STATE OF MAINE, ACTING THROUGH THE	)	PETITION TO REVOKE,
STATE PLANNING OFFICE	)	MODIFY OR SUSPEND
OLD TOWN, PENOBSCOT COUNTY, MAINE	)	SOLID WASTE LICENSE
JUNIPER RIDGE LANDFILL	)	
CHANGE IN MSW BYPASS LIMIT	)	
#S-020700-WD-W-M	)	DISMISSAL

ATTACHMENT C

Department staff review memorandum

from Amanda S. Wade, P.E.
to Cynthia W. Darling, Project Manager of JRL

re: Affidavit of Denis St. Peter

dated July 27, 2011

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MEMORANDUM

To: Cynthia W. Darling; Project Manager – Eastern Maine Regional Office

From: Amanda S. Wade, P.E.; Environmental Engineer – Technical Services (ASW)

Date: July 27, 2011

Subject: Juniper Ridge Landfill
Affidavit of Denis St. Peter

On May 27, 2011, a Petition to Modify the Juniper Ridge Landfill (JRL) Amended License #S-020700-WD-W-M was submitted to the Board of Environmental Protection by David Van Slyke of Preti Flaherty Beliveau & Pachios LLP on behalf of the Penobscot Energy Recovery Company and Municipal Review Committee. The minor revision referenced in the petition allowed for the acceptance of MSW bypass at JRL for use as the protective layer of each new landfill cell at the completion of its construction. The petition included multiple exhibits. As requested, we have reviewed only the Affidavit of Denis St. Peter (Affidavit) presented as Exhibit 4. We have reviewed the Affidavit for its technical merit and factual content. For readability, our comments are arranged in the order that the information was presented in the Affidavit and Mr. St. Peter's language is presented in bold italics.

To provide a more complete understanding of the technical issues associated with landfill liner protective systems, we have attached a copy of our November 8, 2010 memo to you regarding this subject. Also note that in the Affidavit, Mr. St. Peter uses the term "select layer", whereas the solid waste rules use the term "protective system", which may include the use of "select waste". For our responses, we consider that Mr. St. Peter's use of the term select layer is meant to be synonymous with the terms select waste and protective system.

11. ***Based on my understanding of secure MSW landfills in the State of Maine, an initial 10 to 12-inch thick layer of tire chips or wood/bark chips has commonly been used for this layer.***

While it is true that many of the landfills in Maine utilize tire chips and wood/bark chips as a frost protection layer, still others have successfully used MSW for this purpose when there has been sufficient time to place the waste to prevent the onset of frost penetration into the liner system. Many of Maine's landfills are quite small and their fill rates are not adequate for them to place sufficient waste throughout the base of a new cell prior to the winter months. When this is the case, the landfill must find an alternate material that can be delivered in bulk and spread quickly. Still other landfills may build a cell years before it is needed and choose to place a clean material like tire chips or bark mulch in the base because it provides the required protection and allows the facility to discharge the stormwater off site as clean water therefore reducing the costs for leachate treatment. The landfills that have successfully placed MSW as the primary protective system include the City of Bath Landfill Cell 2-1A, the Brunswick Landfill, and Lewiston Landfill in Cell 1.

The use of an initial 10 to 12 inch thick layer of tire chips or wood/bark chips alone as the only component of a protective system would not be sufficient nor approved by the Department. This relatively thin layer may provide adequate protection against frost or erosion, but it would not be adequate to protect the liner system against puncture, either from objects within the waste or equipment driven over the layer. Landfills that propose the use of thin layers of tire chips or wood/bark chips are also required to place select waste directly above this layer until adequate protection against puncture exists, typically viewed as a minimum of 5 feet of material (e.g., waste and/or tire chips or wood/bark chips) over the liner system.

13. I have concerns about the potential for puncture or other damage to the underlying liner and LCS depending upon their configuration unless there is a provision for significant construction quality assurance (CQA) to ensure that the waste items that are within the considerable amounts of MSW are consistent with its use as a select layer.

The procedure for placement of MSW as a protective layer was not included in the minor revision application because waste placement is an operational issue that is outlined in a facility's Operations Manual. The Operations Manual is comprehensively reviewed with the operators annually as required by the Department's solid waste rules. The JRL operators are trained to carefully inspect loads as they are dumped to ensure that all of the wastes are acceptable for disposal at JRL and have the ability to remove any item that may pose a puncture hazard to the liner and leachate collection system. It is typically uncommon for the protective layer (inclusive of waste materials) to placed as part of a construction project, when CQA would be appropriate. An example of this rare instance was the construction of Phase 8A of the Norridgewock Landfill where a new landfill cell was built and waste was excavated from an adjacent, unlined landfill area and placed in Phase 8A as part of one construction project.

The following language is from the Presque Isle Landfill's Operations Manual prepared by Mr. St. Peter's company, CES, Inc., and is an example of the necessary procedure for successful MSW select lift placement. The language does not suggest the need for CQA as Mr. St. Peter claims in his comment above. "The first lift of waste on the new expansion liner should be a minimum 5-foot layer of select waste. Select waste is considered typical residential waste from typical packer trucks; waste with less likelihood of bulky or sharp objects. Wastes should be dumped on previously placed wastes and carefully pushed ahead onto the new liner system. The **equipment operator** (emphasis added) should be carefully inspecting the waste as it is being pushed. No construction debris, inert fill, or bulky waste will be used for the first lift of waste on the new liner system."

