Review of the Proposed City of Kankakee Regional Landfill's Ability to Provide Public Health and Environmental Protection for as Long as the Wastes in this Landfill Will be a Threat

G. Fred Lee, PhD, PE, DEE
G. Fred Lee & Associates
El Macero, California
gfredlee@aol.com
www.gfredlee.com

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Volini (2004) has proposed to construct the City of Kankakee Regional Landfill near Kankakee, Illinois. Members of the public have expressed concern about the potential for this municipal solid waste landfill to pollute ground and surface waters that are used for domestic supply. The non-profit corporation POWER (Protecting Our Water, Environment and Rivers) supported the development of the comments provided herein. POWER and OUTRAGE (Organization United To Reduce All Government Excesses), representing groups of the concerned public, have requested that I conduct a review of the ability of this proposed landfill to provide public health and environmental protection for as long as the wastes that are to be placed in the City of Kankakee Regional Landfill will be a threat to pollute the environment.

A list of the documents that I have reviewed in conducting this review is appended to these comments.

Overall Assessment

The proposed City of Kankakee Landfill site is unsuitable for the proposed landfill. The complex hydrogeology that will underlie the proposed landfill, which includes a high, variable-depth water table, fractured limestone and a hydraulic connection of the groundwater that will be polluted by this landfill to surface waters that are used for domestic water supply, all make this site unsuitable for the proposed landfill.

The proposed City of Kankakee Landfill is a "dry tomb" type landfill, in that it is a minimum US EPA Subtitle D landfill that is to be sited where there is a high groundwater table that potentially would create an inward gradient of groundwater into the bottom of the landfill. This inward gradient will exist so long as the water table is above the bottom of the leachate collection system in the landfill. There are several aspects of this design that will likely result in groundwater pollution by landfill leachate. This groundwater pollution will then lead to surface water pollution.

The most significant deficiency with the proposed landfill is that the applicant only proposes to provide postclosure monitoring and maintenance for the **minimum** period that the State of Illinois requires for postclosure care. The Illinois landfilling regulations are specific that the 30-year postclosure care period is the minimum period. It can be extended if the wastes in the landfill are still a threat to generate leachate that can

penetrate the liner system and pollute the underlying groundwaters. The landfill application does not include any provisions for protecting public health, groundwater quality, and surface water quality beyond the 30-year minimum – i.e., for as long as the wastes in the dry tomb type landfill will be a threat to generate leachate.

Since the wastes in the proposed dry tomb type landfill will be a threat for a very long period of time (effectively, forever) to generate leachate by water that penetrates the cover as well as any reverse gradient groundwater that enters the wastes, there is need for the landfill applicant to provide assured postclosure funding forever. With no assured funding by the landfill owner, there are major deficiencies in the assured postclosure funding that will be needed to

- operate and maintain the leachate collection system,
- maintain and repair the landfill cover,
- operate the landfill gas collection and management system,
- take groundwater monitoring samples and maintain the groundwater monitoring system, and
- perform groundwater remediation when the landfill pollutes groundwaters.

Volini, as the private landfill applicant, apparently assumes that the postclosure funding beyond the 30-year minimum period will be provided by someone else. This is a significant deficiency in the proposed development of the City of Kankakee Landfill. Unless assured postclosure funding is committed by the landfill applicant as part of permitting the landfill, there is a significant likelihood that inadequate public health, water resources and environmental protection will be provided at this landfill.

Overall, the proposed City of Kankakee Landfill should not be permitted since it will represent a significant long-term threat to pollute the environment.

These comments should not be interpreted as being anti-landfill. As discussed in Dr. Anne Jones-Lee and my writings, there is a need for landfills to manage wastes that cannot be recycled. I strongly support

- properly sited landfills with adequate buffer lands to dissipate active life releases of waste-derived constituents on the landfill property, and
- landfills that are designed, operated, closed and for which adequate postclosure funding is provided by the landfill owner to address all plausible worst case landfill containment system failures for as long as the wastes in the landfill are a threat to generate landfill gas and leachate that can pollute the environment.

Our writings have been developed to help landfill developers, regulatory agencies and the public understand and address the near-term and especially long-term potential public health and environmental problems of municipal solid waste and other types of landfills.

Qualifications to Make These Comments

Appended to these comments is a summary of my educational background and professional experience that is pertinent to these comments. As indicated, I first became involved in landfill impact issues in the mid-1950s as an undergraduate student in environmental health sciences at San Jose State College in San Jose, California. One of

the courses that I took was devoted to solid waste management that included landfilling issues. In 1957, I obtained a Master of Science in Public Health from the University of North Carolina that included additional education on waste management issues.

I obtained a PhD degree from Harvard University in environmental engineering/sciences in 1960. For 30 years I held university graduate-level teaching and research positions at several major US universities, including 13 years at the University of Wisconsin, Madison, from 1960-1973. It was at that time that I became involved in investigating the impact of municipal solid waste landfills on groundwater quality. At the University of Texas at Dallas (UTD) I held the position of Professor of Engineering. I helped establish the UTD Center for Environmental Sciences where I directed this center for five years (1973-78). During this time I conducted research for the US EPA National Groundwater Research Center located at Ada, Oklahoma, on landfill liner issues. The focus of these studies was on the impact of organics on clay liners.

During the 1980s I held the position of Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology where I also held the position of Director of the Site Assessment and Remediation Division for a multi-university hazardous waste research center. During this time I conducted studies on plastic sheeting liners of the type used as landfill liners. I also taught graduate-level courses on landfill design to engineers.

During my 30-year university career I conducted over $5 million in water quality research and published over 500 papers and reports on these studies. In 1989 I retired from university positions and expanded my part-time consulting to a full-time activity. My wife, Dr. Anne Jones-Lee, who also held positions in universities' departments of civil and environmental engineering, and I moved to El Macero, California, where we have been full-time consultants for 16.5 years. We have continued to publish the results of our work and have developed over 600 additional papers and reports on our consulting activities. Many of these publications are devoted to landfill impact issues. Our more recent publications are made available on our website, www.gfredlee.com. This website contains an extensive set of our papers/reports as downloadable files. A listing of these publications is available in the attached materials on my qualifications.

In the summer of 2005 we developed a comprehensive report that integrates our work and the literature on landfilling issues. This report, Lee and Jones-Lee (2005) "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," serves as a source of information on many of the issues that need to be evaluated in reviewing the proposed City of Kankakee Landfill. My work on landfilling issues has included a review of reverse (inward) gradient landfilling, Lee and Jones-Lee (1993) "Landfills and Groundwater Pollution Issues: 'Dry Tomb' vs F/L Wet-Cell Landfills."

Importance of Protecting Water Supplies in the Kankakee Watershed

The Joyce Foundation funded a study that was undertaken by Openlands and the Metropolitan Planning Council, in conjunction with the Campaign for Sensible Growth, entitled Troubled Waters: Meeting Future Water Needs in Illinois (2006). This report

discusses the importance of the Kankakee River watershed as a future water supply source and area of recreational activities and aquatic habitat. While the Kankakee River already has some water quality problems, these could be exacerbated by pollution from landfill leachate that is added via groundwater flow to Minnie Creek, which is a tributary of the Kankakee River.

As pointed out in the Troubled Waters report, the issues of concern are impacts not only on future domestic water supplies, but also on aquatic habitat and aquatic life. One of the issues of increasing concern is the fact that the current approach for investigating water quality relies on measuring just a few chemicals of the many thousands of chemicals that are present in landfill leachate. Lee and Jones-Lee (2005) have summarized these issues in terms of the potential impacts of unrecognized, unregulated and unmeasured pollutants in domestic wastewaters and landfill leachate. Of particular concern are pharmaceuticals used for human and animal treatment that are disposed of in municipal landfills.

