

**Comments on
SWANA ARF Disposal Group Report on the
Potential Problems of Subtitle D Landfills**

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September, 2009

The June 2009 MSW Management contains an summary of a SWANA Applied “Research Foundation’s (ARF’s) Disposal Group report by O’Brien that , “*compile and summarize what is known about the actual long-term environmental risks associated with Subtitle D landfills and to introduce long-term care alternatives that can be used to manage and minimize these risks.*”

This report is located at,

<http://www.mswmanagement.com/june-2009/environment-landfills-risks.aspx>.

SWANA is the Solid Waste Association of North America, a professional organization that represents the public owned solid waste management facilities, (landfills and other solid waste management facilities).

We have been involved in reviewing the near and especially the long term potential impacts of municipal solid waste (MSW) landfills since the mid 1960s. Of particular concern is the potential of MSW landfill plastic sheeting and compacted clay liners used in Subtitle D “dry tomb” type landfills to provide for effective leachate collection in the landfill leachate collection and removal system for as long as the MSW will be a threat to pollute the environment. We published extensively on this issue with many of our papers/reports are located on our website, www.gfredlee.com in the Landfills Groundwater section at,

<http://www.gfredlee.com/plandfil2.htm>. At this website is our comprehensive review of what we have found to be the “Flawed Technology” of the US EPA Subtitle D landfilling of MSW in,

Lee, G. F., and Jones-Lee, A., “Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste,” Report of G. Fred Lee & Associates, El Macero, CA, December (2004). Updated September (2009a).

<http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf>

and in,

Lee, G. F., and Jones-Lee, A., “Guidance for Evaluating the Potential Environmental Quality Impacts of a Landfill,” Report of G. Fred Lee & Associates, El Macero, CA (2008). <http://www.gfredlee.com/Landfills/EvaluationImpactLF.pdf>.

These reports contain many references to the literature on the issues discussed where possible links to the Internet for further information is available. The “Flawed Technology” review report was first developed in the early 1990s, and has been periodically updated with additional discussion of the literature on these issues.

The O’Brien summary states, “*Subtitle D regulations require that the postclosure care period—during which the landfill site is maintained and the environmental protection systems are managed and monitored—be 30 years in length. During the service lives of Subtitle D landfills,*

landfill owners are required to set aside or otherwise ensure that funds will be available to cover the costs of these postclosure management, maintenance, and monitoring tasks.

Of primary importance in this regard is the responsibility (and authority) given to state governments to extend or reduce the postclosure period—as warranted—to ensure that human health and the environment are protected for as long as the landfill poses a threat.”

O’Brien states, *“To date, the EPA has not provided any guidance to state governments on how to make this determination or how to promulgate regulations that will ensure that funds are available—should the postclosure period be extended—to cover the required management, maintenance and monitoring tasks beyond the prescribed 30-year postclosure period.”*

O’Brien also states, *“Certain environmental groups have claimed that closed Subtitle D landfills constitute major ongoing environmental risks to the communities in which they are located and that the postclosure care period should never end.”*

The issue of how long the Subtitle D postclosure care (monitoring, maintenance and remediation of environmental pollution) is not restricted to environmental groups, as discussed in Lee and Jones-Lee (2009a) “Flawed Technology” review, L. Hickman and J. Skinner both former executive directors of SWANA have discussed the flawed nature of Subtitle D regulations is the failure to adequately address the long term threat that dry tomb type landfills represent to public health and the environment.

The National Resource Council committee (NRC, 2007) report “Assessment of the Performance of Engineered Waste Containment Barriers has discussed the long term threat that municipal solid wastes (MSW) represent to generate leachate that can lead to groundwater pollution associated with landfill liner failure to effectively collect leachate generated in the landfill. Lee and Jones-Lee (2009a) “Flawed Technology” review states that the funded postclosure period should be for as long as the wastes in the landfill are a threat to generate leachate when contacted by water that can potentially cause groundwater pollution and landfill gas that pollute the environment outside the landfill.

The state of California MSW landfilling regulations (originally Chapter 15 now Title 22) are explicit in requiring that postclosure care persist for as long as the wastes in a landfill are a threat. The California Integrated Waste Management Board is developing funding requirements to implement this requirement. Other states such as Pennsylvania have similar requirements for postclosure funding for landfill care. The US EPA and all states need to adopt an approach to a funded postclosure care of MSW landfills throughout the period that the wastes are a threat.