It is important to understand the cost implications regarding Mr. St. Peter's suggestion that CQA is routinely necessary for select lift placement. Under Maine's regulations, CQA must be performed by an entity that is "separate" from the owner or operator of a solid waste facility. Separate is a defined term in the regulations as a qualified consulting firm under contract with the solid waste facility. Requiring a solid waste facility to contract with a qualified consulting firm during placement of the entire protective system could be a substantial financial burden for the facility. Additionally, we have not seen evidence of widespread damage (as evidenced by

increased flows in leak detection systems) to liner systems from select waste placement that currently supports the need for CQA during this activity.

> ***I am also concerned that used alone, MSW as select layer may not provide the necessary frost protection characteristics unless there is a provision for significant CQA to make sure the varying waste materials provide the required insulation values.***

Timing of construction of new cells at JRL combined with the faster fill rate usually allow for more than 5 feet of waste to be placed in the base of each cell to prevent the onset of frost penetration into the liner system. When evaluating a material for its frost protection capability, it is often the case that the material's organic content plays the largest role. For example, 2-3 feet of a soil, with very little organic content, may need to be placed above a liner system to protect it from frost while 6-9 inches of bark mulch, with a much higher organic content, should provide the same protection. Empirically speaking, MSW should have a much higher organic content than soil but a lower organic content than bark mulch. Based on the relative thicknesses discussed above, 5 feet of MSW would certainly provide adequate frost protection. JRL's currently approved Operations Manual also calls for 2 feet of bark or other material to be placed in the cell if waste operations are not ready to move into the area. This procedure would still be used if enough MSW could not be placed prior to the freezing season.

As noted in our response above, Mr. St. Peter's suggestion that CQA is necessary to ensure that the required insulation values are obtained could be a significant financial burden for a solid waste facility with a limited return. Requiring CQA to evaluate a material that typically meets the necessary requirements is redundant and not cost effective. Ensuring that specific training is provided to the operators, as required by the Solid Waste Rules, is a much better use of resources.

14. I know of no other landfill in the state where only MSW is used as the select layer material.

As stated above, MSW alone was placed as the protective layer at the City of Bath Landfill Cell 2-1A, the Brunswick Landfill, and Lewiston Landfill in Cell 1.

15. CES, Inc. is the Engineer of Record for the design and operation of the Presque Isle Secure Landfill (PSL). The design at PSL utilized tire chips and typical household MSW as the select layer directly above the LCS. The tire chips are placed first, in a 10 inch layer, directly on top of the LCS, followed by MSW. The tire chip layer functions primarily as a frost protection layer, but also provides other benefits such as vertical leachate drainage and puncture/damage resistance.

Tire chips are used at PSL for a number of reasons. As Mr. St. Peter stated above, the tire chips do provide frost protection but were also used for the following reasons. Please note that we could not find a mention of the use of tire chips for puncture/damage resistance in the application materials associated with this expansion.

1. PSL has historically had leachate drainage issues on site that have led to leachate head build up within the Phase I landfill in excess of the regulatory limit of 1 foot. This has led to the installation of vertical leachate pumping wells within the Phase I waste. The tire chips in the expansion design were primarily intended to function as part of the leachate collection system, as presented on page 6-5 of the Phase II expansion application's engineering design report which states, "*The leachate collection system for the proposed expansion consists of several components. These components include: a 10" layer of type B tire shreds, a 12" layer of -1 1/2" crushed stone…".* The use of tire chips is intended to help prevent leachate head build-up in the newly constructed cells.

2. PSL has chosen to divert the stormwater that falls on the currently unused half of the newly constructed area away from the leachate collection system and send it off site as clean water. The use of tire chips enables them to do that while still providing frost protection in the area.

3. PSL has a much lower waste acceptance rate than JRL. Due to the early frosts seen in Aroostook County it is necessary for them to obtain materials other than MSW to place in the base of the cell to ensure that frost protection material is placed in a timely manner. PSL Phase II expansion construction was completed in the late fall of 2010. Select waste placement across the base of the first cell still has not been completed as of this date. In this case, the use of MSW only as a protective system would be completely inappropriate due to the unavailability of enough waste in the time period allotted.

17. ***In addition to the type of waste, placement methodology is an important function of the select layer. Compaction equipment must take care to maintain appropriate thickness to reduce loads transferred by equipment. Visual inspection is ongoing at PSL to verify no unacceptable waste are placed within the select layer and risks associated with puncturing the liner system or damaging the LCS are minimized.***

We concur that waste placement methodology is important. As stated above, waste placement procedures are outlined in a facility's Operations Manual and reviewed and approved by the Department on a site-specific basis. JRL operators are trained to inspect loads as they are delivered to the facility and placed in the cell. JRL operators have the ability to remove any inappropriate wastes at that time. JRL operators are also trained in waste placement methodology, inclusive of the first lift of select waste. As noted in our response to #13 above, the PSL operator is responsible for waste inspection during select waste placement, and similarly, is trained in waste placement methodology. This is a standard operational requirement at all facilities.