In discussing this issue, Dr. Christian Daughton, Chief of the Environmental Chemistry Branch, National Exposure Research Laboratory, Office of Research and Development, US EPA, Las Vegas, Nevada, has characterized today's landfills as ***"pollution postponement."*** Daughton (2005) has discussed the inadequacy of water quality monitoring programs in identifying pollutants over the range of chemicals that could be impacting public health and the environment. Daughton has indicated that there are over 22 million organic and inorganic substances, with nearly 6 million commercially available. The current water quality regulatory approach addresses less than 200 of these chemicals, where in general pharmaceuticals and personal care products (PPCPs) and many other chemicals are not regulated. According to Daughton, *"Regulated pollutants compose but a very small piece of the universe of chemical stressors to which organisms can be exposed on a continual basis."* Daughton has indicated that one of the routes of environmental exposure is through wastes placed in municipal solid waste landfills. He specifically singles out "leaching from municipal landfills" as an origin of PPCPs in the environment.

As summarized by Lee and Jones-Lee (2005), pharmaceuticals that are currently unregulated with respect to their potential impacts on water quality are being found to have significant adverse impacts on aquatic life at very low concentrations. The hydrogeologic setting of the proposed City of Kankakee Landfill, where eventually, with the failure of the landfill liner system and the lack of assured postclosure funding for monitoring, maintenance and remediation for as long as the wastes in the proposed landfill will be a threat, will almost certainly lead to pollution of groundwaters and surface waters by pharmaceuticals and other unregulated chemicals in landfill leachate. This is a long-term threat to domestic water supplies and aquatic life, which must be adequately understood and addressed as part of reviewing the potential for permitting the proposed City of Kankakee Landfill.

Specific Comments

Presented below is a discussion of specific issues based on a review of the reports and correspondence on the proposed City of Kankakee Landfill. These comments focus on

the May, 2004, "Significant Modification Application" (application) for the development of the Kankakee Regional Landfill (Volini 2004), as well as the Shaw Environmental attachments (see attached list) submitted to the Illinois EPA in the spring of 2005 in an attempt to address the issues raised by this Agency in denying the application for this landfill in January 2005.

Proposed Landfill Characteristics. Volini (2004) and Dippon (2005), on behalf of Envirogen (the former Kankakee Landfill consultant), in response to IL EPA's January 24, 2005, letter to T. Volini providing the reasons for denying the Application for Permit for the proposed Kankakee Landfill, provided information on the design of this proposed landfill. The design included a conventional minimum design US EPA Subtitle D landfill with the single composite liner consisting of compacted clay and a plastic sheeting HDPE liner. The landfill is to be sited where there is a high groundwater table, which would create an inward gradient, and according to Volini and his consultants, will prevent groundwater pollution by the landfill. It should be noted, however, that it is my experience that this proposed landfill would not be allowed in a number of states, because of the high groundwater table.

In June 2002 Professor Sandra K. Sixberry (2002) presented a summary of issues that are of concern regarding the "Town and Country (Kankakee) Landfill Siting Application" to the Kankakee City Council. With respect to the proposed landfill design, Professor Sixberry stated,

> *"Inward Flow Landfill Design*
> *This design may work if and only if the rate of advection of the water, associated with the Silurian Dolomite, into the base of the landfill is greater than the rate of diffusion of contaminants migrating through the basal clay liner. Advection describes the process by which existing contaminants will move with the existing flow of water. Diffusion is a process whereby contaminants move strictly as a result of a concentration gradient. In other words contaminants sitting atop clay material will naturally diffuse into and continue to move through the clay because of a difference in concentration. Modeling the diffusion rate through the clay is not a simple process. Diffusion of various contaminants through clay materials has been found to be significantly different from field to laboratory studies; and has been described as not well understood and difficult to constrain (Richard et al., 1989)."*
>
> *"Conclusions*
> *Based on the previously outlined concerns I would note the following conclusions:*
> - *There is no assurance that the inward flow landfill design will not allow contaminants to migrate out of clay liner through a process of diffusion.*
> - *If leachate is capable of diffusing through the clay liner, contaminants will impact the Henry Fm, the Yorkville Fm, the Silurian Dolomite, and Minnie Creek.*

Reference

Richard L. Johnson, John A. Cherry, and James F. Pankanow, 1989. "Diffusive Contaminant Transport in Natural Clay: A Field Example and Implications for Clay Lined Waste Disposal Sites." ENVIRONMENTAL SCIENCE AND TECHNOLOGY, Vol. 23 (March, 1989), pgs 340 -349."

Professor Sixberry has raised several important issues that need to be adequately addressed as part of reviewing a Kankakee Landfill permit. A review of the "Significant Modification Application" shows that these issues have not been adequately addressed to consider the potential for this landfill to pollute groundwaters for as long as the wastes in the landfill will be a threat. These issues must be reliably addressed to understand the potential problems of the proposed inward gradient approach for the proposed City of Kankakee Landfill.

IL EPA (2006), "Title 35: Environmental Protection Subtitle: Waste Disposal Chapter I: Pollution Control Board Subchapter i: Solid Waste and Special Waste Hauling G Part 811 Standards for New Solid Waste Landfills, Subpart A: General Standards for All Landfills, Section 811.101 Scope and Applicability states,

> "*c) Standards for Municipal Solid Waste landfills*
>
> *1 The standards of this Part also apply to all new MSWLF units, as defined at 35 Ill. Adm. Code 810.103. The standards for the new MSWLF units include:*
>
> *A) The standards applicable to new landfills pursuant to subsection (a); and*
>
> *B) The standards adopted in this part that are identical-in-substance to the federal regulations promulgated by the U.S. Environmental Protection Agency pursuant Sections 4004 and 4010 of the RCRA relating to MSWLF program. Such standards are individually indicated as applicable to MSWLF units."*

Basically, the State of Illinois landfilling regulations are equivalent to minimum design US EPA Subtitle D landfilling regulations. Lee and Jones-Lee's (2005) "Flawed Technology" review discussed the deficiencies in US EPA minimum design Subtitle D landfills. Much of what is discussed by Lee and Jones-Lee (2005) about minimum design Subtitle D landfills, such as eventual failure of the landfill liner system; failure to prevent moisture from penetrating through the cap into the wastes for as long as the wastes in the landfill will be a threat; inadequate postclosure funding for the closed landfill for monitoring, maintenance and remediation of polluted groundwater; are applicable to the proposed Kankakee Landfill. The issue that is different is the upward pressure of the groundwater table on composite liner. As pointed out by Professor Sixberry (2002), when the water table is above the bottom of the wastes, there will be an upward pressure on the plastic sheet that could lead to stability issues. Ultimately the HDPE liner of the proposed landfill will deteriorate, and leachate that reaches the points of deterioration will pass through the liner in those areas that are above the water table.

Below the water table the inward gradient will lead to greatly increased amounts of water in the leachate collection system that will have to be managed as leachate. As discussed below, this issue has not been addressed by the applicant.

Throughout the application, such as on page 2.1-1, section 2.1 Location, it is stated that,

> *"The proposed Kankakee Regional Landfill has been located to protect the public health, safety, and welfare, to minimize impacts to the surrounding area, and to comply with all applicable local, state, and federal regulatory requirements."*

This statement can best be characterized as propaganda on behalf of Volini, in which the well-known, long-term problems of minimum design dry tomb type landfills are ignored. Both the US EPA Subtitle D regulations and the Illinois EPA landfilling regulations assume that any landfill developed under these regulations will be protective of public health and the environment for as long as the wastes in the landfill will be a threat. The problems with the implementation of these regulations is that there is no assurance that these long-term problems will be adequately detected and remediated over the many hundreds to a thousand or more years that the wastes in this type of landfill will be a threat. These problems have been documented in the Lee and Jones-Lee (2005) "Flawed Technology" review. It should also be noted, as discussed by Lee and Jones-Lee (2005), that there are at least half a dozen states in the US (such as New York, New Jersey, Michigan and Pennsylvania) that would not allow a minimum Subtitle D landfill to be developed in the state because of the inability to effectively manage the long-term problems.

