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HYDROGEOLOGISTS ■ ENGINEERS ■ ENVIRONMENTAL SCIENTISTS

February 9, 2007

Mr. Alex Moon
Environmental Program Supervisor
Energy & Waste Management Bureau
Iowa Department of Natural Resources
502 East 9th Street
Des Moines, IA 50319

RE: Comments on Proposed Rule Revisions - Iowa Administrative Code (IAC) 567-Chapter 113 "MSW Landfills"

Dear Mr. Moon:

This letter provides Liesch Associates, Inc. (Liesch) comments on the proposed changes to the Iowa Department of Natural Resources (IDNR) rules regarding leachate collection system design and construction, and the requirement that sealed double-ring infiltrometers be used as the final quality control test for clay barrier layers.

A. Leachate Collection System Design and Construction for Municipal Solid Waste Landfills

Generally, the rule proposed in 567 Chapter 113.7(5)b is consistent with the current rules (Iowa and EPA) requiring maintenance of less than 30 cm (12 inches) of head over the liner system. However, the proposed rule includes the following additional requirements that we would like to comment on:

- **"...an additional measuring device shall be installed to measure leachate directly on the liner but not in the sump or within the collection trench. Leachate head measurements from clean-out lines or manholes are not acceptable for the second measurement."**

  We believe that a pressure transducer or alternative measuring device installed within the sump, as required by the current and proposed rules, can be readily calibrated to reflect the corresponding head on the liner outside of the sump and, therefore, an additional/secondary measuring device is unnecessary. If the IDNR does include the requirement for a secondary monitoring device in the final rules, it may actually be preferred that the secondary device also be located in the sump to provide redundancy for the primary pressure transducer controlling the leachate collection pump. Assuming the drainage layer is properly designed,

it is the leachate pump that will be primarily responsible for maintaining the leachate head at less than 30 centimeters (12 inches) on the liner once a landfill cell is in operation.

- **(Paraphrased) A leachate collection system incorporating four distinct components, none having a hydraulic conductivity less than 1 x 10^{-2} cm/sec (an order of magnitude higher than required by the current rules), including:**

  1. **A geotextile cushion over the flexible membrane liner;**

  2. **Collection pipes at least 4 inches in diameter surrounded by high hydraulic conductivity material (e.g. gravel);**

  3. **One of the following high hydraulic conductivity materials;**

     - **A high hydraulic conductivity granular material of uniform size and free of fines at least 6 inches in depth and providing at least 2-inches of cover over the top of the collection piping, or**

     - **A geosynthetic drainage media with geotextile on both sides (e.g. geocomposite) with a minimum thickness of 300 mil or greater sized in accordance with appropriate design calculations**

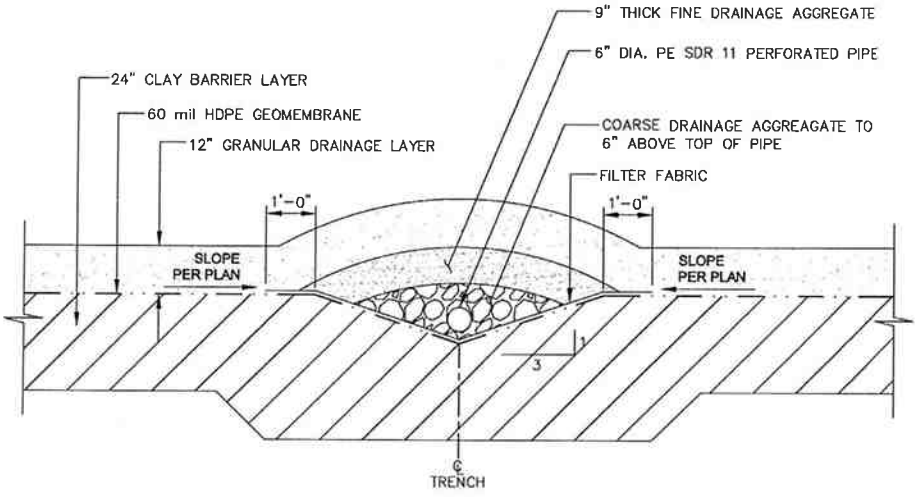
  4. **Geotextile designed to prevent infiltration of fines from the minimum 6-inch layer of coarse granular having less than 1% passing a #200 sieve that is specified to overlay the above-described optional high hydraulic conductivity materials.**

First and foremost, Liesch, and I think most engineers, would prefer that the rules be more performance-based rather than prescriptive, as the proposed rules are, to allow some flexibility in the design of a specific leachate collection system to reflect the actual conditions and operations at each site. We believe that the rule need not say more than it does in the proposed 567 Chapter 113.7(5)b(3), where it states that "a MSWLF unit shall have a leachate collection system that maintains less than a 30 centimeter (cm; i.e. 12 –inch) depth of leachate over the liner."

While higher conductivities will provide for more rapid flow, there may be instances where a permeability of 1 x 10^{-3} cm/sec, as required by Subtitle D, is adequate and where materials may not be readily or affordably available to justify the higher permeability requirement of the proposed rule. We hope that the IDNR recognizes that as a concern and will consider a variance for such situations. Again, the bottom line is performance and the systems ability to maintain less than 30 cm (12 in) head on the liner.

With respect to the four-part leachate collection system described in the proposed rule, the language may just need some clarification. If the intent of this part of the rule is to require facilities to provide a graded filter around leachate collection piping, our issue is only with the requirement that a geotextile separator be placed between the drainage material types as

it is widely recognized that there is a potential for biofouling of geotextiles in leachate collection systems. We have been designing and building landfills for several years using graded filters composed entirely of layers of compatible granular materials that have eliminated the need for a geotextile filter between adjacent layers with no reduction in performance. A typical detail of the graded filter is provided below. Again, if the intent of this part of the rule is to require graded filters around leachate collection piping, we suggest that the language of the rule be revised to reflect a performance-based approach requiring simply that the design consider and prevent migration of fines into the piping system.



