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Water | Wastewater | Solid Waste | Stormwater & Environmental | Site Development

1601 Golden Aspen Dr.
Suite 103
Ames, Iowa 50010
1.515.233.0000
1.800.433.3469
Fax 1.515.233.0103
www.foxeng.com
info@foxeng.com

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Mr. Jeff Myrom, Deputy Bureau Chief
Energy & Waste Management Bureau
Iowa Department of Natural Reources
502 East 9th Street
Des Moines, Iowa 50319

RE: Comments – Technical Information/Alternative Liners
IDNR Request dated 1/21/05

Mr. Myrom:

Below are our comments in response to your January 21, 2005 request for technical information regarding Alternative liner design (Attachment A). Note that our comments have been reviewed and endorsed in separate correspondence submitted to the department by several of our landfill clients and other professionals in the solid waste management profession.

We appreciate the opportunity to provide information. We, like the Department, are committed to protecting the environment, promoting the highest and best use of existing landfill sites, inhibiting the sprawl of landfill expansions, allowing the upcoming/evolving landfill methodologies to be employed, and preserving the economics of Solid Waste Disposal. Our comments are aimed at promoting these efforts.

We also see this response as an opportunity to raise several questions that we anticipate have equal bearing on this topic and deserve consideration as new rules are drafted.

General

Alternative Liners proposed in Iowa (thus far) typically mimic former Iowa rules consisting of four (4) feet of compacted clay soil. The Composite Liner in Iowa (default liner in rule) is a combination of two (2) feet of compacted clay soil and a flexible membrane liner (FML). The compacted clay in either liner is required by rule to meet the same hydraulic conductivity requirement. Throughout this response, we assume the Alternative Liner and the Composite Liner to be as described above. We realize there are many additional Alternative Liner possibilities that could and should be considered.

The compacted clay liner when utilized as an Alternative Liner is required to have performance demonstrated through modeling. The compacted clay liner when utilized as part of a composite liner is not required to have performance demonstrated. The fact that current Federal and State rules require performance demonstrations for Alternative Liners and not for Composite Liners leads to erroneous conclusions such as:

> ***Erroneous Conclusion #1*** - The FML component of the Composite Liner is perfect, infallible, and removes the potential for impacts to waters of the State. It follows that Composite Liners are not questioned with the same

rigor as Alternative Liners. There are published research papers indicating that the life expectancy of FML is far less than the period of time that the waste remains a threat to the environment[1]. It is our opinion that any liner warrants critical evaluation.

Erroneous Conclusion #2 - A demonstration that the hydraulic conductivity of an Alternative Liner is "equivalent to" that of the Composite Liner is incited. The concept of "equivalency" is in no way pertinent to State or Federal rule and should be disregarded. State and Federal rule pertain strictly to performance, not equivalency between liner types.

Erroneous Conclusion #3 - An Alternative Liner is not a Subtitle D compliant liner.

Those that adhere to these erroneous conclusions often consider (overtly or covertly) the successful demonstration of Alternative Liner performance to be insufficient. Worse yet, insinuations are made that the model variables are "manipulated" until the Alternative Liner model passes the performance criteria.

None of the erroneous conclusions stated above promote the intent of Federal or State rules (to be sufficiently protective of human health and the environment). We believe endorsement of the conclusions above are in direct opposition to the intent of the rule.

The future rules related to MSW landfill system design should assuredly and openly state the goal of protection of human health and the environment. The future rules related to MSW landfill systems should maintain a performance criteria for protection of the groundwater. A demonstrated preference for a particular liner type has no place in rule or policy. In fact, limiting the liner to a prescriptive composite design in State rule may prove to be less protective of the environment than Federal rule.

We do <u>not</u> believe that the fourteen (14) technical design questions in your 1/25/05 letter related to Alternative Liners (of any type) can, or should, be asked without also considering the fourteen (14) technical design questions as they relate to both a perfectly constructed Composite Liner (without defects in the FML) and a compromised Composite Liner (with defects in the FML).

There appears to be an inherent danger in the assumption that a particular liner type (the Composite Liner in this instance) is protective of the environment in all applications, without site-specific evaluation. It is our understanding that IDNR may be considering a "state-wide" Alternative Liner in rule (similar to Illinois Rules). The same inherent danger logically exists if the "state-wide" Alternative Liner is installed without site-specific evaluation.