In Illinois EPA literature, there seems to be some confusion about the lack of evidence of single composite lined landfill liner failure that has resulted in pollution of groundwater. As discussed by Lee and Jones-Lee (1999), the lack of observing pollution of groundwater by a single composite lined landfill does not provide any indication that there will not be eventual failure of this liner system. As discussed by Lee and Jones-Lee (2005), it is well recognized that a single composite liner system will eventually fail to prevent groundwater pollution by landfill leachate. With respect to observing the early failure of the compacted clay and plastic sheeting flexible membrane liner (FML) (if it is properly constructed and the leachate head in the landfill is kept in accord with regulatory requirements), the clay liner part of the composite liner should not yet have been penetrated by leachate that has passed through the plastic sheeting liner associated with improper construction and/or improper initial waste placement in the landfill that allows penetration of the liner by waste components. The time that single composite liners have been in use under Subtitle D is less than the time that it would take for migration through the clay component of a single composite liner if it maintains its design characteristics.

Further, the groundwater monitoring system, based on vertical monitoring wells spaced at hundreds of feet apart at the point of compliance for groundwater monitoring, is unreliable in detecting the initial groundwater pollution when it first reaches the point of compliance for groundwater monitoring. Basically the early failure of a single composite

liner would not be expected to be observable at this time. Lee and Jones-Lee (2005) have provided a discussion of these issues.

Section 2.1 Location includes Table 2.1-1 Kankakee Regional Landfill Location Standards. In this table, under K. Water Supply Well Setback, the statement is made that *"No known water supply wells are located within 200 feet of the waste boundary nor are there any community water supply wells within 1,000 feet of the waste boundary …."* However, no discussion is provided about the situation that exists at the proposed Kankakee Landfill, where the underlying groundwaters that will eventually be polluted by landfill leachate are hydraulically connected to surface waters that are water supply sources. Further, it should be recognized that there are situations where groundwater pollution by landfills has traveled through the groundwater system for over a mile and thereby caused pollution of wells located at that distance.

Hydrogeology of the Proposed Landfill Site. Section 2.1 of the application includes a presentation of the hydrogeologic characteristics underlying and in the vicinity of the proposed landfill. Professor Sixberry (2002) has provided the following information on the hydrogeology of the site:

> *"Site Specific Geology*
> *The applicant has referred to the geology at the site as being quite simple in nature. The geologic deposits at the site are a result of glaciers that once covered Kankakee County. As the glaciers begin to melt, a deposit at the furthest extent of the glacier consisting of mostly clay, silt, and sand was laid down."*
>
> * * *
>
> *"Silurian Dolomite Aquifer*
> *It cannot be stated enough that the Silurian Dolomite beneath the proposed landfill site is an aquifer and should be viewed as such. Dolomite rocks in the Kankakee area contain fractures and crevices capable of transporting large amounts of water to be transmitted. This transmissive ability of the dolomite makes it a great resource for storing water that has been commonly utilized as a water supply source. The depths of water well in the Otto Township area are strong evidence that fractures are present in the Silurian Dolomite and are capable of supplying adequate water to the surrounding water users. Published data by Illinois State Agencies also indicates that the Silurian Dolomite is an aquifer (Cravens, et al, 1990). To ignore the plethora of water well logs available surrounding the proposed landfill as well as published data and solely rely on one site specific boring to determine the potential for the Silurian Dolomite to transmit water would be a huge error.*
>
> *Conclusions*
> *Based on the previously outlined concerns I would note the following conclusions:*
>
> - *The complex geologic setting will make it difficult to track migration of contaminants through preferential pathways (sand & gravel and fractures) in the site area.*

- *The Silurian Dolomite is a known aquifer and should be recognized as such.*
- *This site is not located in a hydrogeologic setting that would be capable of adequately protecting humans and the environment."*

References

Cravens, S, S Wilson, and R Barry, 1990. Regional Assessment of the Ground Water Resources in Eastern Kankakee and Northern Iroquois Counties, Illinois State Water Survey Report of Investigation 111, 86 p."

More recently, associated with the resubmitted landfill application, S. Cravens (2005) of Kelron Environmental has provided detailed analysis of the hydrogeology of the proposed City of Kankakee Landfill site. He concluded that the proposed site is unsuitable for the proposed Kankakee Landfill for many of the same reasons cited by Professor Sixberry. Drommerhausen (2005) of Shaw Environmental (the current proposed Kankakee Landfill consultant) attempts to discredit the comments by Cravens. However, based on many years of reviewing landfill applications and my expertise and experience, including serving as a member of the editorial board for the journal *Ground Water*, I find that Drommerhausen has failed to adequately address the unsuitability of the proposed Kankakee Landfill site for the development of a landfill that will be protective of public health, groundwater resources and the environment.

Landfill Design. Section 2.3 Design Report of the resubmitted application states in the Introduction on page 2.3-1,

> *"The Kankakee Regional Landfill is based on conventional landfill designs. The design incorporates many features which meet or exceed the applicable regulations. The general design of the Kankakee Regional Landfill has been implemented at the existing landfills and shown to be protective of the public health, safety, and welfare."*

This is more of the propaganda that Volini and his consultants are foisting on the regulatory agencies, the city of Kankakee and the public. As discussed by Lee and Jones-Lee (2005), it has been and continues to be well-recognized that today's minimum design Subtitle D dry tomb type landfills at best only postpone when groundwater pollution will occur. The US EPA (1988a), as part of developing the current landfilling regulations, stated in its Solid Waste Disposal Criteria,

> *"First, even the best liner and leachate collection system will ultimately fail due to natural deterioration, and recent improvements in MSWLF (municipal solid waste landfill) containment technologies suggest that releases may be delayed by many decades at some landfills."*

The US EPA (July 1988b) Criteria for Municipal Solid Waste Landfills state,

> *"Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit."*

Lee and Jones-Lee (2005) have discussed the situation of the US EPA adopting landfilling regulations under conditions where the senior staff of the Agency knew that the landfill liner systems would eventually fail. Basically the situation was that the Agency was involved in litigation with an environmental group, where the environmental group forced the Agency to promulgate regulations even though it was known that the regulations were not adequate to protect public health and the environment for as long as the landfilled wastes would be a threat. Lee and Jones-Lee (2005) have provided a summary of the current information on the failure mechanisms for plastic sheeting and compacted clay liners. As discussed, the US EPA's consultants have acknowledged that it is only a matter of time until the plastic sheeting liner fails to prevent leachate migration through it.

The application states on page 2.3-1, in section 1 Composite Liner,

> *"The inward gradient has groundwater attempting to enter the landfill rather than leachate attempting to exit the landfill. The composite liner has been computer modeled, and the analysis demonstrates that the landfill will not negatively impact groundwater quality."*

Those familiar with computer models know that the reliability of the model depends on the characteristics of the model, as well as the reliability of the input information used in the model. In order to evaluate the reliability of the computer modeling that has been done on the landfill liner system, it is necessary to consider the characteristics of the liner that will evolve over the period of time that the wastes in the landfill will be a threat – i.e., hundreds to a thousand or more years. Professor H. Inyang has published a paper (Inyang 2004) on modeling the behavior of landfill liners. She concludes that failure of currently used liners is inevitable.

According to the application, in the last paragraph on page 2.3-3,

> *"The composite liner system has been designed to function throughout the 60 year design period (30 years operation and 30 years post-closure care period) of the landfill and beyond."*

However, as discussed by Lee and Jones-Lee (2005), based on the information available in the literature on the expected performance of landfill liners, there are many reasons why the design characteristics of a minimum design Subtitle D landfill liner of the type proposed for the Kankakee Landfill will fail to be maintained throughout a 60-year period, much less for as long as the wastes in the landfill will be a threat. For example, it is unreasonable to expect that the compacted soil liner, which at the time of construction is supposed to have a maximum permeability of 1×10^{-7} cm/sec, will maintain this permeability throughout the period of time that the wastes in the landfill will be a threat. In order to achieve this level of permeability, the clay liner must be compacted slightly

wet of optimum moisture density. When the groundwater enters the clay liner, as part of the inward gradient conditions, the permeability will change.