18. ***I am aware of at least three other secure landfills that CES staff have worked on, including Town of Hartland Landfill, Tri-Community Landfill (TCL) and Norridgewock Landfill and that use other materials besides MSW only for the select layer. For example, tire chips and MSW are used as select layer for TCL and Norridgewock Landfill. Wood chips and sludge are used as the select layer at the Town of Hartland Landfill.***

The landfills referenced above all have additional reasons for using an alternate material as a component of the select layer. TCL, like PSL referenced above, is located in Aroostook County and has a low waste acceptance rate so an alternate frost protection layer needs to be placed quickly following construction in order to ensure adequate protection prior to the winter months. The Norridgewock Landfill has constructed cells that remain unused and the use of tire chips allows them to shed stormwater as clean water. Hartland is a secure sludge landfill that is not permitted to take any wastes except for the town's treatment plant sludge, therefore it is not able to accept MSW for placement as a select layer. Regardless of the reasons, an alternate material is used as a component of the protective system. The total protective system at these facilities includes the select layer material referenced by Mr. St. Peter and the first lift of select waste placed in the landfill. Had circumstances differed from the additional reasons cited for each facility, the facilities could have proposed, and the Department would have evaluated, the use of MSW only as the protective system.

19. ***In my professional opinion, I believe the applicant and the DEP should conduct a review of (1) JRL's liner and LCS design to evaluate its ability to provide puncture/protection; (2) the CQA Plan to evaluate its effectiveness to identify objects during placement that may damage the liner and/or LCS; and (3) the frost protection ("R value"), erosion control, and puncture resistance properties of MSW as select layer.***

The Department is currently responsible for reviewing and approving all designs, CQA Plans and operational procedures (through the approval of facility operations manuals). All aspects of a facility are taken into consideration during our reviews, including the items referenced by Mr. St. Peter.

JRL's liner system design includes 2 feet of clay, a geosynthetic clay liner, and an 80 mil textured High Density PolyEthylene (HDPE) geomembrane. Its leachate collection system, which sits directly on the geomembrane, consists of a drainage geocomposite overlain by 1 foot of sand and perforated HDPE piping placed in stone bedding. Each cell design is approved by the Department, its construction is inspected frequently by the Department's project engineer, and the material testing results are reviewed and approved by the Department prior to cell operation.

As stated in our response to Mr. St. Peter's comment No. 13 above, a CQA Plan is not required for waste placement; however, the facility's waste placement practices are reviewed and approved by the Department as part of its Operations Manual. JRL's operators are trained annually on the contents of the manual as required by Chapter 401 of the Department's solid waste rules and are capable of identifying and removing any inappropriate materials during waste placement.

As stated in our response to Mr. St. Peter's comment No. 13 above we discussed the properties used when determining a material's frost protection potential and the logic behind the Department's acceptance of a 5 foot layer of MSW.

While erosion control is a required property for a protective layer, the base cells at JRL are all basically flat with a gentle slope toward the sump. This design minimizes the potential for erosion of the leachate collection sand. MSW is therefore adequate to prevent any potential erosion at this site.

As stated above, waste placement practices at JRL are adequate to allow the operators to examine the waste during placement and remove any material that may pose a puncture hazard. Five feet of MSW plus a foot of sand and a drainage geocomposite are also adequate to prevent any liner system damage from puncture due to waste placement above the MSW protective layer.

21. The order contains insufficient technical support to find that as a technical matter MSW is the most appropriate material, or an appropriate substitution for, tire chips and/or other materials that are traditionally used for the select layer.

In a memo to you dated November 8, 2010, we outlined the technical merits and thought process for recommending the use of MSW at JRL. In the memo, we discussed the properties we look for when determining the suitability of a material for use as a protective layer. We then examined all of the wastes permitted for acceptance at the facility and discussed each of their properties. Based on this assessment, we concluded that MSW has the appropriate characteristics to support its use in the protection of the liner and leachate collection system. The above mentioned memo is attached to this memo as Attachment 1.

22./23. The Order at Page 6, Section 3, states that the "applicant has used other licensed wastes including front-end process residual from the incinerators, ash, contaminated soil, and bark for the soft layer." The Order also states, "that it is possible these wastes will cause problems with the leachate collection system" by hindering leachate movement into the LCS. The Order does not reference any technical support or justification for this finding. Therefore, I asked DEP what material, if any, they have to support such a conclusion.

The Department used knowledge gained from experiences at other similar facilities when making the technical recommendations regarding this licensing decision. It is typical practice for the Department to use lessons learned from one facility to assist other facilities so that similar problems and situations are avoided to the extent possible.

As you are aware, JRL's waste stream is similar to the waste stream that was deposited at the Pine Tree Landfill (PTL) in Hampden and because the operator is the same, waste placement procedures are similar. NEWSME, the facilities' operator, has struggled for years to find the right waste mixture to use as a protective layer. As was outlined in our November 8, 2010 memo, many of the wastes that are accepted for disposal at PTL and JRL, have characteristics that preclude them from being placed directly on the leachate collection system. Based on the characteristics of the licensed wastes, the operator placed different combinations of Front End Process Residuals (FEPR) and incinerator ash at PTL.

