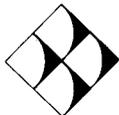


Columbus Co 24-02

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24022003



G.N. RICHARDSON & ASSOCIATES

Engineering and Geological Services

December 15, 2003

Mr. Edward Mussler
NC DENR Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, North Carolina



**RE: Request for Permit to Operate
Cell 1 Industrial Landfill
International Paper Industrial Landfill Permit # 24-02
Riegelwood, North Carolina**

Dear Mr. Mussler

Construction of Cell 1, the lined lateral expansion of the existing industrial landfill is complete. The attached certified Construction Quality Assurance Report is submitted to you in accordance with the Conditions of the Permit to Construct, issued December 30, 2002. Submitting this report completes the items required by the conditions of the Permit to Construct.

The documentation contained within the one volume report establishes the Record of Construction of the landfill cell, complete with photographs, as-built drawings, material tests, well abandonment records, and the Geologist's certification of subgrade conditions of Cell 1. Should you have any questions regarding the report, please feel free to contact Greg Richardson or me at 919-828-0577. For any other questions about the landfill, please contact Ed Kreul at 910-655-6229.

Sincerely,

Greg Mills
Project Engineer

Enclosures

cc: Edward Kreul, International Paper
Richard Lowe, International Paper

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director



September 2, 2003

To: Stuart Parker, NC Super Fund Section

From: Ed Mussler, Solid Waste Section

A handwritten signature in black ink, appearing to be 'Ed Mussler', written over the 'From:' line of the memo.

RE: Comments on *Removal Investigation Plan, Former International Paper Masonite Corporation Facility, Spring Hope, North Carolina.*

Dear Stuart,

Per your request I have reviewed the above referenced document with respect to Solid Waste Section's concerns or perspective. The testing submitted to date appears to document that the wood fiber pile is not a characteristic hazardous waste. The conclusions reached by the consultant, URS Corp appear valid. In the past few years the Section has been contacted by various entities requesting permission to use the material for daily cover, or as an amendment to the vegetative layer in a landfill cap. Testing done for this purpose indicates that formaldehyde is present as well as small amounts of trace metals, that could be the limiting agronomic factors for using this material unblended. In addition the data indicates that significant soil preparation, such as lime and extra nitrogen, would be needed to use this material in a landfill cover.

While there appears to be no limitation on disposing of this material in a properly permitted sanitary landfill, alternative uses, such as listed above, or as a sludge amendment, at permitted landfills, do require Solid Waste Section involvement. The material was used at the Riegelewood IP facility as a light weight fill and sludge amendment. This use at the Riegelwood facility requires Solid Waste Section approval. Please note the approval is not required because of the nature of the material, but for other reasons including the type of facility, and the facilities approved service area.

If you have any further questions, please don't hesitate to contact me.

June 17, 2002

Ms. Joan A. Smyth, P.G.
G.N. Richardson & Associates
425 N. Boylan Avenue
Raleigh, NC 27603

Re: Wood Fiber for Alternate Daily Cover and Final Cover Material, Johnston County
Landfill, Permit Number 51-03.

Dear Ms. Smyth,

Sometime ago you contacted the Solid Waste Section (Section) with respect to using some wood fiber material, from International Paper, as alternate daily cover and as a soil amendment in the final cover at the Johnston County Landfill. In May of 2002 you faxed me a copy of your correspondence. I apologize for the delay in responding to your request.

The Section has dealt with this material and similar requests from other MSWLF's in the past. While you submitted some old TCLP data indicating non-detectable results, you should be aware that analysis do exist that indicate that some trace metals and small amounts of formaldehyde exist in the material that has been tested to date. This is an extremely large pile of material and International Paper has been working with both Region IV EPA and the North Carolina Superfund Section, for years, to determine how best to handle this material and any cleanup of the site that may be necessary. Agronomic data on the material also indicates that the material may require significant additional soil preparation, such as lime and extra nitrogen addition, to ensure that an adequate vegetative cover can be established at closure.

These disclosures being made, the Section would consider further processing of your request should you so desire. The material could be used at the facility and stockpiled either in the cell, on intermediate cover, or at an alternate location away from groundwater monitoring wells, that you would propose to the section. Proper sedimentation and erosion control of the pile would be needed as well as possible dust suppression measures.

The material that the Section has seen indicates that it is mostly wood fibers. Its use as an alternate daily cover would need to be tested in a pilot for at least 90 days. The purpose of the trial would be to determine the optimum ratio of material to native soil to use as alternate daily cover. Recent history at landfills that have used mulch, from hurricane debris, as alternate daily cover have shown it to be inadequate to suppress fires equivalent to that of a six inch soil cover. Consequently the Section is reevaluating the use of the material, particularly with respect to the amount and frequency of traditional soil cover.

The Section would approve incorporation of the material into a final cover. The county would need to provide more specifics as to the amount of the material to be added to the required vegetative layer of the final cover, and how it is proposed to be blended and placed in the final cover, prior to its use. Pending the results of more frequent laboratory testing of the material, particularly from the middle and bottom of the pile, the use of the material outside the limits of the liner system is not approved.

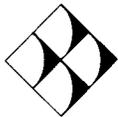
If you desire to proceed with a trial demonstration of this material as ADC then you should contact your Waste Management Specialist, Ben Barnes, to conduct and monitor the trial. If you have any further questions regarding the approval for use of the wood fibers, or the conditions set forth in this letter, please contact the Section. The phone number is 919.733.0692 ext 343. Mr. Barnes may be reached at the Raleigh Regional Office of DENR. His number is 919.571.4700.

Sincerely,

Edward Mussler, P.E.
Environmental Engineer
Solid Waste Section

cc:(via email)

Haywood Phthisic, Johnston County
Pieter Scheer, GNRA
Jim Barber, DWM
Mark Fry, DWM
Ben Barnes, DWM



G.N. RICHARDSON & ASSOCIATES

Engineering and Geological Services

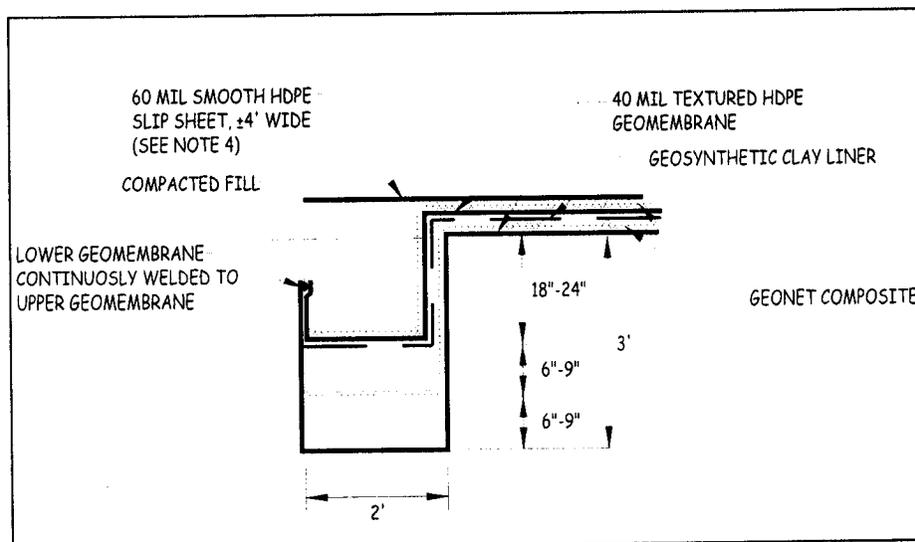
May 27, 2003

Mr. Edward Mussler
Environmental Engineer
NC DENR Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27605

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 6/3/03 BY JMD
2402 Cell 1 PTC

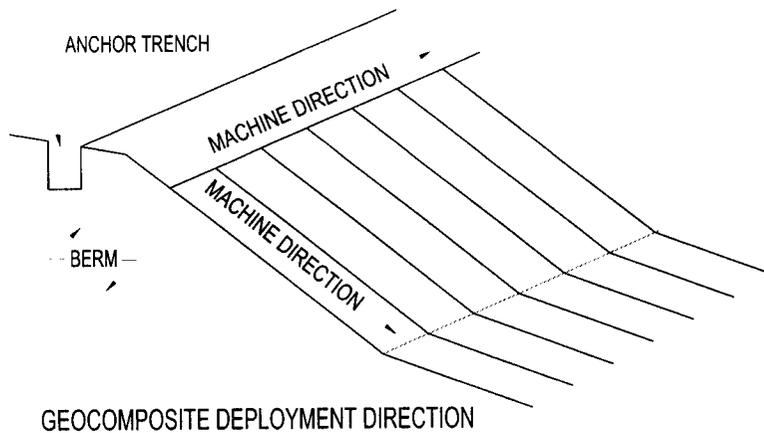
**RE: International Paper
Riegelwood, North Carolina
Cell 1 Construction
Anchor Trench and Geocomposite Installation**

Just to keep you up to date on the latest events at the International Paper landfill construction in Riegelwood, we are having some difficulty keeping the anchor trench open after rain storms. You may recall that the liner system is a 5-layer synthetic sandwich, with 40-mil HDPE, a geocomposite, a GCL, a 40-mil HDPE primary liner and a primary geocomposite. A sketch of the anchor trench is shown below.