Page 2.3-13, Groundwater Seepage, second paragraph states,

> *"The 60-mil geomembrane liner was assumed to be flawed over approximately 0.05 % of the liner area. Although the Construction Quality Assurance Program ensures that this will not occur, a flawed liner was conservatively assumed in order to model a worst case scenario."*

This approach is far from being "conservative" – i.e., protective of public health and the environment for as long as the wastes in the landfill will be a threat. The details of the calculations are presented on page "40029," where it is assumed that the initial design characteristics of the landfill are applicable throughout the postclosure period. Shaw Environmental Attachment 18 "Revised HELP Model" indicates that a revised number of defects in the landfill liner plastic sheeting layer has been assumed in subsequent modeling. While it is possible, with high QA/QC to achieve low rates of initial flaws in the plastic sheeting layer of the landfill liner at the time of construction, there are well-known problems associated with the initial placement of wastes in landfills' disrupting the integrity of the plastic sheeting layer as a result of waste components puncturing this layer. Further, there is no question about the fact that, over time, the plastic sheeting layer in the liner will deteriorate and eventually become nonfunctional. Assuming that groundwater seepage will only occur to the extent that is presented in the application throughout the period that the wastes in the landfill will be a threat is totally unreliable and inappropriate.

Page 2.3-19, Leachate Treatment, states that the leachate generated in the landfill will be treated at the Kankakee Metropolitan Wastewater Utility or some other permitted facility. The situation with respect to domestic wastewater treatment plants (POTWs) accepting landfill leachate will likely change in the future as greater recognition is given to the fact that landfill leachate contains a variety of currently unrecognized, unregulated pollutants. As discussed above, of particular concern at this time are PPCPs, which are known to be present in domestic wastewaters and landfill leachate. It is also known that a number of these PPCPs pass through domestic wastewater treatment without being removed. This is another source of pollutants for surface waters receiving domestic wastewater discharges. As POTWs face ever-increasing restrictions on their discharges, managers of POTWs will likely curtail acceptance of municipal landfill leachate.

Page 2.3-19, Leachate Monitoring, states,

> *"Sampling will be conducted for 30 years after closure of the facility, unless a reduced period is found to sufficiently protect the public health and the environment."*

This is another of the statements made in the Volini (2004) application that indicates that he does not plan to provide postclosure management of leachate beyond the minimum

30-year postclosure requirements. As discussed above, it will be important that the characteristics of a dry tomb landfill be considered in evaluating the potential for leachate generation. Following closure of the landfill with a low-permeability cover, the rate of leachate generation can effectively drop to zero if a high-quality cover is installed. However, the dormant period for leachate generation will end when the plastic sheeting layer in the landfill cover is no longer adequately maintained. This situation could readily occur after the minimum postclosure care period. In order to protect public health and the environment from the pollutants in the landfill, it will be necessary that leachate management be practiced for as long as the wastes in the landfill, when contacted by water, can generate leachate. This can be a very long period of time.

Page 2.3-25 presents the design of the final cover. The proposed final cover consists of,

> *"1. 12 inch thick low permeability compacted material cover (maximum hydraulic conductivity of 1 x 10^{-7} cm/sec).*
>
> *2. A 40-mil LLDPE or equivalent geomembrane liner.*
>
> *3. A minimum three foot thick protective layer overlying the low permeability layer, with the uppermost six inches consisting of soil suitable for vegetation.*
>
> *4. A vegetation layer."*

Lee and Jones-Lee (2005) have discussed the significant problems that will occur with this type of cover design. These include the deterioration of the geomembrane liner that is not observable from the surface of the landfill, cracking of the low-permeability compacted materials and only providing six inches of soil suitable for vegetation. This thin layer of soil may not be enough to maintain vegetation during droughts.

Page 2.3-13 of the application presents a discussion of "Cover Infiltration," where it is mentioned that HELP computer modeling was used. The conditions that were used in the HELP model calculations are presented on pages "40146" and "40147" and were updated in Shaw Attachment 18. On page "40147" it is stated that the HPDE geomembrane will have an assumed *"pinhole density = .75 hole per acre"* and *"installation defects = 2.5 holes per acre."* Shaw Attachment 18 indicates that the *"FML pinhole density = 1.00 holes/acre"* and *"FML installation defects = 10.00 holes/acre."* The proposed landfill cover includes a plastic sheeting layer with a *"pinhole density = 1 hole per acre"* and *"installation defects = 5 holes per acre."* In order for HELP modeling to be reliable in describing leachate generation, it must accurately consider the deterioration of the plastic sheeting layer in the cover that will occur over the period of time that the wastes in the landfill will be a threat. Eventually, the plastic sheeting layer in the cover will deteriorate and allow rainfall that falls on the landfill surface, which penetrates the topsoil layer of the cover, to pass into the wastes through the deteriorated plastic sheeting layer. The generation of leachate under these conditions will be far greater than that presented by Volini (2004) in Table 2.3-2.

Lee and Jones-Lee have pointed out, in their review of potential problems with landfill covers of the type proposed for the Kankakee Landfill, that there will be need to periodically repair/replace the plastic sheeting layer in a landfill cover. They point out, however, that, since the plastic sheeting layer is buried below a topsoil layer, the deterioration of this layer is not readily observable. Further, as discussed below, the postclosure funding that is proposed to be provided does not include repair/replacement of the plastic sheeting layer in the cover over the period of time that the wastes in the landfill will be a threat.

Postclosure Care. Section 2.9 of the application provides information on the approach that Volini proposes to follow for closure and postclosure care for the proposed landfill. This section states on page 2.9-2, item 1,

> *"Close the site in a manner that prevents post-closure release of waste, waste constituents, leachate, contaminated rainfall, or waste decomposition products to the groundwater, surface water or to the atmosphere; complements the final land use; and prevents threats to human health or the environment."*

The most significant deficiency in the Application for a Permit for the proposed Kankakee Landfill is that Volini, as the landfill applicant, only proposes to provide the minimum postclosure care funding. If allowed to adopt this approach, some other entity such as the city of Kankakee and/or Kankakee County will be responsible for paying the large amount of postclosure funds that will be needed for hundreds to a thousand or more years to monitor and maintain this landfill during the postclosure period while the wastes in the landfill are still a threat to public health and the environment. While it might be argued that Volini could be held responsible for funding postclosure care beyond the minimum postclosure period, the likelihood that Volini will be willing/able to provide such funding is questionable. If the proposed landfill has an active life of 30 years, it would be about 60 years from when the landfill is permitted that attempts will have to be made to get Volini to continue to fund postclosure care.

Other states have recognized the deficiencies in only providing assured postclosure funding for 30 years after closure. For example, the California landfilling regulations require postclosure monitoring and maintenance **for as long as the wastes in the landfill will be a threat.** The California Integrated Waste Management Board (CIWMB) has held a series of workshops devoted to providing financial assurance beyond the 30-year minimum postclosure period. On January 23, 2006, the CIWMB held a workshop, "Financial Assurance for Postclosure and Beyond." The Board staff (CIWMB 2006) prepared a report, "Discussion Paper Regarding Financial Assurance Demonstrations Applicable to Extended Postclosure Maintenance Timeframes," that states,

> *"Postclosure maintenance (PCM) activities at solid waste landfills are required to be performed for a minimum of 30 years after the closure of a landfill. However, as currently practiced, the financial assurance demonstrations for these maintenance activities are currently only required for the first 30 years after closure. If financial assurance demonstrations are required beyond this period,*

at least until it is determined that the waste no longer poses a threat, then the question becomes one of how operators could demonstrate financial assurances to the State of California? The answer to this question has long-term implications for future generations and immediate ones for landfill owners/operators responsible for providing financial assurances."

