9000 protocol.
- (ii) Quality assurance in manufacturing (MQA); which is the inspection of the product by the manufacturer or by an independent consultant.
- (iii) Quality control in construction (CQC); which should follow the quality manual developed by the installation contractor. Individuals and companies can be certified by the International Association of Geosynthetic Installers; see www.iagi.org for details.
- (iv) Quality assurance in construction (CQA); which is the actual inspection of the installed geosynthetic product. Certification of CQA personnel is available through the GCI-ICP; see www.geosynthetic-institute.org/icpintro.htm for details.

This white paper concerns indirectly itself with all of the above but mainly focuses on the fourth item, namely CQA, insofar as the minimum level (type and amount) of conformance, or compliance testing* required by state regulation or by federal guidance documents. It is an important issue since the as-installed geosynthetics must eventually be approved by the regulatory authority for ultimate acceptance and permit issuance.

* Conformance testing, also known as compliance testing, is a methodology used in engineering to ensure that a product meets a defined set of standards or specifications. These standards or specifications are commonly developed by independent entities such as an institute, society, or consortium. Conformance testing can be carried out by private companies and/or laboratories that specialize in such services. This is not the manufacturer's quality control testing carried out by the vendor in an in-house laboratory, but rather a final check carried out by the CQA organization to insure that the client has received the material that meets the project-specific specification prior to use.

It should be noted that conformance testing procedures are covered in ASTM D4354 Section 8, which gives guidance on sampling procedures, and in ASTM D4759, which is a practice standard on general procedures of conformance of geosynthetics. It is important to note, however, that there is no specificity in either of these very generalized ASTM Standards.

THE SURVEY FORM AND RESULTS

This survey was suggested by a GSI member who was interested in conformance testing trends for the various geosynthetics used for landfill liner and cover systems. Since CQA organizations hold their specific procedures and practices proprietary, the various state environmental agencies were the targeted group from which to request the basic minimum of required testing information. A survey form was sent to environmental agency personnel in all fifty states. It was kept as simple as possible so as to solicit the maximum amount of responses. That said, many instances required follow-up internet searches to obtain the appropriate information.

Eventually, forty-three (43) state agency personnel responded and the authors express a sincere gratitude to them in this regard. The results of the survey are given in the Table 1 following.

Table 1 – Survey Information by Individual States

	AZ	AR	CA	CO	CT	DE	FL	ID	IL	IN	KY	LA	ME	MD	MA	MI	MN	MS	MO	MT	NE
1. Do your regulations contain general and/or specific requirements for CQA conformance testing for geomembranes, geotextiles, geocomposites, geogrids and plastic pipe?																					
a. All yes													X		X	X					
b. All yes except pipe							X			X											
c. All no	X			X	X	X		X	X			X		X				X	X	X	X
d. GM only		X	X								X						X				
e. GM and pipe																					
2. If no, does your agency rely upon:																					
a. US EPA guidelines (min. tech. guidance)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
b. Manufacturer's data	X			X	X	X	X			X		X				X	X		X		X
c. Design consultant's data	X		X	X	X	X				X		X					X		X		X
d. Literature or historical data	X			X	X	X				X		X					X		X		X
e. Other - CQA conformance plans									X					X							
3. Does your regulation specifically state the interval for destructive seam sampling of geomembranes?																					
a. Yes		X					X			X	X		X			X					
b. No	X		X	X		X			X			X		X*	X		X		X	X	X
4. If yes, at what interval?		500'					500' *			500' *	500'		500'			500'					
5. If no, how do you approach the situation?																					
a. Design consultants recommendation			X	X		X											X		X		X
b. CQA organization recommendation			X	X					X					X			X		X		X
c. Manufacturer/installer recommendation	X			X		X											X				
d. Other- Independent contractor														X							
Use Standard of 500 ft or GM14																					
6. Do your regulations or guides allow for a nondestructive (NDT) alternative to destructive tests?																					
Allows infrared sensing				X					X				X		X						
Allows ultrasonic testing				X					X				X		X						
Allows electrical leak integrity survey				X		X	*		X				X		X		X				
Allows spark testing				X		X	X		X			X	X		X						
Other – Air lance testing									X												
Vacuum chamber method														X							
Requires NDT testing, but method not specified											X						X				
7. Does the use of any of these NDT methods allow for reduction or elimination of the destructive sampling protocol?																					
a. Yes				X			X														
b. No		X							X		X					X			X		
c. Maybe/Possibly						X							X		X						

*Florida – Changing regulations to say DT are required at 500 ft interval unless applicant chooses to use an electrical leak location method. In that case, DT will be allowed at every 1000 ft of seam.