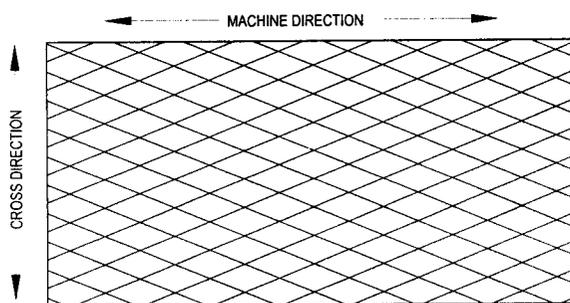
To install the synthetics in such a way as to minimize the time that elapses until the anchor trench is backfilled, the installer wants to place all of the layers of geosynthetics into the trench as quickly as possible. This means that the anchor trench will not be backfilled in lifts as is shown on the permit drawings. As we discussed in the geosynthetics pre-installation meeting on May 13, this minor change can be covered in the as-built drawings.

A second change involves the direction of deploying the uppermost geonet composite (geocomposite). As is typical in geosynthetic installations, the synthetics will run down the slope to the floor. The exception is the primary geocomposite. It will run with the anchor trench. In other words, each roll of the primary geocomposite will run about 14-feet out of the trench, and 200-feet along the trench. The sketch below illustrates the proposed deployment direction.



As you can see in the above sketch, the first panel of geocomposite will be run with the machine direction parallel to the anchor trench and across to the slope, but the remaining panels will be run with the slope. Nothing in the project specifications prohibits installing the geocomposite this way, but it is usually run with the slope. I talked with Perry Vass, an engineer with the geocomposite manufacturer about the proposed installation. He said that there might be a reduced transmissivity in the cross direction. I told him that since the only panel that would possibly get flow in the cross direction is the one at the top of the berm, but there should be very little flow at the top of the berm anyway.

My other concern was for the strength of the geonet core of the geocomposite. Perry said that the lamination of the geonet would be at least as strong in either direction. The geonet is laminated to form diamond patterns, as shown in the sketch below.



As seen in the sketch, the diamond pattern is oriented so that the strength of the lamination of the geonet should be stronger in the cross direction than in the machine direction. As a precaution, we are spacing the nylon ties on 2-foot centers along the geocomposite seams running in different directions (as opposed to every 5-feet as is required by the specifications).

Since this change is not a deviation from the specifications, it does not require a design modification. However, since it is an atypical installation technique, the project owner wanted to be certain that you were aware of the deployment method.

If you have any further questions or comments, please contact me at 828-0577 extension 129.

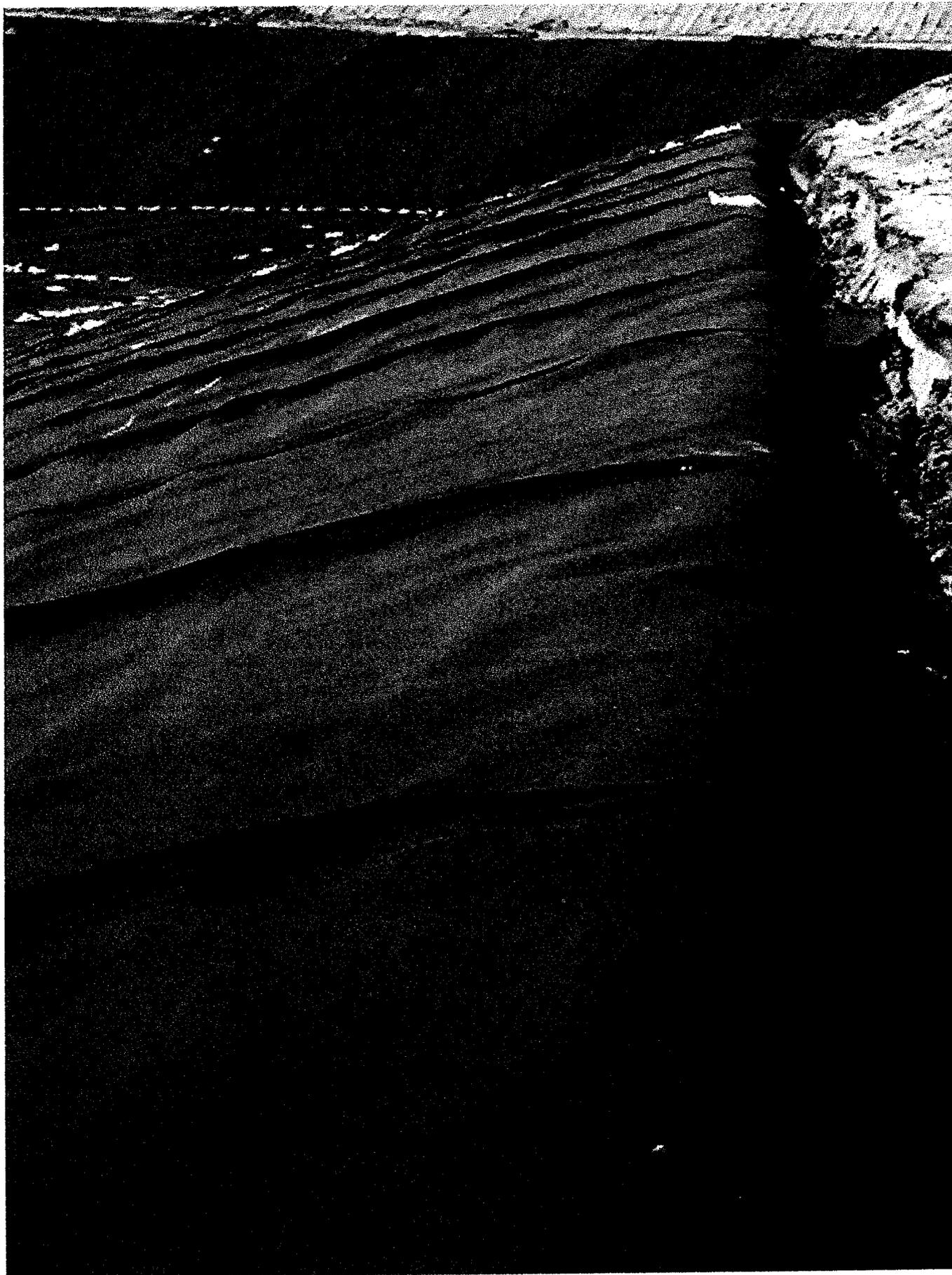
On behalf of International Paper, thank you.

G.N. Richardson & Associates

A handwritten signature in black ink, appearing to read 'G. Mills', with a stylized flourish at the end.

Gregory G. Mills, P.E.
Project Engineer





**International Paper
North Bay Landfill Cell 1 Construction
Progress Meeting No. 20 Summary
04/23/2003**

Attendees:

Ed Kreul	International Paper (IP)
Rich Lowe	IP
John Carver	Phillips & Jordan (P&J)
Tom Morgan	Brunswick Surveying
Greg Richardson	G. N. Richardson & Associates (GNRA)
Randy Sederstrom	GNRA
Greg Mills	GNRA

Safety

No accidents.

Some diesel fuel spilled Wednesday morning when the pump did not shut off. The spill was soaked up, and the soil was dug up and placed in containers.

Because of the safety record of the liner installer, their crews will have to be escorted while on the site. Mr. Carver said that he would have some personnel go through additional training so that they can escort the liner crew. Mr. Sederstrom said that he would be with the liner crew "16 hours a day."

