February 12, 2007

Mr. Alex Moon
Energy and Waste Management Bureau
Iowa Department of Natural Resources
502 East 9th Street
Des Moines, Iowa 50391-0034

Dear Alex:

RE: Technical Comments on Proposed Solid Waste Rules in the IAC, Chapter 113

Thank you for the opportunity to provide comments on the proposed solid waste rules. Foth supports the DNR in its efforts to bring all solid waste disposal facilities in Iowa into compliance with the minimum Federal Standards.

Foth has worked with our clients and identified some of the proposed rules that require a more technical evaluation and response. Thus, some of our clients have asked Foth to respond to those rules sections that address the technical aspect of landfill permitting, design, construction and monitoring. We have formatted our comments by first identifying the rules section followed by our comments and our suggestions for revising the proposed rule.

Rule Section: *113.7(5)b.(7) Leachate Collection Systems*

No component of the leachate collection system shall have a hydraulic conductivity of less than 1 × 10-2 cm/sec. Components of the leachate collection system shall have a minimal carbonate content. The leachate collection system shall be at least 6 inches thick over the liner and designed and constructed as follows:

1. A geotextile cushion over the flexible membrane liner (FML), if the liner utilizes an FML. The geotextile's mass shall be determined based on the allowable pressure on the geomembrane.

2. Collection pipe(s) at least 4 inches in diameter at the base of the liner slope(s), surrounded by the high hydraulic conductivity material listed in numbered paragraph 113.7(5)"b"(7)"3" below. The collection pipe shall have slots or holes large enough to minimize the potential for clogging from fines conveyed by incoming leachate.

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3. One of the following high hydraulic-conductivity materials:

▪ High hydraulic-conductivity material (e.g., gravel) of uniform size and free of fines. The high hydraulic conductivity material shall be at least 6 inches in depth and provide at least 2 inches of cover over the top of the collection pipes. The high hydraulic-conductivity material shall be surrounded by a geotextile listed in numbered paragraph 113.7(5)"b"(7)"4"; or

▪ A geosynthetic drainage media (e.g., geonet) with a minimum thickness of 300 mil or greater sized in accordance with appropriate design calculations. The geonet shall be covered on both sides with the geotextiles specified in numbered paragraphs 113.7(5)"b"(7)"1" and "4."

4. Geotextile designed to prevent the coarse granular material listed in numbered paragraph 113.7(5)"b"(7)"5" below from filtering into the high hydraulic-conductivity material. However, the geotextile shall not filter out fines being transmitted through the coarse granular material.

5. Coarse granular (e.g., coarse sand) top layer at least 6 inches thick to separate waste from the geotextile listed in numbered paragraph 113.7(5)"b"(7)"4." The coarse granular layer shall have a fines content of less than 1 percent passing a #200 sieve. The coarse granular layer shall separate the waste from the liner and the rest of the leachate collection system while readily transmitting leachate.

Comment: Foth believes the prescriptive nature of the proposed rules does not allow for engineering innovation or site specific conditions. The prescriptive rules as proposed provide a "one size fits all" approach for leachate collection systems that can be costly and inappropriate at some sites. Several landfill sites have used various innovate designs and materials in the leachate collection layer that have performed effectively at maintaining the leachate head less than 1 foot.

Foth also has concerns from a constructability standpoint. Placing six inches of material on a geomembrane with standard construction equipment may not be possible without significant damage to the geomembrane even if it is covered with a geotextile. Even low ground pressure equipment typically requires 8 to 12 inches of material to safely operate and minimize damage to the underlying geomembrane.

Furthermore, the installation of a geotextile over the geomembrane is not needed in all applications. With the use of electrical leak location testing, damage to the liner can be detected and repaired prior to waste placement. In addition, if sub angular leachate drainage material is used, the likelihood of damage as a result of overburden pressure is limited.

Foth recommends this proposed rule section be revised to provide for the engineering selection and specifications of materials used for the leachate drainage layer that will be protective of the flexible membrane liner and assure leachate head on the liner does not exceed one foot during the active life or post closure period of the MSWLF unit. These materials may include geocomposites, aggregates or other materials that can be demonstrated to meet the performance requirements for the leachate collection system.

Rule Section: *113.7(6)b.(2)1. Electrical resistivity testing*

Comment: Foth also has concerns with this proposed rule regarding the requirement for electrical leak testing of geomembranes in certain applications. Foth supports the requirement to conduct electrical leak location testing, however, electrical leak location testing will not be as effective for landfills that use a geocomposite drainage net as part of the leachate collection system. Use of the geocomposite drainage net would require electrical leak location testing to be conducted prior to placement of the leachate collection system layers above the geomembrane. The geocomposite forms an air gap between the leachate collection layers and the geomembrane which prohibits electrical leak location testing to be conducted after the drainage material has been placed above the geomembrane. Research has shown that most defects in geomembranes are a result of placement of materials on the geomembrane. For MSWLF units that use a geocomposite, electrical leak location testing could be conducted on the bare liner. But this type of testing would not be effective at finding leaks caused by placement of the drainage materials above the geomembrane.