In PTL's Phase VI, the operator placed a combination of ash and FEPR and in Phase VIII-C FEPR was placed by itself. In both cases the operator had to excavate the sumps due to a lack of leachate drainage. When the sumps were excavated it became evident that the FEPR and FEPR and ash mixtures had blocked the leachate collection system. Pictures from the facility show evidence of clean leachate collection sand around the edge of the sump which would suggest that leachate never made it to the leachate collection system. The photographs are appended as Attachment 2.

Based on the issues observed at PTL, the Department has been working collaboratively with NEWSME for several years to help prevent the occurrence of these issues at JRL.

24./25. Based on her description, the evidence clearly showed "cementing" or other physical barriers to leachate migration. However, without physical testing of the layers in question, the reason(s) for the potential leachate migration barrier(s) cannot be determined. The photos provided to CES from Amanda Wade show a brown layer of material (which Amanda identified as "straight FEPR") and a geosynthetic material resembling a geotextile. Observations cannot determine which material (the FEPR or the geosynthetic) may be contributing to the barrier. An investigation that includes field observations and testing (e.g., hydraulic conductivity, permittivity, grain size analysis, etc.) are necessary to determine which material or processes are causing the clogging. In addition, it is not clear which waste materials (i.e., FEPR, ash, contaminated soil, bark, or geotextile) or which blend(s) were causing the leachate blockage.

The leachate collection system designs at PTL and JRL do not include a geotextile above the sand as suggested by Mr. St. Peter's review of the photos provided to him by the Department. Based on this information it is evident that the FEPR is the material that is causing the barrier, therefore testing, along with the added expense to the facility, is not necessary. Department staff have also observed FEPR after it was placed as grading material at PSL. The FEPR begins to decompose shortly after it is placed and becomes soft and difficult to operate on. Due to the drainage problems observed at PTL with the placement of both FEPR alone and FEPR mixed with ash and the observations at PSL, the Department concluded that JRL should avoid placement of these combinations of wastes as their protective layer.

26. Material directly above the LCS should be at least as permeable as the waste within the landfill and not act as a physical or chemical barrier to vertical leachate migration; however, we recommend the applicant or DEP explore which waste material(s)— or blend(s) of waste materials – were providing the leachate migration barrier so that we are not precluding the use of potentially effective waste materials that may be more consistent with the State's Waste Management Hierarchy (Title 38, M.R.S.A. 2101).

As outlined in our November 8, 2010 memo, many of the wastes that are accepted for disposal at JRL have characteristics that preclude them from being placed directly on the leachate collection system. JRL is seeking the ability to place MSW bypass, a waste material, in the base of new cells as the protective layer to prevent the repeat of drainage issues observed at PTL.

JRL has not requested to use MSW exclusively as the protective layer; rather they have requested the ability to use this material. The materials that Mr. St. Peter references as being used throughout the state as the base of the protective layer include clean materials such as tire chips and bark mulch which have numerous other, non landfill applications. In this case the placement of a waste within the landfill instead of a clean fill material is consistent with the State's Waste Management Hierarchy.

27. ***For example, if DEP believes that FEPR or ash should not be used as a select layer because of perceived leachate clogging, it is worth studying whether such perceived clogging is eliminated by mixing them with other waste materials. It is necessary to conduct technical analysis prior to ruling out particular waste materials.***

As outlined in our November 8, 2010 memo, many of the wastes that are accepted for disposal at JRL have characteristics that preclude them from being placed directly on the leachate collection system; therefore, there are no other currently approved wastes to mix with FEPR or ash to reduce the observed clogging.

28. ***Moreover, the DEP photographs appear to show a landfill's leachate collection sump mechanism. Sumps are locations in landfills where leachate is collected, and are typically less than five percent of the footprint of a landfill cell. It is not surprising that ash or FEPR could become cemented in this particular location due to the collected moisture. However, before concluding that FEPR is inappropriate for select layer purposes entirely, it is important to determine whether FEPR and ash has affected downward movement of liquids elsewhere in landfills (and not simply near sump locations).***

The photographs provided to Mr. St. Peter were indeed of the sumps in PTL's Phase VI and VIII-C. For ease of reference we have attached the photos to this memo as Attachment 2. While we agree that sumps are typically less than 5 percent of the footprint of the landfill they are an important component of the leachate collection system because they handle 100% of the cell's leachate. Therefore, drainage issues at the sump can cause leachate to back up within the waste and become a real threat of leachate releases to the environment or cause instability of the landfill.

Typical sump design at JRL and PTL includes piping and stone overlain by tire chips to aid in drainage. In the photos this material had been removed to allow for repairs to the system. The area that is important to note on the photos is the point where the leachate collection sand ends at the edge of the sump. At this location there is visual evidence that the protective layer has blinded (see Attachment 1 for a further description of this phenomenon) the leachate collection sand because the sand itself appears to be as clean as it was when it was placed. Leachate collection sand that is working properly would be discolored and appear either orange or black. This discoloration is not seen in the photo.