Mr. Kreul said that the safety requirements for the sub-contractors needs to be better clarified during the bid process. (In the bid proposal, the contractor is required to meet the following safety criteria:

TIR (Total Incidence Rate):	3.2 or less
LWDIR (Lost Workday Incidence Rate):	1.0 or less
EMR (Experience Modifier Rate):	0.75 or less

The bid proposal also states:

Prior to the commencement of work, the successful contractor's employees (including supervision) will be required to attend a Contractor's Safety Orientation Session. In addition, it is the supervisor's responsibility to communicate these safety rules and regulations to sub-contractors.

Survey

Mr. Morgan gave out a volume summary for the cut quantity in Cell 1. Mr. Mills had requested Mr. Morgan to verify the volume, based on the design subgrade elevation and the topo by Brunswick Surveying on January 24. Mr. Mills said that his copy of the survey had some break lines missing, which had created some problems with running the volume. Mr. Mills said that the GNRA volume calculations had gone up every time the volume was re-calculated. GNRA calculated a volume of cut of 17,453 cubic yards. Mr. Morgan said that he had done the calculations, using a grid spacing of 2-feet, and had a volume quantity of 17,577 cubic yards. It was agreed to accept Mr. Morgan's value as the pay quantity.

Mr. Carver requested a survey of the Gooseneck borrow site for final payment for subgrade. He said that he would stop hauling from Gooseneck on Wednesday, April 23. Mr. Morgan was asked if he could compute the volume before April 30, so that it could be included on the next pay request. Mr. Morgan said that he believed that would be possible.

Berm Construction/Cell Grading

Mr. Carver said that today would be the last day of hauling from the Gooseneck site. He believes he will have enough soil at the construction area to finish construction to the subgrade. Mr. Carver estimated that there is a cut of 0.6 to 0.8 feet on the bottom of the cell. In addition, excess material is being taken from the berm slopes.

P&J has begun fine grading the cell bottom, starting from the west side, moving east.

Mr. Lowe asked about survey conformation for the base grades in the cell. Mr. Carver said that conformation survey will not be needed before next Wednesday, but he will have a better idea about when to survey on Monday. He will talk with J.D. when he comes out to survey the Gooseneck borrow area.

Borrow Area

Once the cell is at subgrade and the liner crew is on-site, P&J will not take any borrow material until they begin placing the protective cover, which should be about a month after the liner crew starts. Mr. Carver said that he would have to double handle the protective cover from the Gooseneck site.

Based on observation at the Gooseneck site, Mr. Mills estimated that there may be 18-20 thousand cubic yards of material available at the currently permitted borrow area (Area

A). IP has a permit for an additional 5-acre area (Area C) east of the current borrow location on the Gooseneck site. However, it is a clayey soil that could be better used elsewhere. Mr. Mills explained the plan for swapping Area C for a new area that would join Area A with the 5-acre Area B. The existing roadway will remain, but will be lowered. Mr. Mills estimates that this area will yield around 90,000 cubic yards of material.

Two previous borings are in the area (JEP-6 by Joyce Engineering in June 2001, and B-2 by S&ME in April 1994). Each boring shows the material to be a fine to medium sand, or a clayey sand. The water table was at Elevation 33.7 in JEP-6, and approximately elevation 43 in B-2.

Mr. Lowe said that IP expects Mr. Mills to follow through with all necessary items to get the borrow permit.

Personnel

Mr. Mills said that he had heard that several of the people on site will be going to a different job next week, and asked Mr. Carver about operators available to do the finish grading. Mr. Carver has hired two new people this week. He said he would hire other people if he needs to. Mr. Carver said he expects to have 9 people on-site when the liner crew starts (counting himself), and added, "A typical landfill crew."

Mr. Mills asked if the newly hired personnel had experience with GPS equipment before. Mr. Carver said no.

Other Construction Issues

Liner Crew Mobilization

The liner crew will mobilize to the site on May 5, if the subgrade is ready. A formal liner pre-installation meeting will be held on Wednesday, May 7 at 1:00 p.m. Mr. Mills will invite representatives from NCDENR to attend.

Note: After the meeting, Mr. Carver asked if liner installation can begin before the Wednesday meeting. Mr. Mills said that installation could begin before the formal meeting on May 7, but not without an on-site meeting with Mr. Carver, Mr. Sederstrom and the liner installation superintendent.

Interim Berm

A discussion was held about changing the interim anchor trench detail. P&J have said that backfilling the anchor trench will be extremely difficult. Mr. Carver said that the detail, showing the anchor trench to be backfilled in lifts, will make backfilling especially hard. Mr. Mills said that the anchor trench will not have to be backfilled in lifts, but the trench could be sandbagged. A discussion ensued about relocating the anchor trench. In its current location (at the far side of the berm, future cells can be constructed without taking out the roadway on top of the interim berm. Therefore, the anchor trench will have to be placed at approximately the location shown on the Detail E/5/12. However, Dr. Richardson said that he would look at the detail to see if he could come up with an alternative.

Design Clarifications/Changes

Mr. Lowe asked about the geotextile on the south slope. The textile was originally planned as a cushion against damaging materials that may have been present in the south slope. However, with the large volume of fill that has been placed on the slope to build out the berm, the geotextile is not needed. A discussion ensued as to whether the geotextile could help prevent erosion, or if leaving out would be a problem with NC DENR. The geotextile will be left out from the south slope. However, Mr. Sederstrom said that an area on the southern eastern end that could need a cushion. Note: The extents of the area and if a cushion geotextile is needed will be clarified later this week

Submittals/Distributions

Mr. Morgan distributed the cell grading volume.

Housekeeping Other Items

Two rolls of geocomposite that were not supposed to be shipped are on-site (rolls 924157 and 924228). Mr. Lowe said the rolls could be used as a scrub sheet over the interim berm. Some of the geocomposite may be usable as the cushion geotextile on the southern eastern end of the cell (if needed).

Mr. Kreul said that approximately 10 trucks a day would be coming from HoltraChem, starting soon.

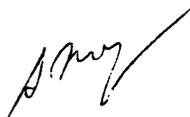
Upcoming Work Fine Grading

Action Items

- Mr. Mills to revise the connection of the underdrain manhole discharge to the forcemain.
- Mr. Mills to prepare sediment and erosion control modification.
- Mr. Mills to notify NCDENR about the geosynthetics pre-installation meeting.
- Dr. Richardson to look at the interim berm anchor trench detail.

The next meeting is scheduled for Wednesday, April 30 at 1:00 p.m.

MEMORANDUM

To: File
From: Stuart F. Parker, 
Hydrogeologist
Date: April 15, 2003
Subject: Masonite Corp., Fiberboard Division
Spring Hope, Nash County NC
NCD 055 359 079
Waste Wood Fiber Disposal Status

SFP received a call from Phil Slowiak (International Paper Co.) inquiring about the status of the Deferral approval by EPA Region IV. SFP reported having recently spoken with Jennifer Wendel and Ken Mallory (EPA) who were following up on the request.

SFP inquired as to the status of the fiber pile. Phil reported that approximately 20,000 tons (40,000 cu yd.) of the material had been transferred for use at the IP Riegelwood sludge stabilization site to repair the landfill failure. He reported that McGill Composting, who had expressed interest in using the material to bulk out compost, was holding back on demand for the time being for inventory management. However, they anticipated the withdrawal rate of 2-3 trucks per week to increase to 4 to 6 trucks.

Phil Slowiak reported on the emergence of an additional disposal option, involving the former Scotts/Hypox company (now P&L Bark) in Louisburg NC. P&L representative Mike Pyler reportedly observed the fiber at Riegelwood and proposed blending the material with wood bark to produce retail grade mulch. Phil said that Pyler had already analyzed the fiber, and that its high carbon/low nitrogen content was suitable for this use. Pyler was expected to contact SFP shortly to discuss this option, which potentially would consume the remainder of the material stockpiled at Spring Hope. Phil assured that Pyler's analyses would be documented as required by the Deferral AOC. Phil also noted that Louisburg was only about 25 miles from Spring Hope, minimizing potential transportation costs.

Dear Greg,

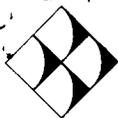
This email is in response to your email of 1/31/03. It is my understanding that the final closure plan is being prepared and should be submitted to the Section early in the week of Feb 3. Any other approaches or materials should be included in the final closure plan and submitted to the Section for review. It is not the intent of the Section to allow the continued disposal of waste in the landfill, as it had to cease accepting wastes on January 1.