Pennsylvania has similar requirements, where landfill owners must provide postclosure funding for as long as the wastes are a threat to release pollutants to the environment. Periodically, for as long the wastes are a threat, the Pennsylvania state landfill regulatory agency reviews the adequacy of postclosure funding and requires that the landfill owner update the assured postclosure funding until such time as it is found that the wastes in the dry tomb type landfill will no longer generate leachate and/or landfill gas when water is added to them.

Table 2.9-4 on page 2.9-19 of the application presents the Cost Estimates for Post Closure Care. Revised cost estimates are presented in Table 2.9-4, in Shaw Attachment 8. These estimates are based on a minimum of postclosure activities during the 30-year minimum postclosure care period. Since the state of Illinois can extend the postclosure period as needed to protect public health and the environment, it should be understood that the cost estimates for a number of the items listed in Table 2.9-4 will greatly increase in subsequent postclosure care periods. For example, no funds are projected for replacement of the plastic sheeting layer in the cover during the first 30 years of postclosure care. The cover will have to be repaired and likely substantially, if not completely, replaced. Substantial funds will be needed over the hundreds to a thousand or more years that the wastes in this proposed landfill will be a threat, for maintenance of the plastic sheeting layer of the cover. Similarly, the funds projected for groundwater analytical testing and leachate analytical testing will, in the future, need to be greatly increased as new hazardous parameters are found in leachate.

Table 2.9-4 projects 100,000 gallons of leachate that will have to be managed per year. As discussed herein, as the plastic sheeting layer in the landfill liner deteriorates, the inward gradient associated with the high groundwater table will cause very large amounts of leachate-polluted water to have to be managed as leachate. The cost of this management will be far greater than that projected.

Those potentially impacted by a landfill should know how postclosure funding will be provided for as long as the wastes in the landfill will be threat. The Volini application is deficient since it does not address this issue.

Landfill Gas Management. In section 2.9 Closure and Post-Closure Care Plan, page 2.9-15 discusses Landfill Gas Monitoring and Collection, where it is stated that,

"Monitoring, beyond the minimum 30 year period, may be discontinued if both of the following conditions have been met for one year:

- *The concentration of methane is less than five percent of the lower explosive limit in air for four consecutive quarters at all monitoring points outside the unit;*
- *Monitoring points within the unit indicate that methane is no longer being produced in quantities that would result in migration from the unit and exceed the regulatory standards."*

These conditions represent another example of Volini and his consultants' failing to understand/properly portray the expected behavior of a dry tomb type landfill. As discussed by Lee and Jones-Lee (2005), it is well understood that upon closure of the landfill with an effective landfill cap/cover, the moisture entering the wastes will be greatly diminished and could become zero, with the result that both leachate generation and landfill gas generation will slow down/cease, and the landfill will become dormant. In time, however, as the effectiveness of the landfill cover deteriorates and moisture again enters the landfill, leachate and landfill gas generation will begin again.

These issues have been discussed by Lee and Jones-Lee (2005), where they point out that recently the California Integrated Waste Management Board staff have independently come to a similar conclusion. Volini's proposed approach of terminating landfill gas monitoring and management when "*… methane is no longer being produced in quantities that would result in migration from the unit and exceed the regulatory standards"* is totally inappropriate. This could readily occur in a short period of time after closing the landfill. Without landfill gas monitoring and management for as long as the wastes in the landfill, when contacted by water, can generate landfill gas, there could readily be a major unmonitored environmental problem associated with the failure of the landfill cover to keep the wastes in a dry tomb landfill dry. This can lead to offsite explosions, migration of hazardous gases from the landfill, and pollution of groundwater by landfill gas.

Another factor that is not addressed in this application is that potentially a substantial part of the wastes will be deposited in the landfill in plastic bags. Unless these bags are emptied or shredded, they can isolate the wastes in the crushed bags from exposure to moisture during the time that water enters the landfill – i.e., during its active life. As discussed by Lee and Jones-Lee (2005), the plastic bags will, over a long period of time, deteriorate, thereby allowing moisture that enters the landfill during the postclosure care period, when the cover is no longer effective in keeping the wastes dry, to interact with the wastes and generate landfill gas again. The statement by Volini (2004) on page 2.3-30, fourth paragraph, that,

> "*Typically, significant quantities of landfill gas generation resulting from anaerobic decomposition occurs for a period of thirty to forty years,"*

is not applicable to Subtitle D dry tomb type landfills. These landfills have the potential for very long periods of time to generate landfill gas. This situation must be clearly recognized and properly addressed as part of permitting the landfill.

Groundwater Impact Assessment. Section 2.7 of the application presents the Groundwater Impact Assessment (GIA). This section states on page 2.7-6,

> *"Landfill design features must be considered prior to developing the conceptual model and establishing model input values. The landfill design features considered in the GIA include the final cover design, efficiency of the leachate collection system, and liner design."*

The groundwater impact assessment presented by Volini, which, as quoted above, depends on the design characteristics of the landfill cover and liner, is unreliable in predicting the impact of leachate produced in the landfill on groundwater quality. As discussed in a previous section, the modeling that is done assumes, albeit incorrectly, that the design characteristics of the cover and liner will be maintained throughout the postclosure period and beyond. For example, page 2.7-11, last paragraph, states that the recompacted soil liner was modeled at 1.0×10^{-7} cm/sec permeability. The deterioration of the landfill cover and liner characteristics that will occur over time makes the groundwater impact assessment modeling unreliable.

Page 2.7-7 states,

> *"The leachate level will be maintained at less than 1 foot above the liner during the operating and 30 year post-closure periods. As mentioned above, the leachate level should not exceed five feet prior to the end of the 130 year GIA modeling period. The inward gradient should be maintained throughout the entire 130 year modeling period."*

It appears from this statement that Volini proposes to stop managing leachate at the end of the 30-year postclosure period, and allow the groundwater that enters the landfill through the inward gradient to accumulate up to five feet in depth in the landfill. Under these conditions there can readily be significant groundwater pollution by this landfill.

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Dr. G. Fred Lee, PE(TX), DEE
AAEE Board Certified Environmental Engineer

Expertise and Experience in Hazardous Chemical Site and Municipal/Industrial Landfill Impact Assessment/Management

Dr. G. Fred Lee's work on hazardous chemical site and municipal/industrial landfill impact assessment began in the mid-1950s while he was an undergraduate student in environmental health sciences at San Jose State College in San Jose, California. His course and field work involved review of municipal and industrial solid waste landfill impacts on public health and the environment.

He obtained a Master of Science in Public Health degree from the University of North Carolina, Chapel Hill, in 1957. The focus of his masters degree work was on water quality evaluation and management with respect to public health and environmental protection from chemical constituents and pathogenic organisms.

Dr. Lee obtained a PhD degree specializing in environmental engineering from Harvard University in 1960. As part of this degree work he obtained further formal education in the fate, effects and significance and the development of control programs for chemical constituents in surface and ground water systems. An area of specialization during his PhD work was aquatic chemistry, which focused on the transport, fate and transformations of chemical constituents in aquatic (surface and ground water) and terrestrial systems as well as in waste management facilities.

For a 30-year period, he held university graduate-level teaching and research positions in departments of civil and environmental engineering at several major United States universities, including the University of Wisconsin-Madison, University of Texas at Dallas, and Colorado State University. During this period he taught graduate-level environmental engineering courses in water and wastewater analysis, water and wastewater treatment plant design, surface and ground water quality evaluation and management, and solid and hazardous waste management. He has published over 1,000 professional papers and reports on his research results and professional experience. His research included, beginning in the 1970s, the first work done on the impacts of organics on clay liners for landfills and waste piles/lagoons.

His work on the impacts of hazardous chemical site and municipal/industrial solid waste landfills began in the 1960s when, while directing the Water Chemistry Program in the Department of Civil and Environmental Engineering at the University of Wisconsin-Madison, he became involved in the review of the impacts of municipal solid waste landfills on groundwater quality.

In the 1970s, while he was Director of the Center for Environmental Studies at the University of Texas at Dallas, he was involved in the review of a number of municipal solid and industrial (hazardous) waste landfill situations, focusing on the impacts of releases from the landfill on public health and the environment.

