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17 May 2011

Ms Paula Plont
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
3711 Middlebrook Pike
Knoxville, TN 37921

Subject: Letter Report of Findings
Assessment of Paper Waste By-product Material from Kimberly-Clark
Matlock Bend Landfill
Loudon County, Tennessee

Dear Ms. Plont:

On behalf of the Loudon County Solid Waste Disposal Commission (LCSWDC) and Santek Environmental, Inc. (Santek), Geosyntec Consultants (Geosyntec) prepared this Letter Report of Findings (Report) regarding the site- and material-specific assessment of the compaction characteristics of a waste paper by-product material from Kimberly-Clark Corporation (K-C), Loudon County, Tennessee. The field testing occurred at the Matlock Bend Landfill (Matlock Bend), also located in Loudon County. This Report was prepared after an on-site meeting and discussion at Matlock Bend on 24 March 2011 with representatives of the Tennessee Department of Environment and Conservation (TDEC) regarding the disposal of K-C's residual short paper fiber (residual fiber derivative) and other materials at Matlock Bend. Hereinafter, the K-C residual fiber derivative will be referenced as RFD. Geosyntec requests that TDEC consider the findings presented in this report in developing recommendations regarding the acceptance of the RFD at Matlock Bend. The remainder of this Report is organized to include: (i) brief background; (ii) results of field assessment; (iii) results of laboratory assessment; (iv) permitted disposal practices by other agencies; and (v) recommendations.

BACKGROUND

In response to the 3 November 2010 waste slope failure at Matlock Bend (slope failure), Geosyntec prepared the February 2011 report titled *Assessment Report - Root Cause of the 3 November 2010 Waste Slope Failure and Rehabilitation Recommendations, Matlock Bend Landfill, Loudon County, Tennessee* (Assessment Report). In its summary regarding the root cause of the slope failure, Geosyntec offered the following opinion regarding the factors that contributed to the slope failure:

> "…*Specifically, Geosyntec believes that the root cause of the failure was due primarily to increased liquid levels in the landfill that were not being effectively conveyed to the LCS. It is anticipated that these liquids were a result of the large amount of sludge that was being placed, mixed, and compacted at the MBL. The sludge-mixed waste was likely wetter and weaker than waste placed in other portions of the landfill and weaker than waste that is typically expected at MSW landfills. Once the waste in the failure area started to creep downhill due to the ongoing waste placement activities, it is likely that the sludge-rich zones started to "smear" along localized planes. This had the effect of further reducing the ability of liquids to vertically percolate to the LCS and tended to result in local zones of weakened waste…*"

In response to the slope failure, TDEC placed a limit on the quantity of "sludge" materials that can be accepted at Matlock Bend. TDEC currently considers the RFD as a component of the waste stream at Matlock Bend that is characterized as "sludge." During subsequent meetings and preliminary field trials and investigations, Geosyntec and Santek concluded that the RFD, referenced as "Kimberly-Clark's residual short paper fiber (residual fiber derivative)" in the 2011 Special Waste Recertification (see Attachment 1), was not the source of the "sludge" referenced in Geosyntec's assessment of the slope failure. In fact, a preliminary assessment by Geosyntec based on the compaction characteristics of municipal solid waste (MSW) and RFD indicated that the blended waste was performing quite well when compacted at Matlock Bend. Furthermore, Geosyntec found that the RFD remained stable after being compacted. Santek requested that TDEC reconsider its imposed implied limitation on the RFD based on these observations and assessments. TDEC recommended that a review of the RFD be provided and that an independent assessment be made of the compaction performance of the RFD, with results provided to TDEC for its review and consideration. This Report was prepared to provide TDEC with the requested independent review and assessment.