You indicated in your email that monitoring of the waste slide area indicates some movement of the waste behind the slide area. You are requesting the ok to place stabilization material in the slide area, prior to receiving an approval of the final closure plan. Previously IP has identified lightweight fill materials that have sufficient shear strength to make them beneficial for stabilizing the sludge. (Woodyard waste, ash, bulked pond material, sawdust, Krueel letter 1/13). In an email of January 17, 2002 I acknowledged the approach being proposed, specifically the placement of the specific light weight materials for the purpose of stabilizing the slide area prior to the approval of the final closure plan and concur with that construction activity occurring prior to the final approval of the closure plan.

To the maximum extent possible, prior to the approval of the final closure plan, stabilization should be accomplished through the use of the previously approved lightweight fill materials generated at the Riegleswood facility.

I look forward to receiving the final closure and remedial action plan for the facility.

Regards
Ed Mussler



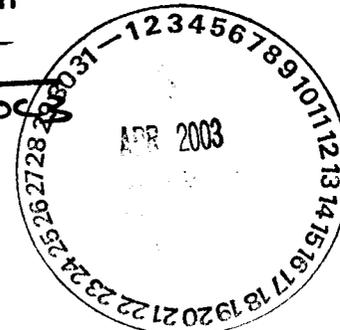
G.N. RICHARDSON & ASSOCIATES

Engineering and Geological Services

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 5/12/03 BY JMS
2402 PTC AI DOC

April 1, 2003

Mr. Edward Mussler
Environmental Engineer
NC DENR Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27605



**RE: Permit Modification
Request for Specification Revision
International Paper Industrial Solid Waste Landfill
Facility Permit Number 24-02
Riegelwood, North Carolina**

Dear Mr. Mussler:

On behalf of International Paper, G.N. Richardson & Associates is requesting approval to modify the Project Specifications for the above project. **Section 02172** of the Project Specifications (included in Permit Documents) presently requires the **Geonet Drainage Media** to have a ply adhesion of 2.0 pounds per inch (ppi) average, and a minimum for any specimen of 1.0 ppi. The required test method is ASTM D 413. We are proposing to change the requirement to 1.0 ppi average, and no more than one of five specimens to be less than 0.5 ppi. Additionally, we are proposing GRI GC7 as the test method.

The change is requested for several reasons. First, the ply adhesion results are not an indication of shear performance, only an indication of manufacturing quality. Second, increasing the required ply adhesion to average values above 1.0 ppi can have a detrimental effect on transmissivity, as the pressure applied to gain the adhesion may deform the geonet core. Third, an examination of the samples of the material proposed for use at the site (as you saw) shows the material to have ample adhesion on specimens with less than 2.0 ppi results. Finally, we request changing the test method since GRI GC7 uses a 4-inch wide sample, rather than a 2-inch wide sample. A 4-inch sample seems to better reflect the properties of the composite, since the geonet has a relatively small surface for bonding.

A second change is a correction in **Section 02173** for the **Tri-planar Geonet Drainage Media**. The required transmissivity of 2.0 gpm/ft is incorrectly converted to $4.1 \times 10^{-3} \text{ m}^3/\text{m}/\text{sec}$. The correct conversion is $4.1 \times 10^{-4} \text{ m}^3/\text{m}/\text{sec}$. No one makes a geocomposite that has a transmissivity of $4.1 \times 10^{-3} \text{ m}^3/\text{m}/\text{sec}$. You may recall that the tri-planar geocomposite is used in the valleys in the detection layer instead of pipes. Using the tri-planar allows the HDPE liner to be run

relatively flat, without a grading issue that would arise if pipes were used. Based on the expected flow into the underdrain, the material can have a transmissivity less than $1 \times 10^{-6} \text{ m}^3/\text{m}/\text{sec}$ and still exceed the service requirements. Additionally, we request modifying the specification for the Tri-planar geocomposite to include GRI GC7 instead of ASTM D 413 for ply adhesion.

Included with this letter is an article about ply adhesion and conformance results for the geocomposite. In addition, copies of the proposed specifications with revisions area attached, along with the CQA manual addressing the geonet drainage media (updated to include the GRI test method). In the Specification and CQA sections attached, the original text is marked out, and the revised text is in boldface type. Should you have any questions or require clarification, please contact us at your earliest convenience.

Sincerely,
G.N. Richardson & Associates, Inc.

Gregory Mills, P.E.
Project Engineer

Enclosures

cc: Edward Kreul
Richard Lowe, P.E.
Craig Smith, P.E.





Geocomposite Ply Adhesion vs. Friction Angle

GSE emphasizes the development of geonets and geocomposites drainage products that are manufactured specifically for maximum field performance, with emphasis on their flow capacity. This is the most important property of geonets and geocomposites since their primary function is to transmit fluids (leachate, gases, etc.) in the plane of the geonet or composite to a designated area for collection and/or treatment.

Geotextile is used in conjunction with a geonet to provide filtration and prevent clogging of the drainage layer when placed under a soil layer. In order to facilitate installation of the two geosynthetic materials, the geotextile is laminated (heat bonded) to the geonet creating a composite drainage material that can be installed in one step.

From an engineering perspective, the friction angle of the geonet to geotextile interface will exceed the friction angle of the composite-to-soil interface with very minimal bonding. Two comprehensive studies were performed by GeoSyntec Consultants ("Final Report Interface Direct Shear Testing, GSE Geocomposite Study", GeoSyntec Consultants, August, 1996 on file at GSE) and Vector Engineering ("Large Scale Direct Shear Report", Vector Engineering, Inc., April, 1998, on file at GSE) that demonstrates this relationship. These reports are available through GSE upon request.

According to the study performed by Vector Engineering, the shear test results "are not influenced by the strength of the composites' fabric to net ply adhesion" (Vector, 1998). The material used in the study was lightly bonded with a ply adhesion strength of <0.5 lb/in (<90 g/cm) and was subjected to three different loads in a direct shear test utilizing ASTM D 5321. The results showed that the failure mechanism was the geotextile/soil interface and not the geonet/geotextile interface demonstrating that the sample with less than a 0.5 lb/in (90 g/cm) ply adhesion had sufficient bond strength to move the failure plane away from the geonet/geotextile interface.

According to the GeoSyntec report (GeoSyntec, 1996), the amount of ply adhesion does not affect the friction angle. A composite consisting of a lightly bonded polypropylene (PP) geotextile, a medium bonded PP geotextile, and a heavily bonded polyester (PET) geotextile all demonstrated comparable friction angles (35°, 36° and 36° respectively). These results clearly demonstrate that minimal ply adhesion is needed to move the failure plane away from the geonet/geotextile interface.

A ply adhesion test (ASTM D 413 or F 904 or GRI GC-7) is commonly used to measure the bond between the geotextile and the geonet to monitor the manufacturing consistency. Results from a ply adhesion test should not be used for design purposes as summarized by a study presented at the Geosynthetics '99 Conference in Boston, MA (Vol. 2, pp. 799-812). The study, "Use of Increased Frictional Resistance in Landfill Liner System Design and Construction", states that ASTM D 413 "which had previously been used as an index test to determine the strength of the bond, did not produce a shear-type failure which would be the anticipated mode of failure in the field. As such, it is entirely inadequate for design purposes."

TN015 R11/06/02

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Americas	GSE Lining Technology, Inc.	Houston, Texas	800-435-2008	281-443-8564	Fax: 281-230-8650
Europe/Middle East/Africa	GSE Lining Technology GmbH	Hamburg, Germany		49-40-767420	Fax: 49-40-7674233
Asia/Pacific	GSE Lining Technology Company Ltd.	Bangkok, Thailand		66-2-937-0091	Fax: 66-2-937-0097

This technical note is also available on our website at:

www.gseworld.com

G.N. Richardson & Associates
ENGINEERING AND GEOLOGICAL SERVICES

International Paper
Riegelwood, NC
Geocomposite Roll Information

SHEET:

JOB #: IP-2

DATE: 3/27/03

BY: Greg Mills

CHKD BY:

Total square footage 1,397,200
Min. Number of MQC Tests 14
Min. Number of CQA Tests 7

No. Tests	52	52	12	12	24
Min	1.11	2.32	0.20	1.73	4.82E-04
Max	1.46	4.40	3.00	4.54	7.95E-04
Avg		2.71		2.75	6.82E-04