Additionally, provisions for Alternative Liners (performance based liners) will still be warranted in rule because an endless number of Alternative Liner designs are possible and may prove to be the best application in a site-specific case or allow new technologies to be considered (i.e. Alternative Liners that include GCL, or some combination of soil, FML, or GCL).

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[1] Hsuan, Y.G. and Koerner, R.M., "Long Term Durability of HDPE Geomembranes Part 1 – Depletion of Antioxidants," Geosynthetic Research Institute Report #16, Drexel University, Philadelphia, PA (1995).

Specific Responses

Question 1A. Given that final cover may not be installed for a significant period of time (e.g. for 30 years or longer over some disposal cells), why should point-of-compliance modeling for alternative liners be allowed to include the final cover?

Response #1A.1 – There is a great deal of precedent set throughout EPA literature, EPA Guidance, Federal Rules, State Rules, and the industry for modeling of landfill systems in their complete and final, long-term condition. Some specific examples include:

EPA's Hydrologic Evaluation of Landfill Performance (HELP) model
EPA gas generation models
EPA's Summary Review of Iowa Landfill Liner Design for State MSWLF Program Approval (1994)
40-CFR-258.40(a)1 – *discussions pertain to MSWLF units, not solely liners*
40-CFR-258.60 – *closure cap hydraulic conductivities are tied to liner conductivity.*
IAC 567 Chapter 113.26(1)f,g,s,t,u – *applies to MSWLF units long-term*
IAC 567 Chapter 113.26(1)e(1) - *discussions pertain to "system", not solely liners*
Illinois Rule, Section 811.307(b)2(B)

Response #1A.2 – The EPA's Multimedia Exposure Assessment Model (MULTIMED) is recommended in EPA literature as a "screening level" model where modeling a "worst case scenario" is acceptable (1993 EPA *Technical Manual for the Solid Waste Disposal Facility Criteria, Chapter 4.2*). The EPA's Subtitle D Landfill Application Manual for MULTIMED sets out specific ultra-conservative assumptions applicable to Subtitle D modeling using MULTIMED. Since MULTIMED is an analytical model, only steady-state transport simulations are allowed, no decay of the source term is allowed (the concentration does not change with time), and the contaminant pulse is to be continuous and constant over time. The result of the assumption imposed by EPA is that the duration of the model pulse is infinitely long. Comparison of the operational phase of the landfill (e.g 30 years, or more) to an infinitely long modeled life makes the operational phase of the site an insignificant amount of time.

Response #1A.3 – If the landfill system is not modeled in the complete and final condition, an infinite number of models would be required to model the daily changes that occur at any given site during the operational phase of the site. This would hold true for either the Composite Liner or Alternative Liner. EPA's selection of the current Composite Liner as a default design is based on performance modeling in the closed and final capped condition.

Finite source modeling would be more appropriate under such conditions (rather than an analytical model), where the leakage pulse would be reduced from infinity to the length of time that the actual stage of development existed (hours, possibly). Exceptional efforts could be required to model the many "daily stages" anticipated to occur during the operational phase of the site. The "daily" models would be for naught when held up to the infinite life currently modeled under steady-state conditions.

Further, it is interesting to note that the EPA employed finite source modeling on a theoretical closed landfill as part of their 1994 Summary Review of Iowa Landfill Liner Design for State MSWLF Program Approval. The modeling effort indicated that the closed landfill with a 4-foot thick cap and 4-foot thick base liner required a leakage pulse duration of 11,000 years for contaminants in the modeled system to reach the monitoring point of compliance. As a result, EPA considered this a "model failure" and rejected a state-wide 4 ft thick "default" soil liner. Set against this time frame, the 30 year operational period (referenced in Question 1A) approximates 0.27% of the 11,000 year long leakage pulse duration and is considered to be insignificant.

Response #1A.4 – A simple review of the minimum regulatory hydraulic conductivity requirements gives a general "feel" for impact of the operational phase on groundwater movement. Given the $1x10^{-7}$ cm/sec regulatory maximum hydraulic conductivity for compacted clay liners (Alternative or Composite), we can estimate water moves 1.24 inches per year through the saturated clay (at a maximum). In the referenced 30 year time period, water will move roughly 37 inches. Impacted water would not move through a 4 ft thick Alternative Liner in this time. However, water would pass through a 2 ft thick Composite Liner with defects in the FML in approximately 19 years.