FIELD ASSESSMENT

A series of field trials was performed by Santek on 4 April 2011 at Matlock Bend. The field trials were designed to allow Geosyntec to monitor the blending of RFD with MSW and the compaction of the blended materials. Mr. Levi Higdon of Santek directed field operations during blending and compaction activities, while Mr. Erik Miller of Geosyntec observed and documented results of the field trials. The procedures used for the field assessment are summarized as follows:

- A stockpile of the RFD was maintained in the test area, as shown in Photograph 1. Photographs are included as Attachment 2.

- Initially, an approximate volume ratio of 25 percent RFD and 75 percent MSW was blended using the conventional on-site equipment, comprising a dozer as shown in Photograph 2.

- The blended material was then placed and compacted as shown in Photograph 3 using the compactor that is normally used at Matlock Bend, while visual observations were noted by Mr. Miller of the compactor performance and the waste response during compaction.

- As part of the field observations, a small diameter probe rod was used by Mr. Miller to push through the compacted waste. The purpose of this effort was to provide a qualitative assessment of the probe resistance to penetration. This technique is commonly used by geotechnical engineers to assess building foundation conditions prior to pouring concrete footings, as the resistance is related to compaction quality.

Following the initial trial that considered a K-C/MSW ratio of 25/75, subsequent trials were performed using a K-C/MSW ratio of 35/65, 50/50, 60/40, and 75/25. Visual and photographic documentation were again provided by Mr. Miller. Photograph 4 shows the compactor response during the 50/50 trial. The attached Table 1 was prepared by Mr. Miller to document the field observations.

In general, the RFD mixed well with the MSW materials. This observation is consistent with the observations made during the on-site visit by TDEC on 24 March 2011. When compacted, the material exhibited somewhat of a “spongy” characteristic that is due to the inherent structure of the paper by-product comprising the RFD. Importantly, however, even at the high K-C/MSW ratios there was no indication of problems with the use of this material. In fact, the field trials indicated the contrary. Specifically, when the RFD was mixed with MSW, the resulting blended matrix: (i) was stable; (ii) showed no sign of segregate when blending; and/or (iii) exhibited no tendency to be “squeezed” from the blended MSW/RFD matrix under the energy from the compactor. In conclusion, the field trials confirmed acceptable performance of the compacted MSW/RFD even at very high blending ratios.

LABORATORY ASSESSMENT

To compliment the field compaction trials, a limited laboratory study was initiated. The purpose of the laboratory study was threefold: (i) characterize the as-received moisture content of the RFD; (ii) assess the ability of the RFD to "release" and/or "absorb" liquids; and (iii) assess the long-term degradation characteristics of the material. Results of the assessment are summarized as follows:

- As-received Moisture Content: Grab samples of the RFD were obtained during the 24 March 2011 site visit and then during Geosyntec's subsequent 28 April 2011 site visit. The measured moisture content of grab samples of the as-received RFD was consistent and ranged from 106 to 115 percent when measured as the ratio of the weight of water to the weight of solids (i.e., "w" as defined by geotechnical engineers). If moisture content is defined consistent with process engineering terminology as the ratio of the weight of water to <u>total</u> weight, (i.e., "w_g" or gravimetric water content), the calculated moisture content ranged from 52 to 54 percent, consistent with K-C's characterization.

- Potential to Release and/or Absorb Water: When the as-received RFD is squeezed, there is no tendency of water to be released. When placed in a plastic bag and further moisture conditioned by adding additional water, the RFD has a limited affinity to absorb the additional water. At a calculated moisture content of approximately 249 percent (w_g = 71 percent), the RFD does not absorb additional moisture. This value is an upper bound estimate of the field capacity of the RFD, as the laboratory sample was mixed and stored in an "unconfined" state." Water that is added to achieve field capacity can be squeezed out by hand, resulting in a calculated moisture content of about 146 percent (w_g = 59 percent). Importantly, when water was added to the RFD, the "feel" of the material did not change. The RFD was not "slimy" nor did it seem to weaken. This demonstrates that there is a limited potential for the RFD to exhibit "sponge-like" characteristics. When the RFD is blended, compacted, and confined, the moisture content will likely not exceed 250 percent (w_g = 71 percent).