Landfills owned by public agencies can be required to provide the needed postclosure funding for as long as the wastes will be a threat through the regulatory authority of the state and federal agencies. However, owners of privately owned landfills are not preparing to fund postclosure care beyond the minimum of about 30 years. This creates a situation where funds may not be available from private landfill owners to fund postclosure for landfill monitoring, maintenance and remediation of polluted groundwater as needed.

A key issue that needs to be understood is that the primary area of concern with respect to Subtitle D regulations is that it allows developing landfills with a single composite liner consisting of a plastic sheeting (HDPE) and compacted clay liner. However there are at least half a dozen states that will not allow the development of a minimum design single composite lined Subtitle D landfill based on the potential failure of this liner system.

O'Brien in the report provides a summary of the current experience in the performance of Subtitle D landfills in protecting groundwater from pollution by landfill leachate over the past 15 to 20 or so years that they have been developed. While it is possible with high quality construction and appropriate waste placement in the landfill to develop protective landfills over the near term such as in the time that Subtitle D landfills have been developed, this level of performance cannot be expected to continue for as long as the wastes in a dry tomb landfill can be a threat. This period can be a very long time to hundreds of years or longer.

O'Brein stated, *"The general consensus is that biodegradable wastes in closed Subtitle D landfills that have not decomposed will represent a potential environmental and public health risk for hundreds of years and possibly into perpetuity."*

Lee and Jones-Lee (2009a) "Flawed Technology" review provides a discussion of the processes that govern the duration that various types MSW waste components will be a threat. Basically the key to degradation of waste components is the leaching and transformations of the degradable waste components is the moisture content of the wastes. The dry tomb landfilling approach is fundamentally flawed when plastic sheeting and compacted clay liners are allowed to be used to try to keep the wastes dry in perpetuity. Both of these types of materials were selected based on low cost; they have a finite period of time when they can be expected to perform to keep the wastes dry in a closed landfill and collect the leachate that is generated when the landfill cover is not adequately maintained and allows moisture to enter the landfilled wastes. This is the basic cause of why it is appropriate to classify the US EPA Subtitle D landfill regulations as fundamentally flawed.

The O'Brein summary states, *"In summary, as concluded by one major recent study: "Based on as much as 20 years of observations, the committee concluded that most engineered waste-containment barrier systems that have been designed, constructed, operated, and maintained in accordance with current statutory regulations and requirements have thus far provided environmental protection at or above specified levels."* (National Research Council. 2007. *Assessment of the Performance of Engineered Waste Containment Barriers*. Washington, DC: National Academies Press. p.1.)

However, Lee and Jones-Lee (2009b) has conducted a comprehensive review of the NRC committee report and have concluded that while this report provides significant additional information on many of the issues on the expected performance of plastic sheeting and compacted clay liners as barriers to prevent groundwater pollution by landfill leachate, this report's conclusion on that, *"have thus far provided environmental protection at or above specified levels"* is based on an inadequate review of the reliability of detecting groundwater pollution by monitoring wells typically used in accord with Subtitle D regulatory requirements.

Obrien (2009) presents a discussion of *“Performance to Date of Subtitle D Environmental Protection Systems”* which states that, *“One of the major objectives of Subtitle D landfills is to prevent the discharge of pollutants from the landfilled waste to the atmosphere, surface water, or groundwater. Subtitle D regulations require the installation of a number of such environmental protection systems as the bottom liner system, leachate collection, and removal system, landfill gas collection and control systems, and final cover systems to accomplish this objective. Based on data and findings from a number of recent reports, the following general conclusions can be drawn regarding the performance of the environmental protection systems of Subtitle D landfills.”*

The Obrien review states, *“Bottom Liner Systems substantially prevent leachate from leaking out of the landfill and are enabling the vast majority of the leachate to be collected and treated. The life of the geomembrane in the bottom liner system, however, can be significantly shortened—from on the order of 900 years to 100 years or less—by high landfill temperatures. In some cases, landfill gas has been found to exit the bottom liner system through the leachate collection system piping and cause groundwater contamination.”*

Lee and Jones-Lee (2009a) *“Flawed Technology”* discusses the unreliability of estimates of the service life of HDPE plastic sheeting liners. This estimate is based on an extrapolation of short term laboratory tests conducted under conditions that do not simulate landfill conditions.

Obrien states, *“Leachate Collection Systems generally perform well and are collecting the vast majority (over 99%) of the leachate generated. Clogging problems have been experienced in a small number of cases.”*

However contrary to this statement there is no reliable method to determine how much partial plugging of leachate collection systems that lead to increased leachate head in part of the area of a landfill liner system. Also under the current landfill monitoring systems there is no reliable method to reliably estimate that 99% of the leachate generated is being collected by existing Subtitle D landfills.