Roll Number	Pass/Fail	Ply Adhesion				Transmissivity	Comments
		MQC Min.	MQC Avg.	CQA Min	CQA Avg		
924001	Accept	1.22	2.58				
924010	Accept	1.35	2.61				
924015	Accept			0.7	2.36	5.37E-04	two values less than 1 (0.7, 0.8)
924020	Accept	1.31	2.58				
924030	Accept	1.11	2.46			7.10E-04	
924040	Accept	1.46	3.6				
924050	Accept	1.37	2.74				
924060	Accept	1.28	2.32			7.60E-04	
924070	Accept	1.35	2.61				
924080	Accept	1.27	2.55				
924086	Accept			0.8	2.2775	4.82E-04	three values less than 1 (0.8, 0.8, 0.9)
924090	Accept	1.18	2.39			7.95E-04	
924100	Accept	1.35	2.58				
924105	Accept			0.4	1.765		(values of 0.4, 0.7, and 0.9 on three different test sides. The 0.4 has tests of 1.9, 0.9, 1.3 and 3.5)
924110	Accept	1.24	2.45				
924120	Accept	1.36	2.52			6.90E-04	
924130	Accept	1.18	2.35				
924140	Accept	1.24	2.7				
924150	Accept	1.39	2.66			6.55E-04	
924156	Accept			1.6	4.3275		
924157	Fail			0.3	1.9825	7.65E-04	(4 values less than 1, and 3 values less than 0.5. Average of MD on sie B is 0.89)
924158	Accept			1.9	3.8725		
924160	Accept	1.25	2.75				
924170	Accept	1.27	2.91				
924180	Accept	1.3	2.74			7.25E-04	
924190	Accept	1.32	2.58				
924200	Accept	1.25	2.72				
924210	Accept	1.41	2.85			6.85E-04	
924220	Accept	1.38	2.49				
924227	Accept			3	4.54		
924228	Fail			0.2	1.7275	6.19E-04	(one value of 0.4 on MD B-side, the other 4 values on that side were 3.0, 3.5, 4.3, 3.9. The next lowest value on any side was 2.0)
924229	Accept			0.4	3.02		
924230	Accept	1.42	2.62				
924240	Accept	1.28	2.58			7.35E-04	
924250	Accept	1.44	2.9				
924260	Accept	1.35	2.85				
924270	Accept	1.38	2.73			6.99E-04	
924280	Accept	1.4	2.82				
924290	Accept	1.25	2.68				
924299	Accept			0.2	2.52	6.40E-04	Value of 0.2 on CD A-side. The other four tests on the A side were 2.0, 3.0, 1.5, 4.0)

924300	Accept	1.21	2.48			7.45E-04	
924310	Accept	1.17	2.59				
924320	Accept	1.27	2.69				
924330	Accept	1.15	2.59			7.25E-04	
924340	Accept	1.31	2.74				
924350	Accept	1.36	2.55				
924360	Accept	1.45	4.4			6.82E-04	
924370	Accept	1.25	2.61	1.1	2.1475	6.23E-04	
924380	Accept	1.36	2.75				
924390	Accept	1.19	2.54			7.31E-04	
924400	Accept	1.41	2.92				
924410	Accept	1.29	2.8				
924420	Accept	1.45	2.7			6.85E-04	
924430	Accept	1.2	2.62				
924440	Accept	1.36	2.72				
924441	Accept			0.5	2.5125	5.24E-04	
924450	Accept	1.16	2.91			6.55E-04	
924460	Accept	1.41	2.87				
924470	Accept	1.28	2.56				
924480	Accept	1.25	2.6			7.15E-04	
924490	Accept	1.37	2.8				
924500	Accept	1.12	2.63				
924510	Accept	1.37	2.85			7.85E-04	



CONFORMANCE TEST RESULTS

CLIENT: G. N. RICHARDSON
 CLIENT PROJECT: INTERNATIONAL PAPER
 RIEGELWOOD MILL LANDFILL
 CLIENT PROJ. NO.: IP-2
 PROJECT NO.: L03108-04
 LAB ID NO.: L03108-04-01
 MATERIAL: SKAP8 GEOCOMPOSITE TN-270-2-8
 SAMPLE I.D.: NA
 ROLL NO: 924015

ACCEPT

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
PLY ADHESION	GRI GC-7 SIDE "A"	MD-lb/in	5.0	1.9	0.7	0.8	1.1	1.89	1.800
		CD-lb/in	3.1	2.7	1.9	1.2	1.1	2.00	0.892
	SIDE "B"	MD-lb/in	3.1	1.9	1.6	1.6	1.9	2.00	0.648
		CD-lb/in	4.7	5.1	4.1	1.9	1.9	3.53	1.553

2+AVG

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L03108-04-01

3/14/03

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
<u>Geonet</u> THICKNESS	D 5199	Inches	0.3130	0.3076	0.3055	0.2978	0.3046	0.3032	0.0056
			0.2997	0.3017	0.2931	0.3062	0.3025		
DENSITY	D 1505	g/cc	0.9514	0.9514	0.9514			0.9514	0.0000
<u>Geocomposite</u> PLY ADHESION	D 413 SIDE "A"	MD-lb/in		0.7	0.9	1.3	3.5	1.58	1.201
			CD-lb/in	1.3	1.0	0.7	1.5	2.5	1.39
	SIDE "B"	MD-lb/in	0.9	2.4	1.6	1.8	3.3	1.99	0.875
		CD-lb/in	2.0	1.0	1.3	2.3	4.0	2.10	1.181
TRANSMISSIVITY* 8000psf; grad 0.25 24 hr seat	D 4716	m2/s	1					5.37E-04	
			5.37E-04						

*Boundary = Plate/Sand/Geocomposite/Plate

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CONFORMANCE TEST RESULTS



CLIENT: G. N. RICHARDSON
 CLIENT PROJECT: INTERNATIONAL PAPER
 RIEGELWOOD MILL LANDFILL
 CLIENT PROJ. NO.: IP-2
 PROJECT NO.: L03108-04
 LAB ID NO.: L03108-04-02
 MATERIAL: SKAPS GEOCOMPOSITE TN-270-2-6
 SAMPLE I.D.: NA
 ROLL NO: 924088

Accept

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
PLY ADHESION	GRI GC-7 SIDE "A"	MD-lb/in	2.8	1.4	1.8	2.5	1.9	2.08	0.565
		CD-lb/in	6.3	3.8	3.4	2.2	2.5	3.63	1.603
	SIDE "B"	MD-lb/in	3.4	0.8	0.8	1.4	1.3	1.54	1.092
		CD-lb/in	4.1	1.1	1.9	1.4	0.9	1.86	1.282

2.27 Typ A-B

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L03108-04-02

3/14/03

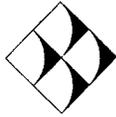
TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
Geonet THICKNESS	D 5199	inches	0.3028	0.3124	0.3006	0.3045	0.2991	0.3043	0.0048
			0.3036	0.2978	0.3036	0.3070	0.3113		
DENSITY	D 1505	g/cc	0.9503	0.9503	0.9502			0.9503	0.0001
Geocomposite									
PLY ADHESION	D 413 SIDE "A"	MD-lb/in	1.5	0.8	1.5	1.8	2.5	1.60	0.627
		CD-lb/in	4.0	3.5	2.3	1.5	2.3	2.70	1.022
	SIDE "B"	MD-lb/in	1.3	0.5	1.3	2.5	1.5	1.40	0.720
		CD-lb/in	2.5	1.0	2.0	1.3	2.5	1.85	0.688
TRANSMISSIVITY* 8000psf;grad 0.25 24 hr seat	D 4716	m2/s	1 4.82E-04					4.82E-04	

*Boundary = Plate/Sand/Geocomposite/Plate

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CHECKED BY: JRB DATE: 3-11-03

L03108-04-02



G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

MEMORANDUM

March 27, 2003

To: Edward J. Kreul
International Paper

CC: Ed Mussler, P.E.
Richard Lowe, P.E.
Craig Smith, P.E.

From: Greg Mills, P.E. *RAM*
G.N. Richardson & Associates, Inc.

Re: **DESIGN MODIFICATION NO. 1**
International Paper
Riegelwood, N.C.
Industrial Landfill Permit Number 24-02
Cell 1 Construction

GNRA would like to make the following modifications to the project specifications.

1. Geonet Drainage Media (Specification Section 02712):

Ply Adhesion: To satisfy standard manufacturing practices, GNRA will allow an average value of ply adhesion to be 1.0 ppi and a minimum value of . 0.5 ppi on 4 of 5 test samples per side, per direction based on GRI GC7. Attached is documentation from GSE which demonstrates the acceptability of this change.