- Long-term Degradation Potential: A sample of the RFD was placed in a sealed plastic bag and left exposed to sunlight for approximately four weeks. Although there was an abundance of condensate water collected on the inside of the plastic bag, the water was absorbed back into the material when re-mixed. The RFD did not appear to physically degrade or to release additional water when squeezed by hand. In summary, over this

relatively short time period, the RFD did not appear to show signs of accelerated degradation.

A laboratory test for shear strength was not performed as part of this study, but it is noted that the strength of the RFD is likely similar to that of MSW. Furthermore, as deduced from results of the field study, the strength of the blended MSW/RFD is likely better than the MSW itself. The results of this limited laboratory study indicate that there is little potential for the RFD to readily absorb or release significant quantities of water. Furthermore, the material does not show signs of rapid deterioration or degradation. The RFD appears to be a stable by-product that will slowly degrade, much like conventional MSW. The RFD appears to improve the strength of MSW when added to the waste stream but may slightly increase the compressibility of the waste.

PERMITTED DISPOSAL PRACTICES BY OTHER AGENCIES

As a component of this assessment, Santek met with K-C personnel to confirm the anticipated disposal volumes to Matlock Bend in the future and to confirm the 2011 Special Waste Recertification. K-C reports that the material provided to Matlock Bend for disposal is beneficially re-used to the extent possible by K-C and other vendors. Excess materials that cannot be re-used on a timely basis are shipped to Matlock Bend. The 2011 Special Waste Recertification from K-C (see Attachment 1) references this material as recycled fiber derivative. K-C also reported to Santek that material at other K-C facilities is similar to that produced at the Loudon Mill plant and that other states, notably Indiana, have permitted the material for beneficial use as alternative daily cover (ADC) in permitted landfills. Geosyntec has worked extensively in Indiana and interacts with personnel from the Indiana Department of Environmental Management (IDEM) regularly. With K-C's permission, Geosyntec contacted Ms. Daniela Klesmith, P.E., Engineering Permits Manager in IDEM's Office of Land Quality, regarding the agency's experience with this material. The following is an excerpt of the response from Ms. Klesmith:

> "*…Regarding your question about paper sludge (we call this material short-paper-fiber-sludge), we did approved this material as an alternative daily cover for a couple of landfills in Indiana and it is approved for use without additional soil for up to seven days. If the ADC is exposed for longer than 7 seven days the facility must put additional waste or additional soil cover. The only concern I would have is the nature of this material (clay-like) creating fairly impermeable*

> *seal over the waste, so scarifying the cover or removing before the next layer of waste is placed is advisable…*"

It is also noted that Geosyntec has used short-paper fiber by-products as ADC and to amend final cover soils, as the paper fibers tend to add "structure" and improve the water retention characteristics of clayey soils. Geosyntec's experience is consistent with that noted by IDEM and believes that the material can be used beneficially at Matlock Bend (see recommendations below). Furthermore, Geosyntec does not believe that the disposal of the RFD has adverse impacts on the performance of the landfill when managed appropriately.

RECOMMENDATIONS

Based on the results of the field trials and the laboratory study, Geosyntec recommends that the volume of RDF disposed at Matlock Bend not be limited and that this material explicitly should not be considered as a component of the "sludge" waste stream that is limited for disposal at Matlock Bend. As stated previously, Geosyntec does not believe that the RFD had any detrimental influence on the 3 November 2010 waste slope failure, in which a weak interface was likely formed and sheared. As noted by Ms. Klesmith, the surface of the RFD should be scarified when left exposed prior to additional waste placement. This potential problem can be alleviated when the RFD is mixed and blended with MSW.