SECTION: LEACHATE COLLECTION LATERAL TRENCH

If, instead, it is the intent of the IDNR to require the multi-layer drainage system (6-inches of high hydraulic conductivity material overlain by geotextile separator and 6-inches of coarse granular material) be constructed over the entire landfill liner system, we believe this requirement is unnecessary, costly, and problematic from both functional and construction perspectives. Functionally, leachate transport in granular and geocomposite layers is well-understood and the drainage required to limit head on the liner to less than 30 cm (12-inches) can be readily achieved using a simple monolayer of appropriately-designed granular material or geocomposite, assuming appropriate factors of safety and reduction factors for the leachate characteristics and practices utilized at the facility (e.g. leachate recirculation).

With respect to constructibility, placement of a minimum thickness of 6-inches of each layer of drainage material (high hydraulic conductivity and coarse) is feasible and appropriate around the leachate collection piping components of a liner system, but not over the entire primary liner system. Even with a geotextile cushion, Liesch would not endorse placement of granular drainage materials of any type over flexible membrane base liners at a thickness of less than 12-inches, even with the use of low ground pressure (LGP<5 psi) construction equipment.. In high traffic areas, e.g. haul roads, we would not recommend a thickness of

less than two to three feet during placement, based on our field experience and others experiences reported in the literature.

Lastly, with respect to the requirement that a geotextile cushion be provided, there are design procedures readily available that can be used to determine the need for and characteristics of a geotextile cushion. Examples include Section 5.6.7 of Robert M. Koerner's book "Designing with Geosynthetics" (1998) and the design calculators provided on the internet at www.landfilldesign.com. For conventional well-rounded granular materials less than 3/8 inches in diameter used for typical drainage layers, the requirement for a geotextile cushion would generally represent an unnecessary and costly addition.

To summarize, we would prefer that the rules regarding leachate collection be more performance-based, rather than prescriptive, to allow some flexibility in the design of systems to reflect the actual conditions and operations at each site. We generally concur with the IDNR's design approach for providing a graded filter around leachate collection piping, although we would prefer to see the rule revised to allow a truly graded filter that does not require a geotextile separator as an alternative design. We do not believe that a multi-layer leachate collection system should be required over the entire liner system for all landfill designs and would not recommend that soil layers be placed at anything less than 12-inches of thickness. We believe that equivalent performance can be achieved using a monolayer of appropriately-designed granular material or geocomposite, assuming appropriate factors of safety and reduction factors are considered for the leachate characteristics and practices utilized at the facility (e.g. leachate recirculation). Lastly, we do not believe that a geotextile cushion is necessary for all applications and would, again, prefer that this requirement be based on performance-based criteria using the methods described above.

B. Sealed Double-Ring Infiltrometer Testing of Clay Barrier Layers

The following comments and attached list of references pertain to the rule change proposed for 567 Chapter 113.7(6)(b)(2)(i) and (ii), requiring the use of sealed double ring infiltrometer (SDRI) testing of clay barrier layers as a final quality control and assurance test for landfill construction.

As you know, it is common practice in the solid waste industry to use thin-wall, small diameter sampling tubes (Shelby tubes) for construction quality assurance testing of compacted clay liners. Test methods utilizing these procedures are specifically referenced in the Environmental Protection Agency (EPA) MSW Landfill Criteria Technical Manual that was published as a companion document to the Subtitle D landfill regulations in 40 CFR 258. Shelby tubes are preferred over SDRIs for two major reasons: 1) SDRIs are more costly to implement; and, 2) the time it takes to complete the test is significantly longer than a test on a Shelby tube. SDRI tests can extend over a period of 20-60 days or more, depending on the hydraulic conductivity of the liner. This length of testing would adversely affect both the schedule and cost for construction, and possible the effectiveness of the soil liner material because the contractor would need to "babysit" the clay over the testing period to prevent desiccation.

Liesch has reviewed several academic papers regarding the subject of construction quality assurance testing using large-scale field tests versus small-scale laboratory tests, including several studies that have been completed that directly compared the results of hydraulic conductivity tests

using large-scale field methods and small-scale laboratory methods (references attached). Among the papers reviewed, the most common large-scale method evaluated was SDRI and the most common small-scale method was Shelby tubes. Although discrepancies were documented between SDRI and Shelby Tube hydraulic conductivity measurements in some studies, the reported discrepancies were generally linked to substandard compaction and placement at less than optimum water content. If barrier materials are compacted to a dry unit weight exceeding 95% standard Proctor maximum dry unit weight and water contents are maintained wet of the standard Proctor optimum water content, the literature suggests that comparable hydraulic conductivities can be obtained using either test method. We would suggest that the rule simply state these requirements for clay liner construction.

SDRI tests have, of course, been run on test pads constructed adjacent to liner systems. However, test pads require additional time and materials, rely on the assumption that the test pad was constructed in exactly the same manner as the actual liner, and would also hamper construction scheduling, as geosynthetic materials could not be placed over the clay liner materials until all testing is complete and hydraulic conductivities verified. If barrier materials are compacted to a dry unit weight exceeding 95% standard Proctor maximum dry unit weight and water contents are maintained wet of the of standard Proctor optimum water content, we believe that laboratory testing of samples collected with Shelby tubes is appropriate.

Thank you for the opportunity to provide comments on the proposed rules. Please call me if you have any questions regarding these comments.

Sincerely,

LIESCH ASSOCIATES, INC.

Bruce Rehwaldt, PE

attachment (References)

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