2. Tri-Planar Geonet Drainage Media (Specification Section 02713)

Transmissivity: The minimum allowable transmissivity of the tri-planar geonet drainage media is 2.0 gpm/ft. In the Specifications, this value is given, and incorrectly converted to $4.1 \times 10^{-3} \text{ m}^3/\text{m}/\text{sec}$. Correctly converted, the value is $4.1 \times 10^{-4} \text{ m}^3/\text{m}/\text{sec}$.

Attachment



Geocomposite Ply Adhesion vs. Friction Angle

GSE emphasizes the development of geonets and geocomposites drainage products that are manufactured specifically for maximum field performance, with emphasis on their flow capacity. This is the most important property of geonets and geocomposites since their primary function is to transmit fluids (leachate, gases, etc.) in the plane of the geonet or composite to a designated area for collection and/or treatment.

Geotextile is used in conjunction with a geonet to provide filtration and prevent clogging of the drainage layer when placed under a soil layer. In order to facilitate installation of the two geosynthetic materials, the geotextile is laminated (heat bonded) to the geonet creating a composite drainage material that can be installed in one step.

From an engineering perspective, the friction angle of the geonet to geotextile interface will exceed the friction angle of the composite-to-soil interface with very minimal bonding. Two comprehensive studies were performed by GeoSyntec Consultants ("Final Report Interface Direct Shear Testing, GSE Geocomposite Study", GeoSyntec Consultants, August, 1996 on file at GSE) and Vector Engineering ("Large Scale Direct Shear Report", Vector Engineering, Inc., April, 1998, on file at GSE) that demonstrates this relationship. These reports are available through GSE upon request.

According to the study performed by Vector Engineering, the shear test results "are not influenced by the strength of the composites' fabric to net ply adhesion" (Vector, 1998). The material used in the study was lightly bonded with a ply adhesion strength of <0.5 lb/in (<90 g/cm) and was subjected to three different loads in a direct shear test utilizing ASTM D 5321. The results showed that the failure mechanism was the geotextile/soil interface and not the geonet/geotextile interface demonstrating that the sample with less than a 0.5 lb/in (90 g/cm) ply adhesion had sufficient bond strength to move the failure plane away from the geonet/geotextile interface.

According to the GeoSyntec report (GeoSyntec, 1996), the amount of ply adhesion does not affect the friction angle. A composite consisting of a lightly bonded polypropylene (PP) geotextile, a medium bonded PP geotextile, and a heavily bonded polyester (PET) geotextile all demonstrated comparable friction angles (35°, 36° and 36° respectively). These results clearly demonstrate that minimal ply adhesion is needed to move the failure plane away from the geonet/geotextile interface.

A ply adhesion test (ASTM D 413 or F 904 or GRI GC-7) is commonly used to measure the bond between the geotextile and the geonet to monitor the manufacturing consistency. Results from a ply adhesion test should not be used for design purposes as summarized by a study presented at the Geosynthetics '99 Conference in Boston, MA (Vol. 2, pp. 799-812). The study, "Use of Increased Frictional Resistance in Landfill Liner System Design and Construction", states that ASTM D 413 "which had previously been used as an index test to determine the strength of the bond, did not produce a shear-type failure which would be the anticipated mode of failure in the field. As such, it is entirely inadequate for design purposes."

TN015 R11/06/02

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Americas	GSE Lining Technology, Inc.	Houston, Texas	800-435-2008	281-443-8564	Fax: 281-230-8650
Europe/Middle East/Africa	GSE Lining Technology GmbH	Hamburg, Germany		49-40-767420	Fax: 49-40-7674233
Asia/Pacific	GSE Lining Technology Company Ltd.	Bangkok, Thailand		66-2-937-0091	Fax: 66-2-937-0097

This technical note is also available on our website at:

www.gseworld.com

G.N. Richardson & Associates
ENGINEERING AND GEOLOGICAL SERVICES

International Paper
Riegelwood, NC
Geocomposite Roll Information

SHEET:
JOB #: IP-2
DATE: 3/27/03
BY: Greg Mills
CHKD BY:

Total square footage 1,397,200
Min. Number of MQC Tests 14
Min. Number of CQA Tests 7

No. Tests	52	52	12	12	24
Min	1.11	2.32	0.20	1.73	4.82E-04
Max	1.46	4.40	3.00	4.54	7.95E-04
Avg		2.71		2.75	6.82E-04

Roll Number	Pass/Fail	Ply Adhesion				Transmissivity	Comments
		MQC Min.	MQC Avg.	CQA Min	CQA Avg		
924001	Accept	1.22	2.58				
924010	Accept	1.35	2.61				
924015	Accept			0.7	2.36	5.37E-04	two values less than 1 (0.7, 0.8)
924020	Accept	1.31	2.58				
924030	Accept	1.11	2.46			7.10E-04	
924040	Accept	1.46	3.6				
924050	Accept	1.37	2.74				
924060	Accept	1.28	2.32			7.60E-04	
924070	Accept	1.35	2.61				
924080	Accept	1.27	2.55				
924086	Accept			0.8	2.2775	4.82E-04	three values less than 1 (0.8, 0.8, 0.9)
924090	Accept	1.18	2.39			7.95E-04	
924100	Accept	1.35	2.58				
924105	Accept			0.4	1.765		(values of 0.4, 0.7, and 0.9 on three different test sides. The 0.4 has tests of 1.9, 0.9, 1.3 and 3.5)
924110	Accept	1.24	2.45				
924120	Accept	1.36	2.52			6.90E-04	
924130	Accept	1.18	2.35				
924140	Accept	1.24	2.7				
924150	Accept	1.39	2.66			6.55E-04	
924156	Accept			1.6	4.3275		
924157	Fail			0.3	1.9825	7.65E-04	(4 values less than 1, and 3 values less than 0.5. Average of MD on sie B is 0.89)
924158	Accept			1.9	3.8725		
924160	Accept	1.25	2.75				
924170	Accept	1.27	2.91				
924180	Accept	1.3	2.74			7.25E-04	
924190	Accept	1.32	2.58				
924200	Accept	1.25	2.72				
924210	Accept	1.41	2.85			6.85E-04	
924220	Accept	1.38	2.49				
924227	Accept			3	4.54		
924228	Fail			0.2	1.7275	6.19E-04	(one value of 0.4 on MD B-side, the other 4 values on that side were 3.0, 3.5, 4.3, 3.9. The next lowest value on any side was 2.0)
924229	Accept			0.4	3.02		
924230	Accept	1.42	2.62				
924240	Accept	1.28	2.58			7.35E-04	
924250	Accept	1.44	2.9				
924260	Accept	1.35	2.85				
924270	Accept	1.38	2.73			6.99E-04	
924280	Accept	1.4	2.82				
924290	Accept	1.25	2.68				
924299	Accept			0.2	2.52	6.40E-04	Value of 0.2 on CD A-side. The othe four tests on the A side were 2.0, 3.0, 1.5, 4.0)

924300	Accept	1.21	2.48			7.45E-04	
924310	Accept	1.17	2.59				
924320	Accept	1.27	2.69				
924330	Accept	1.15	2.59			7.25E-04	
924340	Accept	1.31	2.74				
924350	Accept	1.36	2.55				
924360	Accept	1.45	4.4			6.82E-04	
924370	Accept	1.25	2.61	1.1	2.1475	6.23E-04	
924380	Accept	1.36	2.75				
924390	Accept	1.19	2.54			7.31E-04	
924400	Accept	1.41	2.92				
924410	Accept	1.29	2.8				
924420	Accept	1.45	2.7			6.85E-04	
924430	Accept	1.2	2.62				
924440	Accept	1.36	2.72				
924441	Accept			0.5	2.5125	5.24E-04	
924450	Accept	1.16	2.91			6.55E-04	
924460	Accept	1.41	2.87				
924470	Accept	1.28	2.56				
924480	Accept	1.25	2.6			7.15E-04	
924490	Accept	1.37	2.8				
924500	Accept	1.12	2.63				
924510	Accept	1.37	2.85			7.85E-04	



CONFORMANCE TEST RESULTS

CLIENT: G. N. RICHARDSON
 CLIENT PROJECT: INTERNATIONAL PAPER
 RIEGELWOOD MILL LANDFILL
 CLIENT PROJ. NO.: IP-2
 PROJECT NO.: L03108-04
 LAB ID NO.: L03108-04-01
 MATERIAL: SKAP8 GEOCOMPOSITE TN-270-2-8
 SAMPLE I.D.: NA
 ROLL NO: 924015