Obrien states, *“Landfill Gas Collection Systems collection system efficiencies of 97% should be representative for a landfill with a Subtitle D liner system and an active LFG collection system installed as early as possible. Additional methane oxidation is achieved in the cover soils used in the landfill.”*

However, 97% is overly optimistic estimate of the landfill gas collection efficiency. It is likely to be somewhat less with deterioration of the cover over time after the closure of the landfill.

The Obrien statement, *“Final Cover Systems perform satisfactorily and can effectively isolate landfilled waste from the environment.”*

This statement reflects the bias that is present in the Obrien review of the protective nature of the Subtitle D landfill containment system. As discussed by Lee and Jones-Lee (2009a) review while in the short term it is possible to construct a landfill cover that can greatly reduce the amount of water that enters the landfilled wastes, overtime the ability of the landfill cover to

prevent water from entering the landfill will greatly deteriorate. As discussed by Lee and Jones-Lee (2009a) the plastic sheeting layer in cover is subject to deterioration by a variety of factors and most important this layer of landfill cover is not subject to inspection by the methods used.

Obrien's statement *"In summary, as concluded by one major recent study: "Based on as much as 20 years of observations, the committee concluded that most engineered waste-containment barrier systems that have been designed, constructed, operated, and maintained in accordance with current statutory regulations and requirements have thus far provided environmental protection at or above specified levels." (National Research Council. 2007. Assessment of the Performance of Engineered Waste Containment Barriers. Washington, DC: National Academies Press. p.1.)*

As discussed above and by Lee and Jones-Lee (2009b) the NRC committee Assessment is not reliable in assessing the performance of existing Subtitle D landfills. Lee and Jones-Lee (2009a) in their "Flawed Technology" review have discussed the statements that are frequently made by landfill developer applicants and some regulatory agency and the US EPA that there is no evidence that the current modern MSW landfills are causing groundwater pollution. As discussed by Lee and Jones-Lee (2009a) a critical evaluation of this situation, shows that the clay liner in a Subtitle D MSW landfill should take about 25 years to be penetrated by landfill leachate that has passed through holes, rips and tears in the plastic sheeting liner. Since the requirements for a Subtitle D landfill single composite liners have only been in place since the early 1990s the penetration of the clay lay liner should not have occurred at this time provided that the design characteristics of the clay liner has been maintained.

Further and most important the groundwater monitoring system allowed by the US EPA and many states has a very low potential to detect landfill leachate polluted groundwater when it first reaches the point of compliance for groundwater monitoring. Typically vertical monitoring wells are space a hundred or more feet apart at the point of compliance. With each monitoring well has a zone of capture of about one foot around the well, there are hundreds of feet between monitoring wells where leachate polluted groundwater can pass and not be detected by the monitoring wells. The detection landfill liner failure is not expected at this time. This does not mean however that currently through the holes that exist at the time of construction and eventually as the plastic sheeting liner deteriorates the eventual failure of the landfill liner system will cause significant offsite groundwater pollution under adjacent properties. This situation is discussed in the Lee and Jones-Lee (2009a) "Flawed Technology" review.

Obrien presented the following **Conclusions**.

"Based on a review of the recent literature as well as data collected during the conduct of the SWANA ARF research project, the following conclusions were offered with respect to the long-term public health and environmental risks of Subtitle D landfills.

In general, properly designed, constructed, and operated Subtitle D landfills are meeting environmental regulations and protecting public health and the environment.

A small percentage of existing Subtitle D landfills have experienced problems with: pollution of groundwater by landfill gas escaping through the side slope edges of the bottom liner system,

clogging of the leachate collection and removal system, and leakage of leachate through punctures or tears in the bottom liner system.

This statement more properly reflects the inability of the current landfill monitoring systems to detect the early failure of the landfill containment system. As discussed by Lee and Jones-Lee (2009a) in their “Flawed Technology” review a number of investigators have indicated that the initial leachate plumes from plastic sheeting lined landfill will produce narrow width polluted groundwater plumes that could readily pass by a line of monitoring wells spaced hundreds of feet apart at the point of compliance and not be detected by these wells. There could be a substantial number of minimum design Subtitle D landfills that are experiencing initial liner failure that will in time be detected as widespread pollution of the landfill area.