While it might be interesting to examine the leachate collection sand throughout the base of a cell, it is not practical. At JRL, for example, the sand is located beneath more than 100 feet of

waste. It is not unreasonable, however, to make the assumption that the leachate collection sand throughout the cell may look similar to that located adjacent to the sump because the same wastes were placed above it.

29. ***After October 13, 2010, I received a report by Sevee and Maher Engineers, Inc. entitled Clogging Investigation Report Sump Area, Phase 1 Landfill Expansion Leachate Collection System, ecoMaine Landfill, September 2010.....Based on this investigation, the report concludes that the physical clogging of the geotextile was the primary reason for the clogging problems.***

As we have stated above, there is no geotextile above the leachate collection sand at JRL so geotextile clogging is not of concern. Therefore, a comparison of the cause of the clogging at ecoMaine (which has a geotextile above the sump) to the clogging observed at PTL (which does not have a geotextile above the sump) or the potential for clogging at JRL (which also does not have a geotextile above the sump) is not appropriate. The Report does however discuss some drainage issues observed on the working face at ecoMaine that supports our November 8, 2010 memo. EcoMaine is an ash landfill and according to page 2 of the Report, "the vehicle traffic on the ash surface (and possible some weak cementation) is sufficient to partially seal the ash surface to infiltration". This supports our statement that ash, when placed as part of the protective layer, can become solidified on top of the leachate collection system and prevents leachate from draining down through it.

30. ***I then reviewed a project Summary by the United States Environmental Protection Agency entitled "Leachate Clogging Assessment of Geotextile and Soil Landfill Filters" by Robert M. Koerner and George R. Koerner (September 1995). The Summary provides performance, design, testing, and recommendations for filters used for leachate collection drainage systems at the base of landfills and other solid waste facilities. Three out of the four landfills that were studied had geotextile filters that were "excessively clogged."***

As we have stated previously there is no geotextile above the leachate collection sand at JRL. Although the document cited above is a valuable reference source, it is not applicable to this site based on the design of JRL.

31. ***Based upon my review of the statements in the Order and the record, I have concluded that there is insufficient data and information to support a technical finding that "MSW bypass" by itself is the best material, or even an appropriate material, for the select layer at the JRL landfill.***

As stated above, we have outlined the technical merits and justification for recommending the use of MSW at JRL in a memo to you dated November 8, 2010. For the reasons included in the memo we continue to support its use for this application. From a purely technical standpoint, the key distinction for "bypass" is that it is in fact MSW which, as we have concluded, adequately functions as a protective system. "Bypass" is just a legal term to define MSW that can not be processed by an incinerator during a specific time period and is, therefore, sent to the landfill.

32. I have further concluded that the available technical evidence conflicts with DEP's conclusion that FEPR is unsuitable for use in the select layer.

We have not seen any available technical evidence that would support Mr. St. Peter's statement above. In fact, Mr. St. Peter agrees with the Department regarding the potential for clogging by FEPR and ash within sump locations (reference #28 in the Affidavit). As stated above in our response to comments #24/25 and 28, it is evident that FEPR has contributed to drainage problems at other landfills. Subsequently, we do not recommend its use as the primary component of the protective system at JRL. Mr. St. Peter did not present any evidence regarding the remainder of the landfill base to support his statement.

As you can see from our responses above we disagree with the statements made by Mr. St. Peter in his Affidavit and continue to recommend the use of MSW bypass at JRL as the protective system. Based on the currently approved footprint at JRL, only 2 more base cells (where a protective system will need to be placed) remain to be built (a third cell is under construction this summer and will be completed early this fall). The remainder of the capacity involves waste placement above currently built landfill cells, which does not require the use of a protective system.

Please feel free to contact me with any questions or concerns.

Attachments: November 8, 2010 Memorandum to Cynthia Darling from Amanda Wade, PE.
Photographs of PTL Phases VI and VIII-C Sumps

Pc: David Burns, P.E. – Environmental Engineering Services Manager
Dick Behr, C.G. – Project Hydrogeologist

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Attachment 1

November 8, 2010 Memorandum to Cynthia Darling from Amanda Wade, P.E.

MEMORANDUM

To: Cynthia W. Darling; Project Manager – Eastern Maine Regional Office

From: Amanda S. Wade, P.E.; Environmental Engineer – Technical Services

Date: November 8, 2010

Subject: Juniper Ridge Landfill
Landfill Liner Protective Systems

On November 2, 2010, in response to the appeal filed jointly by PERC and MRC of DEP license #S-020711-WD-W-M, you asked us to provide you with the background information used by the Department's Technical Services Engineering Unit to evaluate the appropriateness of a material as part of a landfill liner protective system. As you are aware, Chapter 401.2.D.(4)(a)(vii), 401.2.D.(6) and 401.4.C.(12)(a) of the solid waste rules requires that a protective system be provided for the primary liner and leachate collection system for every new landfill cell constructed. A landfill liner system must include at least a composite liner consisting of a geomembrane and a barrier soil layer. The leachate collection system for a landfill is typically some combination of sand, stone, piping and geocomposite drainage material. The protective system is a layer of material placed on top of the leachate collection system to cover the entire footprint of a cell and is typically approximately 5 feet deep. The goal of this system is to protect the liner and leachate collection systems from damage due to freeze/thaw effects, erosion and puncture. Protective systems may consist of tire chips, soils, bark mulch or select waste as long as the waste is permitted for disposal at the landfill. Select waste is a component of a facility's waste stream that will meet the goals of the protective system outlined above.