ACCEPT

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
PLY ADHESION	GRI GC-7 SIDE "A"	MD-lb/in	5.0	1.9	0.7	0.8	1.1	1.89	1.800
		CD-lb/in	3.1	2.7	1.9	1.2	1.1	2.00	0.892
	SIDE "B"	MD-lb/in	3.1	1.9	1.6	1.6	1.9	2.00	0.848
		CD-lb/in	4.7	5.1	4.1	1.9	1.9	3.53	1.553

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DATE: 3-14-03

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L03108-04-01

5/14/03

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
Geonet THICKNESS	D 5199	Inches	0.3130	0.3076	0.3055	0.2978	0.3046	0.3032	0.0056
			0.2997	0.3017	0.2931	0.3062	0.3025		
DENSITY	D 1505	g/cc	0.9514	0.9514	0.9514			0.9514	0.0000
Geocomposite PLY ADHESION	D 413 SIDE "A"	MD-lb/in	0.4	1.9	0.9	1.3	3.5	1.58	1.201
		CD-lb/in	1.3	1.0	0.7	1.5	2.5	1.39	0.688
	SIDE "B"	MD-lb/in	0.9	2.4	1.6	1.8	3.3	1.99	0.875
		CD-lb/in	2.0	1.0	1.3	2.3	4.0	2.10	1.181
TRANSMISSIVITY* 8000psf; grad 0.25 24 hr seat	D 4716	m2/s	1					5.37E-04	
			5.37E-04						

*Boundary = Plate/Sand/Geocomposite/Plate

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DATE: 3-11-03

L03108-04-01

5/14/03



CONFORMANCE TEST RESULTS

CLIENT: G. N. RICHARDSON
 CLIENT PROJECT: INTERNATIONAL PAPER
 RIEGELWOOD MILL LANDFILL
 CLIENT PROJ. NO.: IP-2
 PROJECT NO.: L03108-04
 LAB ID NO.: L03108-04-02
 MATERIAL: SKAPS GEOCOMPOSITE TN-270-2-6
 SAMPLE I.D.: NA
 ROLL NO: 924088

Accept

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
PLY ADHESION	GRI GC-7 SIDE "A"	MD-lb/in	2.8	1.4	1.8	2.5	1.9	2.08	0.565
		CD-lb/in	6.3	3.8	3.4	2.2	2.5	3.63	1.603
	SIDE "B"	MD-lb/in	3.4	0.8	0.8	1.4	1.3	1.54	1.092
		CD-lb/in	4.1	1.1	1.9	1.4	0.9	1.88	1.282

2.27 Typ A-B

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L03108-04-02

3/14/03

TEST	ASTM METHOD	UNITS	SPECIMEN NO.					AVE	STD
			1	2	3	4	5		
<u>Geonet</u> THICKNESS	D 5199	inches	0.3028	0.3124	0.3006	0.3045	0.2991	0.3043	0.0048
			0.3036	0.2978	0.3036	0.3070	0.3113		
DENSITY	D 1505	g/cc	0.9503	0.9503	0.9502			0.9503	0.0001
<u>Geocomposite</u> PLY ADHESION	D 413 SIDE "A"	MD-lb/in	1.5	0.8	1.5	1.8	2.5	1.60	0.627
		CD-lb/in	4.0	3.5	2.3	1.5	2.3	2.70	1.022
	SIDE "B"	MD-lb/in	1.3	0.5	1.3	2.5	1.5	1.40	0.720
		CD-lb/in	2.5	1.0	2.0	1.3	2.5	1.85	0.698
TRANSMISSIVITY* 8000psf;grad 0.25 24 hr seat	D 4716	m2/s	1 4.82E-04						4.82E-04

*Boundary = Plate/Sand/Geocomposite/Plate

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L03108-04-02

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director



May 12, 2003

Mr. Edward J. Kreul
Environmental Services Superintendent
International Paper- Riegelwood Mill
John L. Riegel Road
Riegelwood, NC 28456

RE: Design Modification, Revised Geonet Drainage Media Ply Adhesion Specification and Stesting Procedure, International Paper, Rieglewood, NC, Cells 1, Permit Number 2402.

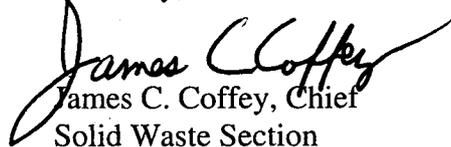
Dear Mr. Kreul;

The Division of Waste Management, Solid Waste Section, has received, on April 1, 2003, a request from your Consultant, G.N. Richardson, Inc., to modify the approved construction plan project specifications for Cell 1 with respect to the geonet drainage media. The Section has reviewed the request and is issuing this letter of modification to the approved plan. The new, approved plan has been revised as follows.

1. Section 02172 Geonet Drainage Media The ply adhesion specification and test method has been amended as specified in the approved plan.
2. Section 02713 Tri-Planar Geonet Drainage Media: A technical correction for the required transmissivity has been made and the GRI GC7 test specification added.

In accordance with Permit to Construct, 2402, Attachment II, Part I, Condition 11, the Section has reviewed the proposed changes and hereby accepts them. Field changes or other deviations from the approved plan, should be included on the as-built drawings and properly identified in the final CQA report as required by the rules. If you have any questions or need additional assistance, please contact the Section.

Sincerely,


James C. Coffey, Chief
Solid Waste Section

cc: Greg Mills, P.E. G. N. Richardson & Ass. Ed Mussler, P.E. DWM

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER - 50% RECYCLED/10% POST CONSUMER PAPER

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director



February 7, 2003

Mr. Edward J. Kreul
Environmental Services Superintendent
International Paper- Riegelwood Mill
John L. Riegel Road
Riegelwood, NC 28456

RE: Closure Plan and Post-Closure Plan, International Paper, Riegelwood, North Carolins,
Permit Number 2402

Dear Mr. Kreul;

The Division of Waste Management, Solid Waste Section (Section), has received your closure and post-closure plan for the unlined landfill unit at the International Paper (IP) Riegelwood Mill. The plan was prepared on your behalf by G.N. Richardson & Associates, Inc. of Raleigh, NC. The report has been reviewed for compliance with 15A NCAC 13B .0504 and .0505. The following comments should be addressed as soon as possible.

In general, the plan needs to be more specific in presenting a proposed schedule to close the landfill by July 1, 2003 in accordance with the rules. Rule .0505(3)(c) and .0505(6) require that after final termination of disposal operations or a major part thereof, that the area shall be covered with at least two feet of suitable compacted earth and within six months after final termination of disposal operations at the site or a major part thereof, the area shall be stabilized with native grasses.

The following, more specific comments should also be addressed :

1. Please provide a current survey as well as the proposed final closure contours in a larger scale than 11 x 14. IP should also provide an estimation of the amount of fill that will be required in each of the three proposed closure areas, to prepare the area for final closure.
2. The mill proposed to use some mill wastes for stabilization and closure. Please provide estimates of the amount of waste available and the time frame that will be needed to provide enough material to achieve the closure goal, should this approach be approved by the Section.

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3. At the January 29 meeting of the Section, IP staff and GN Richardson staff, at the mill, it was discussed that there may be a supply of material that can be used to stabilize the slide area, which would be available from another IP facility. If the mill wishes to pursue this option, it should be discussed and presented within the framework of this closure plan.
4. Page 1, Section 1.0, first paragraph. It was not DENR policy that required the unlined landfill to cease accepting waste. By rule all unlined landfills had to cease accepting waste by January 1, 1998. Industrial Landfills were given a transition period to cease accepting waste and prepare a closure plan. December 21, 2002 was the date by which the transition should have been made. At a minimum, remove the reference to DENR policy.
5. By way of comment, It is apparent that the thixotropic sludge would likely fail the EPA paint filter test at the working face of the landfill. This will have to be addressed within the framework of the operations plan of the new lined disposal cell. Liquid waste will not be allowed in the landfill.
6. When will the earthen berms be vegetated and temporarily stabilized?
7. Page 2, Stable Surface Zones-Reference is made to approximately 11.8 acres of landfill that had been prepared to receive secondary sludge and that this acreage will receive final closure in 2003. Present a schedule for closure that meets the requirements of Rule 0.0505(6).
8. Page 2, Reference is made to approximately 9 acres of landfill and 30 acres of perimeter berms and that this acreage will receive final closure in 2003. Present a schedule for closure that meets the requirements of Rule 0.0505(6).
9. Slide Zones- Please provide more detail on the time line for stabilization and closure of the slide zone. How much stabilization and fill material is required? What is the time to obtain this material? Present a schedule for closure that meets the requirements of Rule 0.0505(6).
10. Secondary Waste Surface Zones- Provide an estimate of the time for this area to consolidate and stabilize. In Attachment 7, methodology for evaluation and closure is presented. When will this be done? What is the criteria for determining when an evaluation of the area will be made in accordance with Attachment 7? Where will the concrete block come from? More detail is required. Please include estimations of fill amounts and time of placement desired as well as present a schedule for closure that meets the requirements of Rule 0.0505(6).
11. Section 2.2, Page 4- With respect to mill beneficial use materials, Where is the Armour Sawmill located? Is sawdust the only material that IP desires to use from the Armour Sawmill? What is the woodwaste referred to as bridging material? Why are paper slabs beneficial use materials and not waste?
12. Page 14. Section 4.5, Please provide more information suitable for design and installation of the passive gas collection or venting system.