Response #1A.5 – EPA's *Interim Final Guidance, Municipal Solid Waste Landfill Liner Petition Process, 40-CFR-Part 258.40(e)*, undated, (Attachment B) suggests the use of EPA's Hydrologic Evaluation of Landfill Performance (HELP) Model and the MULTIMED Model in liner evaluations and further sets forth consistent methodology for the preparation and review of liner studies based on extensive research. The Interim Final Guidance incorporates a portion of the EPA's 1993 *Technical Manual for the Solid Waste Disposal Facility Criteria*, (Chapter 4), the EPA's 1992 User Manual Supplement: Using MULTIMED to Evaluate Subtitle D Designs, and the EPA's 1993 HELP Model User Guide. The Interim Final Guidance and each of the referenced manuals consider modeling of the MSW system in the closed and final condition. No consideration is given to modeling efforts for a facility during the operational phase. Furthermore, it appears that the *Summary Review of Iowa Landfill Liner Design for State MSWLF Program Approval (1994)* (Attachment C) was completed by EPA in accordance with the Interim Final Guidance set forth above.

Response #1A.6 – Although unquantified in this response, daily and intermediate cover soils will be placed over the working face during the operational phase of the site as required by rule. A function of the daily and intermediate cover soils is to divert water from the fill areas and reduce infiltration. The daily and intermediate cover soils placed during the operational phase will function in a similar manner to the final cover in the closed system, albeit not as well. For modeling purposes, assuming the site will exist in the closed state with final cover may sufficiently mimic the performance of the daily/intermediate covers during the operational phase.

Response #1A.7 – Design consideration for MSW SLF units must be comprehensive and consider all components of the system. Ultimately, the goal of the design of a system is to produce a final product that performs in a desired manner.

Response #1A.8 – The EPA maintains Offices of Research (i.e Athens, Georgia; Washington D.C.; Cincinnati, Ohio; etc.), employs University Research Agencies through contract, and employs private research and technical consultants through contracts. EPA's rigor in developing the referenced Guidance, Technical Manuals, Models, and methodology for Liner Evaluation clearly results in the most comprehensive body of knowledge and technical expertise for evaluation of landfill performance. There appears to be no basis for IDNR to deviate from the EPA methodology.

1B) If final cover is not allowed to be a factor in point-of-compliance modeling for Alternative Liner certification, how can Alternative Liners (without leachate recirculation or bioreactive operations) still be designed and constructed as modeled that achieve the point of compliance?

Response #1B.1 – Not allowing final cover to be incorporated in point-of-compliance modeling for Alternative Liner certification would represent a complete and unprecedented deviation from the Federally prescribed Guidance, and from over a decade of completed study and evaluation in the State of Iowa. Furthermore, it appears that the *Summary Review of Iowa Landfill Liner Design for State MSWLF Program Approval (1994)* completed by EPA would warrant reevaluation, since it was completed in accordance with Federal Guidance.

A wholesale movement away from established protocol and Federal Guidance will also warrant an equal movement away from the ultra-conservative assumptions built into the modeling requirements established by EPA. We surmise that "higher powered" numerical (3 dimensional) models would be employed rather than the analytical "screening level/worst case scenario" MULTIMED model. If so, the ultra-conservative assumptions dictated by EPA Guidance will not apply and the numerical models will be calibrated to site conditions and actual attenuation mechanisms. Additionally, aspects of the existing SLF systems that are not currently considered (i.e. effects of groundwater diversion systems on dilution, secondary containment, pH adjustment effects, and attenuation effects) would be incorporated in the modeling efforts. The surmised differences in modeling techniques and assumptions are anticipated to result in demonstration of adequate performance of the 4 ft thick Alternative Liner in cases where the MULTIMED modeling has already demonstrated sufficient performance.

In summary, the design and construction of the Alternative Liner is not likely to change. The modeling effort would simply change from the analytical MULTIMED model (and all the ultra-conservative methods prescribed by EPA), to a higher order numerical modeling effort where ultra-conservative assumptions would no longer apply.

Response #1B.2 –What is the basis for assuming the Composite Lined system performs sufficiently to meet the performance criteria set forth in State and Federal code under all conditions?

1C) If point-of-compliance modeling for Alternative liner certification (without leachate recirculation or bioreactive operations) is allowed to include final cover, then what time period is appropriate for installation of final cover? Furthermore, why is that time period appropriate?

Response #1C.1 –As discussed in Responses 1A, above, this should be a non-issue. Final cover should be installed in accordance with the Development Plan. A prescribed regulatory time period for final cover installation is without merit, especially since the current rule includes specific time limits for installation of intermediate cover soils.