Rule Section: *113.7(6) Quality control and assurance programs*

Comment: Our primary concern is the reference "*A double-ring infiltrometer test shall be utilized as a final QC&A test of the compacted soil portion"* and, "*A double-ring infiltrometer test for the compacted soil portion shall be utilized as a final QC&A test of that component and may be performed on a separate test pad*."

The use of a sealed double ring infiltrometer (SDRI) test as a final verification test for the compacted clay liner is not needed, is costly and time consuming for landfill owners and operators to implement, and other test methods are available that can test the hydraulic conductivity for the compacted clay liner.

The clay soils typically used for composite liners in Iowa have been well tested and documented to demonstrate that the hydraulic conductivity is less than or equal to $1x10^{-7}$ cm/sec. Numerous composite lined cells have been constructed in Iowa with acceptable construction quality assurance and testing to document appropriate hydraulic conductivities were achieved. Tests typically used included a combination of laboratory and field testing to verify the compacted clay liner was constructed to meet the minimum hydraulic conductivity requirement of $1x10^{-7}$ cm/sec. To now require an SDRI test as a final check after numerous laboratory and field tests have been conducted as part of a compacted clay liner construction appears to be redundant and wasteful. Furthermore, an SDRI test requires 30 to 60 days to achieve representative results. This would considerably delay construction of a new MSWLF unit while awaiting test results since placement of the geomembrane could not be conducted until the SDRI test is completed.

There are other methods to ensure a compacted clay liner is constructed such that the hydraulic conductivity is at or below $1x10^{-7}$ cm/sec. The USEPA Technical Resource Document (EPA 600/R-02/099) concludes in the section on compacted clay liners (see Section 4.1.10 Practical Findings from Database).

"CCLs are almost always constructed with the objective of achieving a hydraulic conductivity of 1 x 10-7 cm/s or less. All of the 89 liners and test pads in this database were constructed for the purpose of demonstrating that the k_{Field} *would meet this requirement. Despite all that has been written and learned about CCLs in the past 15 years, the hydraulic conductivity objective of* $k_{Field} \leq 1$ *x 10-7 cm/s was not met at more than one-fourth (26%) of the sites in the database. Why such poor success?*

The soil was unsuitable at a few sites. It appears that in all cases involving unsuitable soils, test pads were built without the benefit of a comprehensive laboratory testing program prior to construction. No simple way of identifying unsuitable soils (based on plasticity information or other index properties) was identified. The database reinforces the recommendation that k_{Lab} tests be performed on representative samples of soil prior to construction, e.g., following the procedures recommended by Daniel and Benson (1990).

Perhaps the single biggest problem identified from the database is failure to recognize that conventional specification of water content and dry unit weight based on a minimum percent compaction often leads to difficulty. The problem is that this procedure does not guarantee that any of the (w, γd) points will lie on or above the line of optimums. Despite widespread publication of procedures that will avoid this problem (e.g., Daniel and Benson, 1990; Daniel and Koerner, 1995), many design professionals and specification writers continue to repeat the mistake. The type of specification that is not generally recommended (but which is still commonly used) is shown in Fig. 4-36A; the more appropriate and recommended approach is shown in Fig. 4-36B.

A conclusion from analysis of the database is that Po is the single most important CQA parameter. The definition of Po is summarized in Fig. 4-24: Po is the percent of water content-dry density (w, γd) points lying on or above the line of optimums. The line of optimums is the locus of peaks of compaction curves developed employing different compaction energies (Fig. 4-23). The key to success in achieving a $k_{Field} \leq 1 \times 10\text{-}7$ cm/s is to ensure that a high percentage (the data indicate a minimum of 70% to 80%) of the field-measured (w, γd) points lie on or above the line of optimums, i.e., in the shaded zone shown in Fig. 4-36B. It should be emphasized that it is practical to compact soil in the shaded zone in Fig. 4-36B, particularly in the shaded area above the line of optimums but below the compaction curve (compaction in this zone could be achieved with a smaller compactive effort than used to develop the compaction curve indicated in the figure). The data in Fig. 4-25 provides confirmation that it is possible and practical to achieve a large value for Po, i.e., to compact within the shaded zone shown in Fig. 4-36B."

