Landfill Models Are Not the Answer to Improved Landfilling[1]

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Hillary Inyang's article in the September 1, 2004, *Environmental Science &Technology*, "Modeling the Long-Term Performance of Waste Containment Systems: Better models will help predict what happens to containments in 50 or 1000 years" presents a discussion of some of the issues that need to be considered/evaluated in developing landfills for waste storage. However, her statement at the conclusion of this paper,

"*Site-specific and structural design-specific assessment factors can be addressed by models that have been selected to analyze the long-term performance of specific systems containing identified substances at sites of known geological and hydrological characteristics,*"

does not properly present the current situation with respect to the approach that needs to be adopted to improve the reliability of landfilling of municipal and industrial solid wastes. The issue of needing more reliable models to predict when a landfill containment systems, landfill groundwater and gas collection systems, groundwater and landfill gas monitoring systems will fail and groundwater and/or environmental pollution occurs is not the area that should be a high priority for attention. The overall problem is not a lack of adequate models, but it is unwillingness of federal and state regulatory agencies to reliably evaluate the potential of a proposed landfill to be adverse to public health and the environment for as long as the wastes in the landfill will be a threat. **This cannot be done with models** (computer games)**.**

It has been well established for over 15 years that the plastic sheeting and compacted soil/clay liners and covers, leachate and gas collection systems, groundwater and gas monitoring systems used in today's landfills are unreliable to prevent groundwater and environmental pollution for as long as the wastes in the landfill will be a threat. Whether this occurs in 31, 50, 100 or 1,000 years is not the issue, it will occur.

Inyang's statements,

"To obtain permits for building containment facilities, designers must be able to predict the containment's long-term performance, provide human and ecological exposure risk assessments, estimate values for contaminant migration assessments, and plan facility maintenance," and

"Not surprisingly, the facility deterioration pattern adopted by regulators—either through formal assessments or by implication—profoundly affects the risk estimates,"

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[1] Published in condensed form as Lee, G. F., "Models Are Not the Answer to Improved Landfilling," *Environmental Science & Technology* 39:31A, January 15 (2005).

could cause the readers of this article to believe that landfill regulatory agencies evaluate the potential for a particular landfill to lead to groundwater pollution as part of permitting a landfill. I have been involved in the review of over 50 landfills and yet have to find a regulatory agency critically evaluate the potential of a proposed landfill to protect groundwater resources, environment and the interests of those who are within the sphere of influence of the landfill for as long as the wastes in the landfill will be a threat. The typical focus of landfill permitting hearings is whether the proposed landfill conforms to minimum US EPA Subtitle D regulations.

With very few exceptions regulatory agency boards and their staff are unwilling to admit that today's US EPA Subtitle D landfills are based on a flawed technology that at best only postpones groundwater pollution and other impacts for a short period of time compared to the time that the wastes in the landfill will be a threat. The basic problem is that those who represent the public's interests generally have been unwilling to support requiring that landfills be developed that have a high probability of preventing groundwater pollution for as long as the wastes in the landfill are a threat since this approach would double to triple the cost of municipal solid and industrial "non-hazardous" wastes management. Instead the regulatory agencies are defacto passing these costs and lost groundwater resources on to those within the sphere of influence of the landfill. This leads to justified NIMBY (not in my back yard) by those potentially impacted by the landfill.

There is an urgent need to develop national landfilling regulations to replace RCRA Subtitle D regulations that require that those who permit a landfill reliably evaluate the potential of the landfill to be adverse to groundwater quality, environment and the interests of those in the sphere of influence of the landfill for as long as the wastes in the landfill are a threat to generate leachate (garbage juice) and landfill gas. For planning purposes this period of time should be considerate to be infinite (thousands of years). During this period consideration should be given to plausible worst case failure of the landfill bottom liner, landfill cover, groundwater and gas monitoring systems, landfill gas collection system etc. Adequate assured postclosure funding to address the failure of any of these systems and the polluted aquifer that will occur over the time that the wastes in the landfill will be a threat should be collected as part of disposal fees and held in a dedicated trust.

A critical review of almost all if not all landfills being permitted under minimum Subtitle D regulations, shows that at sometime in the future the landfill containment/monitoring system will fail to protect public health, groundwater resources, and the environment. This ultimate failure of the landfill to prevent wastes components and their degradation products will be in violation of federal and state landfilling regulations. As discussed by Lee and Jones-Lee (2004) the ultimate failure of landfill liner system and the leachate collection system need not lead to groundwater pollution if a double composite liner system is used which includes a leak detection layer between the two composite liners where the lower composite liner is a leak detection system for the upper composite liner. As Lee and Jones-Lee discuss, the installation of the leak detectable cover on the landfill that is operated forever that includes funding to replace the areas of the landfill cover that

are found to be allowing infiltration to enter the landfill should be required. While landfill cover leak detection systems have been available for over 10 years, it has not been implemented since no landfill owner is willing to commit to funding the operation and repair of the landfill cover forever. Further no regulatory agencies are willing to require as part of permitting of a landfill that the landfill owner commit to installing, operating and maintaining the leak detectable cover. So long as this current situation persists the ultimate failure of MSW Subtitle D landfills will exist.

It is relatively simple to develop mathematical "models" that superficially appear to have predictive capability of landfill management system failure. However the development of reliable models requires an understanding of each of the components waste management system and the ability to develop site specific information on the landfill containment system characteristics. The technical basis of failure of many of the landfilling management system components are poorly understood with the result that is it is not possible to formulate models and develop the site specific data needed to appropriately use the model. Further and most important many of the failure of landfill components is dependent on non technical issues such as the adequacy of maintenance of the system component such the leachate collection plugging, gas collection plumbing, groundwater and gas monitoring wells. Highly effective proactive maintenance can greatly influence when/if failure occurs. However, under the current Subtitle D regulations there is no assured funding for other than minimal maintenance during the 30 year required postclosure funding and no source of funding for year 31 and beyond for the infinite period of time that the wastes in a dry tomb landfill will be a threat. Until this issue is addressed to provides adequate postclosure funding to address all plausible worst case failure scenario and groundwater remediation when pollution occurs.

Models of the type discussed by Inyang should not be used to try to predict the duration of protection, but instead be used to potentially guide the types of studies that need to be conducted to provide the information needed to more reliably evaluate the failure of landfill containment system, monitoring and remediation components. Models without adequate site specific information are nothing more than computer games that have little or no ability to make reliable predictions. Further information on the problems with today's landfills and approaches for addressing these problems is available from www.gfredlee.com in the Landfill Groundwater section.

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