13. Figure 1- How do these final contours compare to present contours, see questions 1 and 2 above.
14. Attachment 7- What is the pass/fail criteria of the bearing capacity test? The strength the material has to meet is understood. If the cement weigh is placed on the material and doesn't disappear, but does settle in the spooge a bit, what is a failed test?
15. Attachment 8- Post Closure care- It is stated that mill beneficial reuse materials would be used to repair areas of local subsidence. Why would we use materials subject to excessive decay or compression to repair an area? Wouldn't soil be more suitable? It is anticipated at this time that the use of beneficial mill materials for repair of the closed unit, would be subject to approval by the Section, on a case-by-case basis.
16. Are any technical specifications required for placement of fill or stabilization materials? Please provide the technical specifications and CQA criteria that will be used to perform and certify that the landfill has been closed in accordance with the rules and the plan.

Revisions to the application should be clearly identified with a revision date in either the header or the footer. It is not necessary to submit five copies of the revisions. Two copies will suffice. A total of five copies will be needed when the application is finalized. Please note that some comments may only address a particular section of your report, while the information appears in other areas . Please proofread your submittal carefully, so that the entire application is consistent from section to section. The final submittal must also include an appendix with correspondence.

These comments are intended to expedite the review of the referenced application, and in no way do they restrict the Section's right to request additional information during the technical review process. If you have any additional questions or need help, please feel free to call me at (919) 733-0692 Ext. 343. My email address is : Ed. Mussler @ncmail.net.

Sincerely,



Edward F. Mussler III, P.E.
Environmental Engineer
Solid Waste Section

cc: John Crowder, SWS
Jim Barber, SWS
Greg Mills, GNRA
File

Subject: IP Riegelwood Slide Stabilization

Date: Fri, 31 Jan 2003 07:51:52 -0500

From: "Greg Richardson" <greg@gnra.com>

Organization: GNRA

To: "Edward Mussler" <Ed.Mussler@ncmail.net>

CC: <edward.kreul1@ipaper.com>

ED;

As I mentioned yesterday, we are seeing up to 1-ft of movement of the waste behind the slide area. The movement is in a relatively small area and does not impact the perimeter berm or wastes at the base. However, we would like to begin placement of stabilization materials including soil, ash, log-yard waste, and bulked pond materials. We have also scoured the mill and have found additional wood waste in the form of pallets and crates that would be great bridging material in the spoogy areas. Jim Powell of ARM has also indicated that the mill has what appear to be thick paper boards that have been used in the past to bridge soft areas. We will determine their availability (cost) and will try them in weak areas. We obviously need you blessing to do this work before receiving approval of the closure plan.

We are still scheduling to have the completed closure report to you on Monday so that we can formalize the closure process.

Thanks
Greg Richardson

Subject: IP-Repair of Berm Letter

Date: Fri, 17 Jan 2003 11:29:43 -0500

From: Edward Mussler <Ed.Mussler@ncmail.net>

To: Edward J Kreul <Edward.Kreul1@ipaper.com>, greg@gnra.com, gregm@gnra.com,
Jim Barber <Jim.Barber@ncmail.net>, MARK FRY <MARK.FRY@ncmail.net>,
JOHN CROWDER <JOHN.CROWDER@ncmail.net>

Dear Ed,

Jim asked that I get back to you. We received your letter of January 13, 2003 regarding the Repair of the Berm Failure at the IP Rieglewood Mill Landfill, Permit No 2402. We acknowledge receipt of your letter and the approach outlined therein. We are reserving final approval pending receipt of your closure plan which we are expecting on January 24, 2003.

Please ensure that the closure plan addresses how much "lightweight" fill will be used for the beneficial stabilization of the sludge and re-establishing acceptable contours for closure. Additionally the time line for closure should be evaluated to ensure that the landfill can be closed as quickly as is safely possible.

If you have any questions, please do not hesitate to contact us.

Regards

Ed Mussler

JR

INTERNATIONAL  PAPER

RIEGELWOOD MILL

Date: January 13, 2003

Telecopy To: Jim Barber 919-733-4810

From: Edward Kreul

Subject: Permit # 2402

Number of Pages: 3 (including cover sheet)

Comments:

INTERNATIONAL  PAPER

January 13, 2003

RIEGELWOOD MILL
JOHN L. RIEGEL ROAD
RIEGELWOOD NC 28456

Jim Barber, Head
NCDENR – Solid Waste Permit Section
401 Oberlin Road
Raleigh, NC 27605

**RE: International Paper Riegelwood Mill Landfill – Permit #2402
Repair of Berm Failure**

Dear Jim:

Thank you for meeting with us on Friday to expedite our remediation and closure of that portion of the closed landfill that experienced a slide on January 5. Per this discussion, we will incorporate the slide area in our final closure plan to be submitted to you by January 24.

The remediation of the slide area will focus on stabilizing the slide debris and establishment of contours compatible with final closure. Initial stabilization has focused on completion of a berm at the leading edge of the slide using both soils carried there by the slide, and new fill soil brought in from our Gooseneck borrow site. We anticipate that this will be completed and available for inspection by DENR during your January 29 site visit.

We have identified lightweight fill materials that have sufficient shear strength to make them beneficial for stabilizing the sludges, and for re-establishing acceptable contours in the slide footprint. These materials include the following:

- Woodyard waste ($\gamma = 27$ pcf, soil and bark)
- Ash ($\gamma = 34$ pcf, sand from fly ash separation and boiler bottom ash)
- Grits and Dregs ($\gamma = 60$ pcf, calcium and lime compounds)
- Bulked pond material ($\gamma = 35$ pcf, 3 parts wood chips + 1 part pond solids)
- Sawdust from Armour sawmill ($\gamma = 25$ pcf)

Wastewater sludges will not be used.

Additional monitoring has been implemented for potential displacements of the remaining berms at the facility and all water ponding on the landfill is being pumped off. Water quality is being monitored on a daily basis. Additional work is currently underway to improve drainage and regrade in preparation for vegetation of the perimeter berms.

Given that the site was flown on January 7, we will have very current topographic map of the landfill. The closure plan will divide the landfill closure into three distinct zones:

- **2003 Closure:** All perimeter berms and the northeast quadrant on the top will be final graded and closed this year. This is estimated to be 36 acres.
- **2003 Remediation/2004 Closure:** The slide footprint will be stabilized this year and will receive final closure in 2004. This is estimated to be 10 acres.
- **2004+ Closure:** Areas that received secondary sludge during 2002 must increase in strength before a final cover can be placed. Strength criteria to determine when closure can commence will be presented in the final closure plan. This is estimated to be 15 acres.

Fortunately, none of the problems associated with the closed landfill will impact the construction of Cell 1 of the lined lateral expansion. We look forward to showing you the progress that has been made on the Cell 1 site.

Again, thank you for your prompt consideration of the work proposed for correction of our recent slide.

Very truly yours,
International Paper – Riegelwood



Edward J. Kregel
Manager - Environmental, Health & Safety

INTERNATIONAL PAPER

January 13, 2003

Jim Barber, Head
NCDENR – Solid Waste Permit Section
401 Oberlin Road
Raleigh, NC 27605

2003
RIEGELWOOD MILL
JOHN L. RIEGEL ROAD
RIEGELWOOD NC 28456

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International Paper – Riegelwood



Edward J. Kreul
Manager - Environmental, Health & Safety