2A) Given that leachate may be recirculated for a significant portion of a disposal cell's active life, why should point-of-compliance modeling for landfills with leachate recirculation over Alternative liners be allowed to include the final cover in these situations?

Response #2A.1 – The Responses in section 1A above apply here as well. However, we recognize that leachate recirculation directly introduces liquid to the system. Under current rule the recirculation of leachate will most likely occur during the active operational phase of the site while personnel are on site and the waste stabilization efforts are greatest (waste stabilization would be a goal prior to installation of the final cap).

The Solid Waste Association of North America (SWANA) endorsed leachate recirculation in their March 30, 2000 Docket Memo to EPA (Attachment D). SWANA endorsed recirculation over Subtitle D Composite Lined sites, Subtitle D Alternative Lined Sites, and at pre-Subtitle D facilities. The basis for the SWANA recommendation is the recognized pollution potential reduction that results from leachate recirculation and bioreactive processes. The pollution potential reduction through the short-term (10 to 30 years) is apparently considered by SWANA to far outweigh potential detrimental groundwater impacts over the long-term.

SWANA indicates a 2 to 10 year time period for waste stabilization by bioreactive processes. This time period becomes insignificant again when comparison is made to the life of the facility and it's existence in a closed state (millennia to infinity).

Response #2A.2 – 40 CFR 258.41(c) *Virginia Landfills XL Project Requirements* applies to two (2) Virginia Landfills where EPA allows addition of leachate, storm water, truck wash water, and other non-hazardous liquids to the Alternative lined sites. If current Federal rule allows recirculation of leachate at Alternative lined sites on a research basis, there is reason to anticipate that given sufficient demonstration of performance at the Virginia sites, leachate recirculation will become allowable at Alternative lined sites under Federal rule. 40 CFR 258.41(c)14 eludes to early termination of the 10 year (2002 to 2012) demonstration in the event that "promulgation of generally applicable requirements that would apply to all landfills that meet or exceed the performance standard set forth in §258.40(a)(1)".

The Virginia Landfills demonstration apparently assesses the sites in a "closed" or "interim capped" condition as 40 CFR 258.41(c)3 includes a requirement to

monitor and report surface seeps. Also, 40 CFR 258.41(c)8 requires an annual topographic survey to determine the rate of settlement of the waste.

It follows that Federal rule apparently allows modeling to include covers at sites where recirculation is occurring over Alternative lined sites.

Response #2A.3 – IAC 567, Chapter 113.26(11)c(2) dictates leachate control systems are required in order to initiate leachate recirculation. The design conditions dictated under IAC 567, Chapter 113.26(11)c(2)a require a drainage layer (12 inches minimum) on top of the liner. The drainage layer acts to limit the head on the liner to 12", or less. Assuming that the leachate collection piping is sufficiently sized to carry leachate to storage, head on the liner should never exceed 12". This should hold true regardless of how much water is introduced to the waste during recirculation and/or bioreactive injection.

It follows that the head that would drive leakage through a liner is limited to 12" or less during the operational phase (whether recirculating leachate, or not) and during the closed phase. The need to differentiate a landfill that doesn't recirculate from a landfill that does recirculate in any modeling effort is eliminated, especially when considered in the long-term, closed condition.

Response #2A.4 – It is recognized throughout literature that bioreactive processes require a considerable amount of liquid to reach the optimum saturation in the waste. In fact, most sites don't have sufficient water available even when leachate recirculation is employed. It is assumed that most sites will observe that recirculated leachate will be consumed in the degradation processes in the fill or be removed through the leachate collection system. When stabilization of waste is achieved (presumably during the active phase of the site), recirculation may likely cease. Modeling of the system in the closed long-term state is still the most appropriate condition for point-of-compliance modeling.

2B) If final cover is not allowed to be a factor in point-of-compliance modeling for Alternative Liner certification, how can Alternative Liners with leachate recirculation still be designed and constructed as modeled that achieve the point of compliance?

Response #2B.1 – See Response 1B and 2A above.

2C) What Modeling program and methodologies accurately simulate the impacts of the addition of leachate through recirculation on liner permeance and leakage to the groundwater?

Response #2C.1 – It is anticipated that the HELP model will overestimate (conservative) leakage, since the model cannot accommodate water loss through consumption in the degredation processes. Additional calculation would be required to adjust for these losses.