*Indiana – 500' if welded with fusion weld and 400' if welded with an extrusion weld

Table 1 (continued) – Survey Information by Individual States

	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	WA	WV	WI	WY
1. Do your regulations contain general and/or specific requirements for CQA conformance testing for geomembranes, geotextiles, geocomposites, geogrids and plastic pipe?																						
a. All yes			X		X	X		X					X							X		
b. All yes except pipe																						
c. All no	X						X			X	X			X	X	X	X		X			X
d. GM only		X		X					X													X
e. GM and pipe												X						X				
2. If no, does your agency rely upon:																						
a. US EPA guidelines (min. tech. guidance)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
b. Manufacturer's data			X			X	X						X	X	X	X	X				X	X
c. Design consultant's data			X			X	X						X	X	X	X						X
d. Literature or historical data						X							X			X		X			X	
e. Other - CQA conformance plans										X	X						X		X			X
3. Does your regulation specifically state the interval for destructive seam sampling of geomembranes?																						
a. Yes			X	X	X			X	X							X						X
b. No		X				X	X				X		X	X	X		X	X	X	X		X
4. If yes, at what interval?			500' *	500'	500'			500'	500'							500'						500' *
5. If no, how do you approach the situation?																						
a. Design consultants recommendation						X	X				X		X	X			X				X	
b. CQA organization recommendation						X	X				X		X	X	X				X		X	X
c. Manufacturer/installer recommendation						X	X						X	X							X	
d. Other- Independent contractor																						
Use Standard of 500 ft or GM14		X																X				
6. Do your regulations or guides allow for a nondestructive (NDT) alternative to destructive tests?																						
Allows infrared sensing						X							X				X					
Allows ultrasonic testing						X							X				X					
Allows electrical leak integrity survey			X			X							X				X					X
Allows spark testing						X							X		X		X					
Other – Air lance testing			X						X							X						
Vacuum chamber method									X							X						
Requires NDT testing, but method not specified					X			X													X	
7. Does the use of any of these NDT methods allow for reduction or elimination of the destructive sampling protocol?																						
a. Yes																						X
b. No			X		X	X	X	X	X					X	X			X			X	
c. Maybe/Possibly													X			X	X*					

*New Jersey – every 400' with temps 32-40° and every 500' with temps over 40°.

* South Carolina – all are possible, but everything is done on case-by-case basis. These answers apply to the Division of Waste Management only.

*Utah - is evaluating reducing or eliminating destructive testing.

*Wisconsin – not in the regulations, but reduction of destructive sampling frequency has been allowed to every 1000 ft of seam

COMMENTARY ON SURVEY RESULTS

Table 2 provides the summary of the survey information retrieved from Table 1. In Question #1, it is seen that 22 states do not require specific conformance testing in their state regulations. That said, all states must comply with the minimum technology guidance (MTG) set forth by the U.S. Environmental Protection Agency, but these are quite generalized and only refer to field seam testing. There are some states, however, that address the product conformance issue specifically and go beyond MTG for various types of geosynthetics, mainly geomembranes, but again in a very generalized manner.

Thus, the major finding of this survey, on the specific issue of conformance testing, is that no specificity of what tests, what frequency, what values, etc., is being required in existing state regulations. We assume that the states are relying on design and CQA organizations to set site-specific and product-specific conformance requirements in this regard. This is corroborated by the response to Question #2.

In Question #2, it is seen that in addition to federal MTG, most states rely on information from manufacturers, design consultants, published literature, or other available historical data.

Questions #3 and #4 focus on destructive testing intervals for field fabricated geomembrane seams. Of the thirteen states that address the topic, all of them use the Federal EPA interval of one sample for every 500 feet (150m) of seam. Other variations on this issue are given in Question #5 which seems to indicate that some state regulators are accepting alternative recommendations.

Question #6 addresses the possible use of nondestructive (NDT) methods for geomembranes. This is interesting in that there appears to be some flexibility insofar as several modern approaches to the topic. In particular, eleven states allow for electrical leak integrity surveys.

This, of course, leads to Question #7 which is the second major reason (after assessing the conformance testing issue) for conducting this survey, i.e., whether or not a reduction in destructive seam testing can occur when using a NDT method such as the electrical leak integrity survey. Only three states said “yes”, six said “maybe/possibly” and fifteen said “no”. The other states were silent on the issue.

Table 2 – Summary of Survey Information

	Total No. of States
1. Do your regulations contain general and/or specific requirements for CQA conformance testing for geomembranes, geotextiles, geocomposites, geogrids and plastic pipe?	
a. All yes	9
b. All yes except pipe	2
c. All no	22
d. GM only	8
e. GM and pipe	2
2. If no, does your agency rely upon:	
a. US EPA guidelines (min. tech. guidance)	43
b. Manufacturer's data	21
c. Design consultant's data	17
d. Literature or historical data	13
e. Other - CQA conformance plans	7
3. Does your regulation specifically state the interval for destructive seam sampling of geomembranes?	
a. Yes	13
b. No	25
4. If yes, at what interval?	13 - all at 500'
5. If no, how do you approach the situation?	
a. Design consultants recommendation	13
b. CQA organization recommendation	16
c. Manufacturer/installer recommendation	9
d. Other- Independent contractor	1
Use Standard of 500 ft or GM14	2
6. Do your regulations or guides allow for a nondestructive (NDT) alternative to destructive tests?	
Allows infrared sensing	7
Allows ultrasonic testing	7
Allows electrical leak integrity survey	12
Allows spark testing	10
Other – Air lance testing	5
Vacuum chamber method	3
Requires NDT testing, but method not specified	5
7. Does the use of any of these NDT methods allow for reduction or elimination of the destructive sampling protocol?	
a. Yes	3
b. No	15
c. Maybe/Possibly	6