Geosyntec believes that the inclusion of the RFD at Matlock Bend provides a benefit and that these benefits can be further exploited to the benefit of LCSWDC, Santek, and TDEC. Specifically, Geosyntec believes that the RFD could be used as ADC in lieu of the native clay soils currently being used. The RFD that is not removed and stockpiled for future use can be readily mixed and blended with the next day's waste stream. This will minimize the use of clay, which will improve leachate collection at the facility, while providing adequate protection from vectors and odors. Geosyntec also believes that the RFD can be considered to amend the soil in the final cover to help improve water retention and the establishment and long-term performance of the native vegetation on the final cover. Upon TDEC review of this Report, Geosyntec and Santek propose to meet with TDEC regarding these potential benefits and the steps that would be necessary to gain agency approval for these applications.

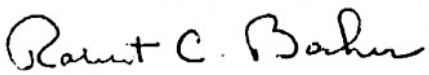
In summary, the K-C RFD is currently providing a benefit at the facility and affords the opportunity for even greater benefits. Geosyntec believes that the results presented herein demonstrate that the use of the RFD should not be limited and that the disposed volume of the

material should not be restricted. As with all aspects of landfill operations, procedures should be developed for proper handling and disposal of waste. In the case of RFD, these procedures include the requirement to blend the material with MSW and to scarify the surface of RFD when compacted, to minimize the potential for developing an interface that may preclude liquids infiltration.

CLOSURE

Geosyntec trusts that the results presented in this Report address concerns that TDEC have identified regarding the RFD at Matlock Bend. On behalf of the LCSWDC and Santek, Geosyntec appreciates TDEC's consideration of this request to encourage and not restrict the use of RFD at Matlock Bend. Upon review of this information, should TDEC have any questions or require additional information, please do not hesitate to contact Geosyntec.

Sincerely,



Robert C. Bachus, Ph.D., P.E.
Principal

Attachments: Tables
Attachment 1
Attachment 2

Copies to: Mr. Matt Dillard, Mr. Levi Higdon, Mr. Rob Burnette – Santek Environmental, Inc.
Mr. Steve Field – Loudon County Solid Waste Disposal Commission

TABLES

TABLE 1. K-C RFD and MSW Materials Approximate Mixtures and Description

K-C RFD	MSW	Observation/Description
25%	75%	The materials mix well together. The compactor is able to compact the test pad easily, and the compacted test pad seems to have approximately the same firmness and density as the working face of the active landfill when tested with a probe rod.
35%	65%	The materials mix well together. The compactor is able to compact the test pad easily, and the compacted test pad seems to have approximately the same firmness and density as the working face of the active landfill when tested with a probe rod.
50%	50%	The materials mix well together. The compactor is able to compact the test pad easily, but the compacted test pad seems to have slightly looser firmness and density than the working face of the active landfill when tested with a probe rod.
60%	40%	The materials mix well together. The compactor is able to compact the test pad easily, but the compacted test pad seems to have slightly looser firmness and density than the working face of the active landfill when tested with a probe rod.
75%	25%	The materials mix well together. The compactor is able to compact the test pad easily, but the compacted test pad seems spongy and looser in firmness and density than the working face of the active landfill when tested with a probe rod.

ATTACHMENT 1

Loudon Mill
KC Professional®

Kimberly-Clark

CERTIFIED MAIL
7009 3410 0000 5676 3540
Return Receipt Requested

April 18, 2011

Mr. David L. Hollinshead
Santek Environmental
650 25th Street, N.W., Suite 100
Cleveland, TN 37311

Subject: Kimberly-Clark Corporation, Loudon Mill
Special Waste Recertification,

Dear Mr. Hollinshead:

Please find enclosed an updated Annual Special Waste Recertification Form (CN-1192) for Kimberly-Clark's residual short paper fiber (recycled fiber derivative) waste stream.