Our discussion below relates to the suitability of select wastes for use as protective systems and provides the basis for our earlier recommendation that municipal solid waste (MSW) be used at the Juniper Ridge Landfill (JRL) for this purpose. For reference, MSW is also a large component of the protective systems placed at Waste Management's Crossroads Landfill in Norridgewock, the City of Bath Landfill, Tri-Community Landfill, the Presque Isle Landfill, and Hatch Hill Landfill in Augusta where they are licensed to accept MSW.

One of the benefits of using a select waste in place of a non-waste material as a component of the protective system is that it allows a facility to manage landfill capacity. For each acre of a new landfill cell, where 5 feet of a protective system is placed, assuming no consolidation factors due to compaction, 8,067 cubic yards of capacity is used. For JRL the typical, yearly constructed, landfill cell is approximately 6 acres in size. If a select waste were not chosen for this facility, this would amount to approximately 48,400 cubic yards of landfill capacity consumed by a non-waste material.

Based on the goals for this system, there are some wastes that are not appropriate for use due to a high risk for puncture of the geomembrane liner. These wastes include construction and demolition debris and oversized bulky waste. There is an obvious risk of damage to the liner system if a large piece of wood, or metal, were to be placed and compacted with the heavy equipment involved in landfill operations within 5 feet of the geomembrane.

Besides the risk for physical damage to a liner system there are other factors that are evaluated in determining waste suitability including, but not limited to; thermal properties, hydraulic conductivity, potential for providing erosion control, potential for blinding or clogging, potential to cause operational issues such as dust and odor, and the potential to impact gas generation. We have presented more detail on these properties below as well as some of the issues we have seen from using different select wastes at landfills throughout the state.

Thermal Properties

The material property that is often investigated first when choosing a select waste is its insulating value. In most cases, new landfill cells are constructed just prior to a facility needing additional capacity and may sit unused for a few months. The construction season for landfill liner systems is usually limited to warmer weather when proper soil compaction and geomembrane seaming can be most readily achieved. In Maine, that means that most of the construction is done in the summer and early fall. Once a cell is completed, if a facility is not ready to immediately utilize the capacity, there is a risk that damage to the compacted soil components of the liner system can occur due to freezing and thawing. This leaves the facility a limited amount of time to obtain enough material to protect the liner system from freezing. One of the characteristics of a material that impacts its insulating value, and determines how much of the material is needed, is the organic content. When using a material with little or no organic content such as soil a facility may need to place a 5 foot layer to achieve the same insulating value as placing a 1 foot layer of a highly organic material like bark mulch.

Hydraulic Conductivity

Since the protective layer is placed continuously across the cell bottom and will be sitting directly on top of the leachate collection system it is important that water can flow as freely as possible through any select waste chosen. For this reason facilities must find a waste material from their approved waste stream with a high hydraulic conductivity while still being cognizant of the risk for puncture. It is also important, since the protective layer is permanent, that the hydraulic conductivity of the select waste be sustainable and not easily impacted by compaction or waste decomposition over time.

Some of the wastes we have seen used in the past that have caused drainage issues include paper mill and waste water treatment plant sludges and some ashes. We have seen instability issues at some of the paper mill landfills in the state, where the majority of the wastes are sludge and ash, which were caused by the build up of water pressures within the waste due to an inability of the leachate to drain into the leachate collection system. This has led to slope failures and leachate breakouts that resulted in releases to the environment.

Erosion Control

Many landfill cell liner systems incorporate a slope in the design. When this occurs it is especially important to consider erosion control when choosing a select waste. Because sideslopes are often one of the last sections of the cell to be covered with waste it is often the case that this portion of the liner and leachate collection system remain unused for more than a year. For this reason select wastes with soil-like properties, such as contaminated soil and ash, which can be easily eroded during rain events should not be chosen.

Blinding or Clogging

When considering a select waste it is also important to question whether there is a potential for the waste to cause blinding or clogging of the leachate collection system. Blinding can occur when a thin layer of fine material settles on top of the leachate collection drainage media blocking the voids that would allow for drainage of leachate. Clogging can occur when fines enter the drainage media and fill the internal voids throughout the depth of the media. Clogging can also be caused by chemical and/or biological reactions.

The wastes we have seen that have been responsible for some of the most significant issues with blinding and clogging are ash and front end process residues (FEPR). Though it may not seem evident that ash and/or FEPR could cause issues, we have seen that ash, when placed as part of the protective layer, can become solidified on top of the leachate collection system preventing leachate from draining down through it. FEPR, when placed as the protective layer, quickly decomposes and can form a uniform restrictive layer that blinds the leachate collection system. Both of these wastes also contain fines that can cause clogging of the leachate collection system. We have observed both of these conditions at the Pine Tree Landfill (PTL) in Hampden where the leachate collection sumps for Phases VI (where ash and FEPR were used together as a protective layer) and VIII-C (where FEPR alone was used as a protective layer) had to be excavated and repaired because leachate was not draining properly.