“Final cover systems have been shown to be effective at isolating waste, as long as periodic maintenance is performed. However, once the final cover system reaches the end of its useful life, precipitation will not be prevented from coming into contact with the remaining biodegradable portion of the landfilled waste, which will result in leachate and landfill gas production from the undecomposed waste.”

The key to keeping moisture out of a Subtitle D landfill is the integrity of the plastic sheeting layer in the cover. Since this layer is buried below top and other soil, it is misleading to imply that points of deterioration in the plastic sheeting layer of the cover is subject to inspection and repair.

“Overall, the period during which a Subtitle D landfill will potentially release contaminants may be on the order of hundreds of years. The threat of leakage can be mitigated through long-term cap maintenance to minimize the migration of liquid into the landfill”.

This is correct however there is need to establish a mechanism to detect when the plastic sheeting layer in the cover deteriorates and there is need to provide funds to make repairs of this layer. Current typical postclosure funding estimates do not include funds to inspect and repair/replace the plastic sheeting layer in the landfill cover.

“The risk posed by closed Subtitle D landfills consists mainly of the generation and possible leaking of a leachate of moderate biological strength, high inorganic macrocomponents, varying concentrations of xenobiotic compounds and low [sic]”

“For a closed landfill with a fully functional final cover system or one where only minor breaches have occurred, the environmental and public health impacts are likely to be relatively minor. This is because the leachate pollutants regulated under Subtitle D—which consists of certain XOCs and heavy metals—are likely to have relatively low concentrations in the mature leachate that is generated and will, in addition, be diluted and/or attenuated by soil beneath the landfill and the receiving groundwater body.”

The dilution/attenuation of leachate that passes through the landfill liner will at some locations be attenuated. However there are groundwater systems in which there will be highly limited dilution and attenuation on the landfill property and therefore be a significant threat to pollute

offsite groundwaters with hazardous and deleterious chemicals that will render a groundwater unusable for domestic and animal water supply.

“As the final cover system of a Subtitle D Landfill reaches the end of its service life and major breaches of the final cover system occur, the environmental and public health risks associated with leachate discharges from the landfill will depend on the capability of the receiving groundwater body to dilute and attenuate the pollutants in the leachate. Even under this scenario, it is not at all clear that the groundwater MCLs established in Subtitle D regulations will be exceeded at the relevant point of compliance.”

As discussed above there will be situations where the failure of the landfill liner system will lead to offsite groundwater pollution.

“Long-term care beyond the current 30-year minimum is likely to be needed. However, the type and level of care needed is not clear. At a minimum, the final cover system needs to be monitored and maintained to ensure its integrity throughout its [sic]”

Subtitle D landfills will under current groundwater quality protection standards will require postclosure funding to maintain and monitor the integrity of the containment system.

“Funding is not required under Subtitle D regulations to be available to support the long-term monitoring and maintenance of the final cover system and, as a result, is not being accrued by Subtitle D landfill owners.”

This is a major problem in allowing private landfills to be developed since there is no assurance that the owners of private landfill will be available to pay for postclosure funding as long as the wastes in the landfill will be a threat to generate leachate when contacted by water.

One option under consideration by the industry is the reduction of postclosure monitoring expenses through the development of “indicator” parameters that would be sufficient to track the landfill’s postclosure performance. The savings in monitoring costs could then be used to fund site monitoring and maintenance activities following the initial 30-year post-closure period.”

Thus far the industry proposed approaches are unreliable to detect when corrective action is needed to remediate the polluted groundwaters.

O'Brien in his review devoted to “Long Term Concerns” discusses many of the issues that Lee and Jones-Lee (2009a) have discussed that causes them to characterize Subtitle D landfills regulations as a Flawed Technology for protection of public health, groundwater resources and the interests of those within the sphere of influence of the landfill for as long as the wastes in the landfill will be a threat. The admission that Subtitle D landfills have significant pollution problems is a major change in the writing of O'Brien on the expected performance of Subtitle D landfills. While O'Brien attempts to minimize the magnitude of this threat, in fact the threat is real and needs to be addressed in revising the MSW landfilling regulations to address the siting of landfills, their design, construction, operation, closure and especially postclosure monitoring

and maintenance for as long as the wastes in the landfill are a threat. Lee and Jones-Lee (2009a) have discussed the approaches that need to be adopted to achieve this level of protection. So long as the current approach is followed in developing MSW landfills, those in the sphere of influence of the landfill are practicing justified NIMBY since the water resources in their area have a high probability of being polluted by releases from the landfill.

References

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