As part of Kimberly-Clark's long-established Environmental 'Vision' program (currently Vision 2015), Kimberly-Clark continues to pursue zero landfill of manufacturing 'wastes'/secondary materials. While working to develop beneficial-use outlets and identify raw material substitution opportunities for our secondary materials, we have identified the need to remove the stigma associated with the term 'sludge'. All other aspects of material composition, method of generation, etc. associated with the material remain unchanged.

Should you have any questions regarding the attached or any information contained herein, please contact me at 865-988-7138 or bcrawford@kcc.com.

Sincerely,

Bryan K. Crawford
Environmental Coordinator
Kimberly-Clark, Loudon Mill

Enc.

cc: Mr. Ryan Miller, TDEC Div. of Solid Waste Management

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF SOLID WASTE MANAGEMENT
SPECIAL WASTE RECERTIFICATION

1. GENERATOR INFORMATION

(A) Facility Name: Kimberly-Clark Corporation, Loudon Mill
Mailing Address: 5600 Kimberly Way
Loudon, TN 37774
Zip Code:
Phone: (865)988-7000

(B) Physical Location: 5600 Kimberly Way
County: Loudon, TN 37774
Phone: (865) 988-7000

(C) Nature of Business: Bath Tissue/Hand Towel Manufacturing Mill (from Secondary, Recycled Fiber)
Technical Contact: Bryan K. Crawford
Title: Environmental Coordinator
Phone: (865) 988-7138

2. NAME AND DESCRIPTION OF WASTE

Recycled Fiber Derivative (RFD) –residual short fiber material generated during the recycled (secondary) fiber preparation process. RFD is removed during the primary clarification process at the mill's wastewater treatment. The Material consists of approx. 50% moisture, 15-20% ash (clay, dirt, grit, etc.) wet basis, balance short cellulose fiber. The material is a non-hazardous waste when discarded. The material is currently used to fuel an onsite biomass boiler. Several other beneficial use/raw material applications have been evaluated and are in various stages of implementation

3. GENERATION RATE

~45,000 tons/year **or** _____ tons/month

4. DATE OF ORIGINAL APPROVAL LETTER 8/24/90, 11/29/01, 4/17/02, 4/25/02, 3/3/03

(ATTACH A COPY OF THE ORIGINAL APPROVAL LETTER)

5. DISPOSAL / PROCESSING FACILITY. List the facility accepting the waste.

(A) Facility Name: Loudon County Landfill
(B) Facility Permit Number: SNL 53-103-0203
(C) Facility Operator / Contact Name: Santek Environmental/Laurie Maples
Phone: (800) 467-9160

6. I hereby certify to the best of my knowledge, the above information is true and accurate, and the waste has not changed since the original approval has been granted.

Waste Generator's Name (Print)	Preparer's Name (Print)
Kimberly-Clark Corp., Loudon Mill Michael K. Smith, Mill Manager	Bryan K. Crawford, Environmental Coordinator
Waste Generator's Authorized Signature Michael K. Smith	Preparer's Signature (If Different)
Date April 15, 2011	Date April 15, 2011

Send originals with requested attachments to the facility listed in Item 5 above and a copy to the Environmental Assistance Center where the processing or disposal facility is located.

(continued on reverse)

ATTACHMENT 2

Geosyntec consultants

PHOTOGRAPH LOG

PROJECT NAME: MATLOCK BEND LANDFILL	PROJECT NO.: GG4773
CLIENT.: LCSWDC	FILE NAME: PHOTO LOG.PPT

Photograph 1: Load of K-C RFD material as received at landfill.

Photograph 2: Mixing MSW with K-C RFD material.

Geosyntec consultants

PHOTOGRAPH LOG

PROJECT NAME: MATLOCK BEND LANDFILL	PROJECT NO.: GG4773
CLIENT.: LCSWDC	FILE NAME: PHOTO LOG.PPT

Photograph 3: Compacting 75% MSW and 25% K-C RFD material.

Photograph 4: Compacting 50% MSW and 50% K-C RFD material.