Operational Concerns

Another important property we consider in our evaluation is whether there are operational concerns from stockpiling or using wastes as a select lift. Will the material create dust or odors, for example? As I have stated above, for a facility like JRL it is typical to require as much as 48,400 cubic yards of select waste material for use in a very short period of time. This would require the facility to stockpile some wastes for months to ensure that they were prepared when the time arrived for placement.

We have seen at PTL and JRL that wastes like FEPR are odorous and both facilities have received odor complaints due to FEPR placement in the past. Department staff have also observed the placement of FEPR at PTL after it had been stockpiled for select lift placement and note that there were significant odors from this practice. We have also seen that ash can create a dust issue at a facility if it is allowed to dry out in the sun and wind and is not covered regularly.

Effects on Gas Production

While direct odors from the waste are a concern to the facility so are the odors that may be caused due to gas production. With this in mind, the facility has to look at the potential impacts a waste stream may have on their gas production and whether they can have effective gas extraction in place early enough to limit offsite impacts.

We have seen at the Bath Landfill, for example, that using materials like construction and demolition debris fines in a thick layer directly on the leachate collection system can increase hydrogen sulfide production and cause significant odors and potential health issues for surrounding neighbors.

JRL Liner System and Waste Streams

At JRL a new cell is constructed annually. The cell is, on average, 6 acres in size and its liner system, in accordance with the facility license, is comprised of a sand and pipe underdrain system, 2 feet of compacted clay, a geosynthetic clay liner, and an 80 mil textured high density polyethylene geomembrane. The leachate collection system is comprised of a geocomposite drainage layer and 1 foot of sand with piping surrounded by stone. These systems need to be protected from freeze/thaw effects, erosion, and puncture, in accordance with the rules, in order to maintain their integrity.

JRL is licensed to accept a variety of wastes for disposal. Based on their 2009 annual report, their waste stream included 24.8% ash, 19.7% construction and demolition debris, 16% FEPR, 13.3% sludge, 9.7% oversized bulky wastes, 8.8% wood fines, and 4.1% municipal solid waste (MSW) bypass. The remainder of components of their waste stream was less than 1% each. When these wastes are blended together and placed in accordance with the facility's operations manual they form a very stable waste

mass. However, based on the information presented above, each of the components, except for the MSW bypass, when utilized as part of the protective layer can be problematic for the facility.

Summary

Taking all of the above information into consideration, the select waste we see used most frequently at commercial and municipal landfills in Maine, where a variety of wastes are accepted for disposal, as the largest constituent of the protective layer is municipal solid waste (MSW). Experience has shown that MSW has the appropriate characteristics to support its use in the protection of the liner and leachate collection system. For these reasons we recommended its use as a select waste at JRL.

Please feel free to contact me with any questions or comments.

Cc: Victoria Eleftheriou
Dick Behr

Attachment 2

Photographs of PTL Phases VI and VIII-C Sumps

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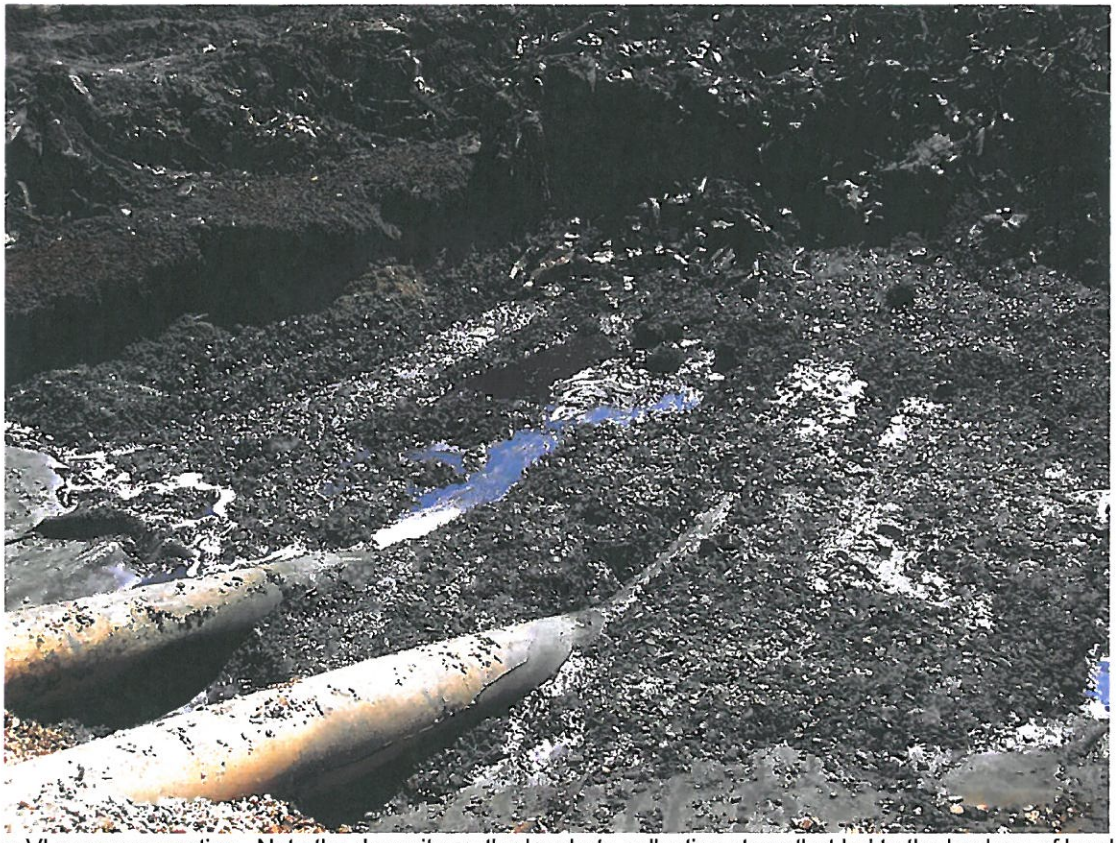
PTL Phase VI Leachate Collection Issues