Given the design criteria described in IAC 567, Chapter 113.26(11)c(2)a and as discussed in Response 2A.3 (above), permeance and leakage should be controlled by limiting the head on the liner within the 12" drainage layer.

3A) Given that bioreactive operations (i.e. addition of liquids for achievement of up to 45% waste moisture) may occur for a significant portion of a disposal cell's active life, why should point-of-compliance modeling for bioreactive landfills with Alternative liners be allowed to include the final cover in these situations?

Response #3A.1 *–See Response 2A.1, 2A.2, 2A.3, and 2A.4 above.*

3B) If final cover is not allowed to be a factor in point-of-compliance modeling for Alternative Liner certification, how can Alternative Liners with bioreactive operations (i.e. addition of liquids for achievement of up to 45% waste moisture content) still be designed and constructed as modeled that achieve the point of compliance?

Response #3B.1 – See Response 1B, 2A, and 2B above.

3C) What Modeling program and methodologies accurately simulate the impacts of the addition of leachate through bioreactive operations on liner permeance and leakage to the groundwater?

Response #3C.1 – See Response 2C above.

4A) Why should point-of-compliance modeling for alternative liner certification be allowed to include intermediate soil layers (daily and intermediate cover)?

Response 4A.1 – Many of the responses in section 1, above, are applicable here. The intermediate soil layers do indeed exist in landfill cells developed under IAC 113. The intermediate soil layers mimic final cover during the operational phase, while the intermediate soil layers have little impact on modeled leakage in a closed and capped system. We have developed models of landfill systems that include the intermediate soil layers and models of landfill systems that do not include the intermediate soil layers during Alternative Liner Studies.

Many sites strip away daily and intermediate cover layers as a normal operational step during waste placement. Additionally, numerous types of alternative daily cover mechanisms are employed at sites that do not result in permanent soil layers in the fill (i.e. tarps, and/or "spray-on" covers).

4B) What is the magnitude of the impact of including intermediate soil layers (e.g. daily and intermediate cover) on point-of-compliance modeling for alternative liner certification? Furthermore, given this impact, should the certifying design engineer also certify that such intermediate layers are constructed as modeled?

Response 4B.1 – Intermediate soil layers when included in the HELP model (of a closed system) have little impact on the leakage rate through the liner. The layers are likely included in the model as vertical percolation layers in conformance with the "basic rules" for layer arrangement described in *The Hydrologic Evaluation of Landfill Performance (HELP) Model User Guide for Version 3*. The effect is observed to be of little significance.

As for certification of intermediate soil layer construction by a design engineer, we are unaware of any regulatory or design requirement for the intermediate soils layers other than for wind, vector, and infiltration control. The intermediate soil covers left in place for any period of time will be inspected by a professional engineer registered in Iowa (IAC 133.26(2)j), as required by Permit Provision (semi-annually), and annually by IDNR Field Office personnel. Testing and/or during construction observation of such layers is unwarranted.

The concept of certifying that construction meets the model is backwards. Current rules require certification that the model is representative of what will actually exist once construction is complete based on available field test data. The model is not the design basis. Rather, the anticipated results of the construction completed according to design are the basis of the model.

This being stated, we acknowledge that the model is developed based on a conceptual design that has not yet been constructed. If the landfill system is not constructed as conceptually designed, then we agree that the model is not valid for the constructed system.

In instances where the landfill system is constructed in accordance with the conceptual design, then the model is considered valid for the constructed system.

All landfill construction projects (whether incorporating an Alternative Liner or a Composite Liner) require during construction observation, testing, and certification by a professional engineer registered in Iowa. This construction certification is validation that the construction was completed as designed. Landfill system construction completed as designed is validation that the model is applicable.

5) How can an Alternative liner (not including the final cover) be designed and constructed as modeled such that it is equivalent to a composite liner in terms of permeance and leakage to groundwater? Furthermore, how can such performance be verified through field tests in Iowa?

Response 5 – See Response 4 above and Response 6 below.

6) How can an Alternative liner (not including the final cover, or intermediate soil layers) be designed and constructed as modeled such that it is equivalent to a composite liner in terms of permeance and leakage to groundwater? Furthermore, how can such performance be verified through field tests in Iowa?