In the early 1980s while holding a professorship in Civil and Environmental Engineering at Colorado State University, he served as an advisor to the town of Brush, Colorado, on the potential impacts of a proposed hazardous waste landfill on the groundwater resources of interest to the community. Based on this work, he published a paper in the Journal of the American Water Works Association discussing the ultimate failure of the liner systems proposed for that landfill in preventing groundwater pollution by landfill leachate. In 1984 this paper was judged by the Water Resources Division of the American Water Works Association as the best paper published in the journal for that year.

In the 1980s, he conducted a comprehensive review of the properties of HDPE liners of the type being used today for lining municipal solid waste and hazardous waste landfills with respect to their compatibility with landfill leachate and their expected performance in containing waste-derived constituents for as long as the waste will be a threat.

In the 1980s while he held the positions of Director of the Site Assessment and Remediation Division of a multi-university consortium hazardous waste research center and Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology, he was involved in numerous situations concerning the impact of landfilling of municipal solid waste on public health and the environment. He has served as an advisor to the states of California, Michigan, New Jersey and Texas on solid waste regulations and management. He was involved in evaluating the potential threat of uranium waste solids from radium watch dial painting on groundwater quality when disposed of by burial in a gravel pit. The public in the area of this state of New Jersey proposed disposal site objected to the State's proposed approach. Dr. Lee provided testimony in litigation, which caused the judge reviewing this matter to prohibit the State from proceeding with the disposal of uranium/radium waste at the proposed location.

Dr. Lee's expertise includes surface and ground water quality evaluation and management. This expertise is based on academic course work, research conducted by Dr. Lee and others and consulting activities. He has served as an advisor to numerous governmental agencies in the US and other countries on water quality issues. Further, he has served on several editorial boards for professional journals, including *Ground Water*, *Environmental Science and Technology*, *Environmental Toxicology and Chemistry*, etc. Throughout his over-45-year professional career, he has been a member of several professional organization committees, including chairing the American Water Works Association national Quality Control in Reservoirs Committee and the US Public Health Service PCBs in Drinking Water Committee.

Beginning in the 1960s, while a full-time university professor, Dr. Lee was a part-time private consultant to governmental agencies, industry and environmental groups on water quality and solid and hazardous waste and mining management issues. His work included evaluating the impacts of a number of municipal and industrial solid waste landfills. Much of this work was done on behalf of water utilities, governmental agencies

and public interest groups who were concerned about the impacts of a proposed landfill on their groundwater resources, public health and the environment.

In 1989, he retired after 30 years of graduate-level university teaching and research and expanded the part-time consulting that he had been doing with governmental agencies, industry and community and environmental groups into a full-time activity. A principal area of his work since then has been assisting water utilities, municipalities, industry, community and environmental groups, agricultural interests and others in evaluating the potential public health and environmental impacts of proposed or existing hazardous, as well as municipal solid waste landfills. He has been involved in the review of approximately 80 different landfills and waste piles (tailings) in various parts of the United States and in other countries.

Dr. Anne Jones-Lee (his wife) and he have published extensively on the issues that should be considered in developing new or expanded municipal solid waste and hazardous waste landfills in order to protect the health, groundwater resources, environment and interests of those within the sphere of influence of the landfill. Their over 100 professional papers and reports on landfilling issues provide guidance not only on the problems of today's minimum US EPA Subtitle D landfills, but also on how landfilling of non-recyclable wastes can and should take place to protect public health, groundwater resources, the environment, and the interests of those within the sphere of influence of a landfill/waste management unit. They make many of their publications available as downloadable files from their web site, www.gfredlee.com.

Their work on landfill issues has particular relevance to Superfund site remediation, since regulatory agencies often propose to perform site remediation by developing an onsite landfill or capping waste materials that are present at the Superfund site. The proposed approach frequently falls short of providing true long-term health and environmental protection from the landfilled/ capped waste.

In the early 1990s, Dr. Lee was appointed to a California Environmental Protection Agency's Comparative Risk Project Human Health Subcommittee that reviewed the public health hazards of chemicals in California's air and water. In connection with this activity, Dr. Jones-Lee and he developed a report, "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview," that served as a basis for the human health advisory committee to assess public health impacts of municipal landfills.

In 2004 Dr Lee was selected as one of two independent peer reviewers by the Pottstown. PA Pottstown Landfill Closure Committee to review the adequacy of the proposed closure of the Pottstown Landfill to protect public health, groundwater resources and the environment for as long as the wastes in the closed landfill will be a threat.

In addition to teaching and serving as a consultant in environmental engineering for over 40 years, Dr. Lee is a registered professional engineer in the state of Texas and a Diplomate in the American Academy of Environmental Engineers (AAEE). The latter

recognizes his leadership roles in the environmental engineering field. He has served as the chief examiner for the AAEE in north-central California and New Jersey, where he has been responsible for administering examinations for professional engineers with extensive experience and expertise in various aspects of environmental engineering, including solid and hazardous waste management.

His work on landfill impacts has included developing and presenting several two-day short-courses devoted to landfills and groundwater quality protection issues. These courses have been presented through the American Society of Civil Engineers, the American Water Resources Association, and the National Ground Water Association in several United States cities, including New York, Atlanta, Seattle and Chicago, and the University of California Extension Programs at several of the UC campuses, as well as through other groups. He has also participated in a mine waste management short-course organized by the University of Wisconsin-Madison and the University of Nevada. He has been an American Chemical Society tour speaker, where he is invited to lecture on landfills and groundwater quality protection issues, as well as domestic water supply water quality issues throughout the United States.

Throughout Dr. Lee's 30-year university graduate-level teaching and research career and his subsequent 16-year private consulting career, he has been active in developing professional papers and reports that are designed to help regulatory agencies and the public gain technical information on environmental quality management issues. Drs. Lee and Jones-Lee have provided a number of reviews on issues pertinent to the appropriate landfilling of solid wastes. Their most comprehensive review of municipal solid waste landfilling issues is what they call the "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," which was originally developed in 1992, and redeveloped and updated in the fall of 2004. Between the two versions they have published numerous invited and contributed papers that provide information on various aspects of municipal solid waste landfilling, with emphasis on protecting public health and the environment from waste components for as long as they will be a threat. The "Flawed Technology" review has been periodically updated, including the most recent update in September 2005, which can be found on their website at
http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf.

This review provides a comprehensive, integrated discussion of the problems that can occur with minimum-design Subtitle D landfills and landfills developed in accord with state regulations that conform to minimum Subtitle D requirements. The "Flawed Technology" review contains a listing of the various reviews that Drs. Lee and Jones-Lee have developed, as well as peer-reviewed literature. Over 40 peer-reviewed papers are cited in "Flawed Technology" supporting issues discussed in this review.