September 2009

Photographs taken by Steve Farrar of Maine DEP and Paul Monroe of Sevee and Maher Engineers, Inc.

Leachate that backed up along the landfill berm because the leachate collection layer was blinded by the soft layer. Note the layer of ash and FEPR seen just above the leachate.



Phase VI sump excavation. Note the deposits on the leachate collection stone that led to the back up of leachate.

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Phase VI sump. Note the layers of clean sand and stone around the perimeter of the sump indicating that leachate was not able to penetrate through the soft layer in these areas to get to the leachate collection system.

Picture of Phase VI sump from afar to show location of waste in relation to the sump. The dark layer of material just above the leachate collection sand is the soft layer placed in the cell and consisted of FEPR and ash.

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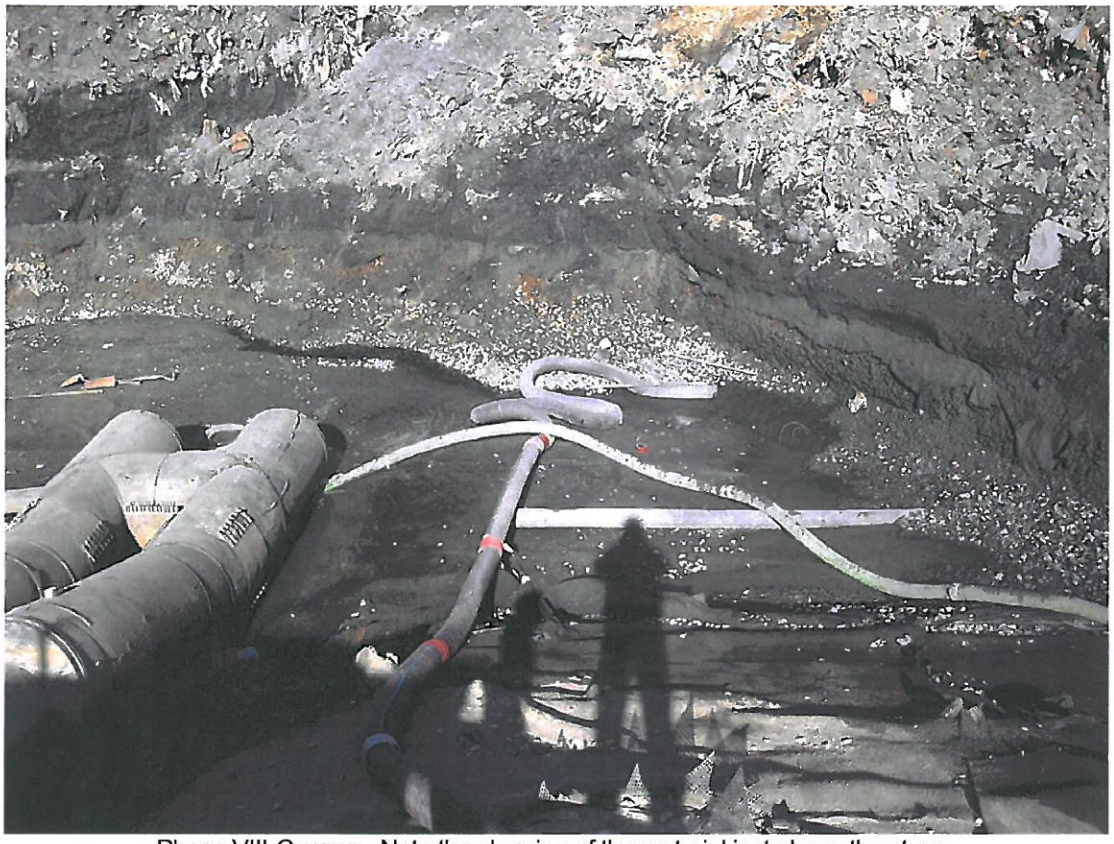
PTL Landfill Phase VIII-C Sump Excavated to deal with Leachate issues.

Photos taken by Paul Monroe of Sevee and Maher Engineers, Inc.

Photo of Phase VIII-C sump. Note the layer of degraded material sitting above the leachate collection stone and the amount of clean stone at the bottom of the sump indicating that leachate did not penetrate into the stone. FEPR was used as a soft layer in Phase VIII-C and ash was placed above it as daily cover and to manage odors at the site.



Phase VIII-C sump. Note the clogging of the material just above the stone.