Response 6.1 - As briefly mentioned in our general comments on page 2, the goal of demonstrating equivalency between liner type(s) is far outside the intent of rule. The Federal and State Rules require an Alternative Liner to demonstrate a minimum performance related to protection of water quality. The question is "does the proposed Alternative Liner meet the specified performance criteria". The question has never been "which liner is better". The IDNR should not endorse the "equivalency" mind-set nor propose rules that endorse such a mind-set.

Additionally, it is our recommendation that IDNR consider the performance of the Composite Liner (best case and worst case). We assume it to be far less than perfect. The performance of a Composite Liner (default) was likely modeled by EPA prior to including the Composite Liner in the Federal Rule. However, that performance is also ultimately tied to modeling and inherent assumptions in that modeling. Do we know what these assumptions are? What is the permeance and leakage to groundwater through a Composite Liner (with imperfections and without imperfections)? What is the true life expectancy of FML? Where are the field tests that verify the Composite Liner system performance?

It would appear that the concept of "equivalency" compounds, rather than clarifies, the problems and issues.

Response 6.2 - Rule dictates that performance be based on water quality at the point of compliance. It is interesting to note that the concentrations listed in 40-CFR-258.40, Table 1 approximate published EPA Drinking Water Standards (albeit not exactly the same concentration in all cases). Likewise, it is noted that the concentrations listed in 40-CFR-258.40, Table 1 are all below the published Statewide Standards for Non-Protected Groundwater under Iowa's Land Recycling Program (IAC 567, Chapter 137, Table 1).

The referenced Standards above are based on Human Health effects derived through toxicological and epidemiological and/or animal studies completed for each compound. Maintaining human health by maintaining water quality is the performance standard. The published limits in 40 CFR 258.40 are based on carcinogenic effects (increased risk on a per million basis) and/or on non-carcinogenic effects (demonstrating a hazard quotient of 1), assuming a lifetime exposure to the compound through consumption of impacted water. For EPA Drinking Water Standards this implies that a 70 kg adult drinks 2 liters of impacted water per day, 365 days per year for 70 years[2]

The Federal rule is very clear. If a liner is demonstrated (through modeling) to meet the water quality performance criteria, the liner is acceptable and is deemed protective of human health and the environment.

Response 6.3 – There is a significant body of study and published literature that raises many issues regarding the long-term performance of the various flexible membrane liners. The FML studies range from quantification of leakage through holes in FML[3], to permeation of organic compounds through non-deteriorated HDPE[456], to deterioration of plastic polymers in FML[7]. It is likely

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[2] US Environmental Protection Agency, Exhibit 6-11, Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual, December, 1989.
[3] Brown, K.W., Thomas, J.C., Lytton, R.L., Jayawickrama, P., Bahrt, S.C., Quantification of Leak Rates Through Holes in Landfill Liners, EPA, August, 1987.
[4] Sakti, J.P., Park, J.K., and Hoopes, J.A., Permeation of Organic Chemicals through HDPE Geomembranes, In: Proceedings of ASCE National Environmental Engineering Conference, ASCE, New York, July, 1991.
[5] Park, J.K., Sakti, J.P., and Hoopes, J.A., Transport of Organic Compounds in Thermoplastic Geomembranes. I: Mathematical Model, Journal of Environmental Engineering, 122(9):800-806, 1996.

short-sighted to try to equivocate between liner types when the long-term performance of FML is unknown. Further, modeling of a Composite Liner with compromised FML (i.e. ripped, punctured, poor seams, deteriorated, etc.) may well demonstrate unacceptable performance. Section 4.16, *Geomembrane Liner Leakage*, HELP Model Engineering Documentation for Version 3, 1994 (EPA/600/R-94/168b) dedicates 20 pages (page 74 to 94) to a discussion of the theory incorporated in the HELP model to attempt to model such leakage.

It is our interpretation that the Performance Criteria set forth in Federal and State rules must be maintained as the standard for Alternative Liners. The standard you are attempting to impose in questions 5 and 6 above has no merit.

Response 6.4 – Federal rule recognizes that above all, landfill design shall be sufficiently protective of the environment. This same rule (40 CFR 258.40) later offers the ***Composite Liner design as a sufficient "default" design in instances where the hydrogeology, the climatic factors, and the volume and character of leachate are not considered in design***.

It is our contention that Alternative Liners offer flexibility and opportunity to design site specific systems that are most protective of the environment at a specific site. It is also our contention that the Composite Liners fulfill a much needed design "default" that goes far to protect the environment regardless of hydrogeology, climate, leachate volume, and leachate character.