In summary, the USEPA concludes that as long as proper soil density and moisture content are achieved in the field from 70% to 80% of the time, the hydraulic conductivity of the compacted clay liner will meet the $1\text{x}10^{-7}$ cm/sec hydraulic conductivity requirement.

If a good CQA program is not implemented such that compacted clay liner testing does not indicate that 70% to 80% of the field testing points lie above the line of optimums, then a more appropriate test may be a large-scale laboratory test in lieu of the SDRI test. The USEPA Technical Resource Document (EPA 600/R-02/099) provides the following information regarding using alternative test methods in lieu of the SDRI (see Section 4.1.8 Field Hydraulic Conductivity Testing Method).

"Benson (e.g., Benson et al., 1994) has pioneered the investigation of the possibility of using large-scale k_{Lab} tests on 300-mm-diameter samples collected in the field as a substitute for k_{Field} tests. Figure 4-35 shows the relationship between k_{Lab} measured on 300-mm-diameter samples and k_{Field} measured with the SDRI test. For all but a few laboratory tests, the correlation between k_{Lab} and k_{Field} is excellent. Of the 8 test pads for which the SDRI indicated a failing k_{Field}, the laboratory tests also indicated failing hydraulic conductivity (i.e., k > 1 x 10-7 cm/s) in 7 of the 8 test pads. Thus, the database supports the use of laboratory tests on 300-mm-diameter samples from the field as an alternative to SDRI tests."

There are also other test methods that may be appropriate rather than the SDRI. One such test is the two-stage borehole test. This test method is documented as ASTM D6391 *Field Measurement of Hydraulic Conductivity Limits of Porous Materials Using Two Stages of Infiltration from a Borehole* and is a faster and much less costly field hydraulic conductivity test used on compacted clay liners. Generally, the USEPA found the two-stage borehole test correlated well with SDRI testing.

Therefore, we feel it is appropriate for the DNR to revise this section of the proposed rules to include other testing methods than the double ring infiltrometer as the final QC&A check for compacted clay liners. Other appropriate methods should include laboratory and field testing to verify in situ material was constructed above the line of optimums, large scale field samples tested in the laboratory (Benson method) or ASTM D6391, two stage borehole test.

Rule Section: *113.10(2)f.(4). Completion every five years of in-situ permeability tests on monitoring wells to compare test data with those collected originally to determine if well deterioration is occurring.*

Comment: In situ permeability testing of wells is not needed and based on the required well design (see 113.10(2)c.(6)3.) that well screens need to be placed above the water table at least 5 feet unless greater distance is required to account for seasonal fluctuations, will not yield results to evaluate the well for deterioration. Common in situ methods for testing permeability are the bale and slug tests. However, both these test methods only evaluate the aquifer immediately adjacent to the filter pack and screen. Additionally, well screen that is placed in the unsaturated portion will influence test results from a slug test by adding water to previously unsaturated areas. These tests are poor indicators of well deterioration.

Foth recommends the DNR consider removing this requirement from the proposed rules. Well deterioration should be determined by a qualified groundwater scientist based on data collected from the field and the laboratory and the professional judgment of the scientist. Additional testing to support any conclusion as to well deterioration and/or well replacement should be made by the groundwater scientist for the site and not mandated by rule.

Rule Section: *113.8(2)h. Leachate recirculation. The department must approve an MSWLF unit for leachate recirculation. The primary goal of the leachate recirculation system is to help stabilize the waste in a more rapid, but controlled, manner. The leachate recirculation system shall not contaminate waters of the state, contribute to erosion, damage cover material, harm vegetation, or spray persons at the MSWLF facility.*

Comment: Foth believes it is important to place in the new rules the EPA prohibition on leachate recirculation at MSWLF units that do not contain a geomembrane. This EPA prohibition was published in the EPA memorandum dated December 16, 1998. The memorandum from EPA Director Robert W. Dellinger stated "*Under the current 40 CFR Part 258 requirements, leachate recirculation is allowed in MSWLF units that meet 258.40(a)(2), i. e., units that are constructed with a composite liner. Leachate recirculation is not allowed in MSWLF units that meet*

§258.40(a)(1), i. e., units that are constructed with alternative liner designs."

Foth recommends a statement be placed in the proposed rule that leachate recirculation is not allowed at MSWLF units that do not have a composite liner. This position is also supported by the Solid Waste Association of North America (SWANA). SWANA has cautioned the EPA that the practice of leachate recirculation in alternative liners MSWLF units should not be conducted unless the alternative design performs as well or better than the composite liner system at protecting the environment (see ISOSWO response dated April 2, 2005 in response to DNR alternative liner request for comments).

We appreciate the opportunity to comment on the proposed rules. Please feel free to contact us at 515/323-7050 if you have any questions.

Sincerely,

Foth Infrastructure & Environment, LLC

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