Both design options are considered to be very necessary parts of the rule; they are considered effective in protecting the environment and allow site specific design decisions by local landfill governments and owners.

Both design criteria should be preserved in Iowa Rule (IAC 113).

7) Are there more appropriate models and methodologies, or series of models and methodologies, to demonstrate and verify point of compliance and construction for regulatory requirements? If so, what are they and why would you recommend them?

This question was raised over a decade ago, prior to Iowa's initial attempt to gain oversight of the Federal Solid Waste Program by the IDNR. EPA's extensive research effort, documented in the *Interim Final Guidance, Municipal Solid Waste Landfill Liner Petition Process, 40-CFR-Part 258.40(e)*, undated, is offered again as the most appropriate model and methodology to evaluate Alternative Liners.

Since the *Interim Guidance* clearly identifies the MULTIMED Model as a screening level analytical model and imposes ultra-conservative assumptions in the Alternative Liner system model runs, higher order models are deemed

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[6] Park, J.K., Sakti, J.P., and Hoopes, J.A., Transport of Organic Compounds in Thermoplastic Geomembranes. II: Mass Flux Estimates and Practical Implications, Journal of Environmental Engineering, 122(9):807-813, 1996.
[7] Hsuan, Y.G. and Koerner, R.M., "Long Term Durability of HDPE Geomembranes Part 1 – Depletion of Antioxidants," Geosynthetic Research Institute Report #16, Drexel University, Philadelphia, PA (1995).

unwarranted unless the model runs indicate uncertain or negative results in the MULTIMED models.

Since the laws of hydraulics, soil properties, and construction methods (Alternative Soil Liners and Composite Liners) have not changed in the past decade, a basis to change methodologies and models is not apparent. This is especially true, given the use of the models and methods as ultra-conservative screening level models.

Additional Responses

Leslie Wolfe, P.E., member of ACEC's IDNR Liason Committee, worked directly with Joe Obr, P.E., former Bureau Chief, on the wording of the Certifications for Alternative Liner Performance Evaluation and Human Health Risk Assessment. IDNR and the regulated community also benefited greatly from Francis "Doc" Hallada's many years of experience as a P.E. in the private sector before joining the Solid Waste Permitting staff. Department retirements have left the current IDNR staff without a mentor and without the in-house expertise to assess site-specific conditions as they relate to alternative liner performance modeling.

The new leadership in Solid Waste Planning and Permitting must decide whether the Department should continue to rely on Professional Engineering Certification as the basis for approving alternative liners or perform formal review by qualified Department staff. Solid Waste Planning and Permitting can draw from the experience of the Water Quality Bureau where Water Supply Section Construction Permits are "Issued Without Review" based on P.E. certification (see Construction Permit Application Schedule 1a). The Department's philosophy appears consistent; if public water supplies can rely on P.E. certification to protect human health and welfare, then protection of surface and groundwater of the State (drinking water sources) from landfills and other sources of contamination can also rely on P.E. certification.

Groundwater Diversion - Current RCRA Subtitle D landfill expansions designed by FOX Engineering Associates generally incorporate groundwater collection and diversion systems directly below the landfill liner in order to maintain separation from a high water table. The Groundwater Collection and Diversion systems include conveyance piping that discharge beyond the waste boundary. Currently all groundwater diversion discharge points are included in the approved Hydrologic Monitoring System Plans (HMSP) for the RCRA Subtitle D cells with the results included in the Annual Groundwater Quality Report.

Grandfather Clause – Sites in Iowa where Alternative Liner Performance Studies have been completed and demonstrate acceptable Performance in accordance with EPA Guidance should not be subjected to reevaluation.

RD & D Applicability – Prescriptive landfill designs dictated by rule may limit the RD & D project applicability or not afford the regulatory flexibility to incorporate new technologies in future years. Performance based designs will be more likely applicable to implementation of future technologies.

We desire rule revisions that protect the environment, promote the highest and best use of existing landfill sites, inhibit the sprawl of landfill expansions, allow

the upcoming/evolving landfill methodologies to be employed, and preserve the economics of Solid Waste Disposal.

We do appreciate your consideration of our comments. Please feel free to call with questions. We are also willing to meet with you to go over our comments in greater detail.

Respectfully Submitted,
FOX ENGINEERING ASSOCIATES, INC.

Leslie S. Wolfe, P.E. Douglas J. Luzbetak, P.E. Todd D. Whipple, CPG