SUMMARY BIOGRAPHICAL INFORMATION

NAME: G. Fred Lee
ADDRESS: 27298 E. El Macero Dr.
El Macero, CA 95618-1005
DATE & PLACE OF BIRTH: July 27, 1933, Delano, California, USA
TELEPHONE: 530/753-9630 (home/office)
E-MAIL: gfredlee@aol.com
WEBPAGE: www.gfredlee.com

EDUCATION

Ph.D. Environmental Engineering & Environmental Science, Harvard University, Cambridge, Mass. 1960

M.S.P.H. Environmental Science-Environmental Chemistry, School of Public Health, University of North Carolina, Chapel Hill, NC 1957

B.A. Environmental Health Science, San Jose State College, San Jose, CA 1955

ACADEMIC AND PROFESSIONAL EXPERIENCE

Current Position:

Consultant, President, G. Fred Lee and Associates

Previous Positions:

Distinguished Professor, Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ, 1984-89

Senior Consulting Engineer, EBASCO-Envirosphere, Lyndhurst, NJ (part-time), 1988-89

Coordinator, Estuarine and Marine Water Quality Management Program, NJ Marine Sciences Consortium Sea Grant Program, 1986

Director, Site Assessment and Remedial Action Division, Industry, Cooperative Center for Research in Hazardous and Toxic Substances, New Jersey Institute of Technology et al., Newark, NJ, 1984-1987

Professor, Department of Civil and Environmental Engineering, Texas Tech University, 1982-1984

Professor, Environmental Engineering, Colorado State University, 1978-1982

Professor, Environmental Engineering & Sciences; Director, Center of Environmental Studies, University of Texas at Dallas, 1973-1978

Professor of Water Chemistry, Department of Civil & Environmental Engineering, University of Wisconsin-Madison, 1961-1973

Registered Professional Engineer, State of Texas, Registration No. 39906

Diplomate, American Academy of Environmental Engineers, Certificate No. 0701

PUBLICATIONS AND AREAS OF ACTIVITY

Published over 1,060 professional papers, chapters in books, professional reports, and similar materials. The topics covered include:

- Studies on sources, significance, fate and the development of control programs for chemicals in aquatic and terrestrial systems.
- Analytical methods for chemical contaminants in fresh and marine waters.
- Landfills and groundwater quality protection issues.
- Impact of landfills on public health and environment.
- Environmental impact and management of various types of wastewater discharges including municipal, mining, electric generating stations, domestic and industrial wastes, paper and steel mill, refinery wastewaters, etc.
  Stormwater runoff water quality evaluation and BMP development for urban areas and highways.
- Eutrophication causes and control, groundwater quality impact of land disposal of municipal and industrial wastes, environmental impact of dredging and dredged material disposal, water quality modeling, hazard assessment for new and existing chemicals, water quality and sediment criteria and standards, water supply water quality, assessment of actual environmental impact of chemical contaminants on water quality.

LECTURES

Presented over 760 lectures at professional society meetings, universities, and to professional and public groups.

GRANTS AND AWARDS

Principal investigator for over six million dollars of contract and grant research in the water quality and solid and hazardous waste management field.

GRADUATE WORK CONDUCTED UNDER SUPERVISION OF G. FRED LEE

Over 90 M.S. theses and Ph.D. dissertations have been completed under the supervision of Dr. Lee.

ADVISORY ACTIVITIES

Consultant to numerous international, national and regional governmental agencies, community and environmental groups and industries.

Municipal Solid Waste Landfills and Groundwater Quality Protection Issues Publications

Drs. G. Fred Lee and Anne Jones-Lee have prepared several papers and reports on various aspects of municipal solid waste (MSW) management and hazardous waste management by landfilling, groundwater quality protection issues, as well as other issues of concern to those within a sphere of influence of a landfill. These materials provide an overview of the key problems associated with landfilling of MSW and hazardous waste utilizing lined "dry tomb" landfills and suggest alternative approaches for MSW management that will not lead to groundwater pollution by landfill leachate and protect the health and interests of those within the sphere of influence of a landfill. Copies of many of these papers and reports are available as downloadable files from Drs. G. Fred Lee's and Anne Jones-Lee's web page (http://www.gfredlee.com). Recent papers and reports on landfilling issues are listed below. Copies of the papers and reports listed below as well as a complete list of publications on this and related topics are available upon request.

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Arizona *(State Landfilling Regulations)*	Verde Valley - Copper Tailings Pile Closure Mobile – Southpoint Landfill
California *(State Landfilling Regulations)*	Colusa County - CERRS Landfill San Gabriel Valley - Azusa Landfill City of Industry - Puente Hills Landfill North San Diego County, 3 landfills San Diego County - Gregory Canyon Landfill El Dorado County Landfill Yolo County Landfill Half Moon Bay - Apanolio Landfill Pittsburg - Keller Canyon Landfill Chuckwalla Valley - Eagle Mountain Landfill Barstow - Hidden Valley and Broadwell Hazardous Waste LFs Cadiz - Bolo Station-Rail Cycle Landfill University of California-Davis Landfills (4) San Marcos - San Marcos Landfill Placer County - Western Regional Sanitary Landfill Placer County – Turkey Carcass Disposal Pits Imperial County - Mesquite Landfill Los Angeles County - Calabasas Landfill Los Angeles County – Palos Verdes Landfill Contra Costa County – Concord Naval Weapons Station Tidal LF Nevada County - Lava Cap Mine Area Landfill Sylmar - Sunshine Canyon Landfill Roseville - Roseville Landfill
Colorado (*State Landfilling Regulations)*	Last Chance/Brush - Hazardous Waste Landfill Denver - Lowry Hazardous Waste Landfill Telluride/Idarado Mine Tailings
Florida	Alachua County Landfill
Georgia	Meriwether County – Turkey Run Landfill Hancock County – Culverton Plantation Landfill
Illinois (*State Landfilling Regulations*)	Crystal Lake - McHenry County Landfill Wayne County Landfill
Indiana (*State Landfilling Regulations*)	Posey County Landfill New Haven-Adams Center Landfill (Hazardous Waste)
Louisiana Env. & Action Network	Gentilly Landfill – New Orleans, LA
Michigan (*State Landfilling Regulations*)	Menominee Township - Landfill Ypsilanti- Waste Disposal Inc. (Hazardous Waste - PCB's)
Minnesota	Reserve Mining Co., Silver Bay - taconite tailings Wright County - Superior FCR Landfill
Missouri	Jefferson County - Bob's Home Service Hazardous Waste LF

New Jersey	Meadowlands - Landfill Fort Dix Landfill and Scotch Plains Leaf Dump
New York	Staten Island - Fresh Kills Landfill, Niagara Falls - Hazardous Waste Landfill, New York City – Ferry Point Landfill
North Dakota	Turtle River Township - Grand Forks Balefill Facility Landfill
Ohio	Clermont County - BFI/CECOS Hazardous Waste Landfill Huber Heights - Taylorville Road Hardfill Landfill
Pennsylvania	Pottstown – Pottstown Landfill
Rhode Island	Richmond - Landfill
South Carolina	Spartanburg - Palmetto Landfill
Texas	Dallas/Sachse - Landfill Fort Worth - Acme Brick Hazardous Waste Landfill City of Dallas - Jim Miller Road Landfill
Vermont	Coventry, Vermont - Coventry Landfill
Washington	Tacoma - 304th and Meridian Landfill
Wisconsin	Madison and Wausau Landfills
INTERNATIONAL LANDFILLS	
Belize	Mile 27 Landfill
Ontario, Canada (*Prov. Landfilling Regulations)*	Greater Toronto Area - Landfill Siting Issues Kirkland Lake - Adams Mine Site Landfill Pembroke - Cott Solid Waste Disposal Areas
Manitoba, Canada	Winnipeg Area - Rosser Landfill
New Brunswick, Canada	St. John's - Crane Mountain Landfill
England	Mercyside Waste Disposal Bootle Landfill
Hong Kong	Three New MSW Landfills
Ireland	County Cork - Bottlehill Landfill County Clare - Central Waste Management Facility, Ballyduff
Korea	Yukong Gas Co. - Hazardous Waste Landfill
Mexico	San Luis Pontosi - Hazardous Waste Landfill
New Zealand	North Waikato Regional Landfill
Puerto Rico	Salinas - Campo Sur Landfill

Surface and Groundwater Quality Evaluation and Management
and
Municipal Solid & Industrial Hazardous Waste Landfills

http://www.gfredlee.com

Dr. G. Fred Lee and Dr. Anne Jones-Lee have prepared professional papers and reports on the various areas in which they are active in research and consulting including domestic water supply water quality, water and wastewater treatment, water pollution control, and the evaluation and management of the impacts of solid and hazardous wastes. Publications are available in the following areas:

Landfills and Groundwater Quality Protection
Water Quality Evaluation and Management for Wastewater Discharges
Stormwater Runoff, Ambient Waters and Pesticide Water Quality Management Issues, TMDL Development, Water Quality Criteria/Standards Development and Implementation
Impact of Hazardous Chemicals -- Superfund
LEHR Superfund Site Reports to DSCSOC
Lava Cap Mine Superfund Site reports to SYRCL
Smith Canal
Contaminated Sediment -- Aquafund, BPTCP, Sediment Quality Criteria
Domestic Water Supply Water Quality
Excessive Fertilization/Eutrophication, Nutrient Criteria
Reuse of Reclaimed Wastewaters
Watershed Based Water Quality Management Programs:
Sacramento River Watershed Program
Delta -- CALFED Program
Upper Newport Bay Watershed Program
San Joaquin River Watershed DO and OP Pesticide TMDL Programs

Stormwater Runoff Water Quality Science/Engineering Newsletter

G. Fred Lee & Associates was organized in the late 1960s to cover the part-time consulting activities that Dr. Lee undertook while a full-time university professor. In 1989, when Dr. Lee retired from 30 years of graduate-level teaching and research, he and Dr. Anne Jones-Lee, who was also a university professor, expanded G. Fred Lee & Associates into a full-time business activity. Examples of governmental agencies, consulting firms, citizens groups, industries and others for whom G. Fred Lee has served as an advisor include the following:

U.S. Environmental Protection Agency - Various Locations
Vison, Elkins, Searls, Connally & Smith, Attorneys - Houston, TX
International Joint Commission for the Great Lakes
U.S. Public Health Service - Washington, DC
Attorney General, State of Texas - Austin, TX
Madison Metropolitan Sewerage District - Madison, WI
Great Lakes Basin Commission - Windsor, Ontario
U.S. Army Environmental Hygiene Agency - Edgewood Arsenal, MD
City of Madison - Madison, WI
Council on Environmental Quality - Washington, DC
National Academies of Sciences and Engineering - Washington, DC
Water Quality Board State of Texas - Austin, TX
U.S. General Accounting Office - Washington, DC
U.S. Army Corps of Engineers - Vicksburg, MS
Tennessee Valley Authority - Various locations in Tennessee Valley
National Oceanic & Atmospheric Administration - Various locations
Organization for Economic Cooperation & Development - Paris
Attorney General, State of Illinois - Chicago, IL
State of Texas Hazardous Waste Legislative Committee - Austin
State of New Mexico Environmental Improvement Agency - Santa Fe
New York District Corps of Engineers - New York, NY
San Francisco District Corps of Engineers - San Francisco, CA
Wisconsin Electric Power Company - Milwaukee, WI
WAPORA - Washington, DC
Reserve Mining Company - Silver Bay, MN
United Engineers - Philadelphia, PA
Automated Environmental Systems - Long Island, NY
Procter & Gamble Company - Cincinnati, OH
Inland Steel Development Company - Chicago, IL
Kennecott Copper Corporation - Salt Lake City, UT
U.S. Steel Corporation - Pittsburgh, PA
Nekoosa Edwards, Inc. - WI
Zimpro, Inc. - Rothschild, WI
FMC Corporation - Philadelphia, PA
Acme Brick Company - Forth Worth, TX
Monsanto Chemical Company - St. Louis, MO
Gould, Inc. - Cleveland, OH
Illinois Petroleum Council - Chicago, IL
Inland Steel Corporation - Chicago, IL
Industrial Biotest Laboratories - Northbrook, IL
Wisconsin Pulp & Paper Industries - Upper Fox Valley, WI

Thilmany Pulp & Paper Company - Green Bay, WI
Chicago Park District - Chicago, IL
Nalco Chemical Company - Chicago, IL
Boise Cascade Development Company - Chicago, IL
Foley & Lardner, Attorneys - Milwaukee, WI
Timken & Lonsdorf, Attorneys - Wausau, WI
Strasburger, Price, Kelton, Martin & Unis, Attorneys - Dallas, TX
Rooks, Pitts, Fullagar & Poust, Attorneys - Chicago, IL
Jones, Day, Cockley & Reaves, Attorneys - Cleveland, OH
Sullivan, Hanft, Hastings, Fride & O'Brien, Attorneys - Duluth, MN
Hinshaw, Culbertson, Molemann, Hoban & Fuller, Attnys - Chicago, IL
Colorado Springs - Colorado Springs, CO
Mayer, Brown & Platt, Attorneys - Chicago, IL
Pueblo Area Council of Governments - Pueblo, CO
Platte River Power Authority - Fort Collins, CO
Linquist & Vennum, Attorneys - Minneapolis, MN
Norfolk District Corps of Engineers - Norfolk, VA
Spanish Ministry of Public Works - Madrid, Spain
The Netherlands - Rijkswaterstaat - Amsterdam, The Netherlands
U.S. Department of Energy - Various locations in US
King Industries - Norwalk, CT
Attorney General, State of Florida - Tallahassee, FL
State of Colorado Governor's Office - Denver, CO
Cities of Fort Collins, Longmont, and Loveland - CO
E.I. DuPont - Wilmington, DE
Allied Chemical Company - Morristown, NJ
Outboard Marine - Waukegan, IL
Amoco Oil Company - Denver, CO
Appalachian Timber Services - Charleston, WV
Mission Viejo Development - Denver, CO
Fisher, Brown, Huddleston & Gun, Attorneys - Fort Collins, CO
Tom Florczak, Attorney - Colorado Springs, CO
Wastewater Authority - Burlington, VT
Tad Foster, Attorney - Pueblo, CO
Holmes, Roberts & Owen, Attorneys - Denver, CO
Center for Energy and Environment Research - Puerto Rico
City of Brush - Brush, CO
Rock Island District Corps of Engineers - Rock Island, IL
Santo Domingo Water Authority - Dominican Republic
Ministry of Public Works and Environment - Buenos Aires, Argentina
Neville Chemical - Pittsburgh, PA
Fike Chemical Company - Huntington, WV
Stauffer Chemical Company - Richmond, CA
Adolph Coors Company - Golden, CO
Water Research Commission - South Africa
Grinnell Fire Protection Systems - Lubbock, TX

City of Lubbock Parks Department - Lubbock, TX
National Planning Council - Amman, Jordan
City of Olathe - Olathe, KS
City of Lubbock - Lubbock, TX
US AID - Amman, Jordan
Buffalo Springs Lake Improvement Association - Buffalo Springs, TX
Union Carbide Company - Charleston, WV
Canadian River Municipal Water Authority - Lake Meredith, TX
Mobil Chemical Company - Pasadena, TX
Unilever Ltd. - Rotterdam, The Netherlands
Brazos River Authority - Waco, TX
U.S. Army Construction Engineering Research Laboratory - Champaign, IL
James Yoho, Attorney - Danville, IL
Zukowsky, Rogers & Flood, Attorneys - Crystal Lake, IL
State of California Water Resources Control Board - Sacramento
Public Service Electric & Gas - Newark, NJ
Health Officer - Boonton Township, NJ
Scotland & Robeson Counties - Lumberton, NC
International Business Machines Corporation - White Plains, NY
Newark Watershed Conservation & Development Authority - NJ
State of Vermont Planning Agency - Montpelier, VT
CDM, Inc. - Edison, NJ
Attorney General, State of North Carolina - Raleigh, NC
City of Vernon - Vernon, NJ
Ebasco Services - Lyndhurst, NJ
Kraft, Inc. - Northbrook IL, with work in Canada, FL and MN
USSR Academy of Sciences - Moscow, USSR
Tillinghast, Collins & Graham, Attorneys - Providence, RI
City of Richmond, RI
Idarado Mining Company - Telluride, CO
Levy, Angstreich, Attorneys - Cherry Hill, NJ
Newport City Development - Jersey City, NJ
Orbe, Nugent & Collins, Attorneys - Ridgewood, NJ
Schmeltzer, Aptaker & Shepard, Attorneys - Washington, DC
CP Chemical - Sewaren, NJ
Dan Walsh, Attorney - Carson City, NJ
William Cody Kelly - Lake Tahoe, NV
NJ Department of Environmental Protection - Trenton, NJ
Hufstedler, Miller, Kaus & Beardsley, Attorneys - Los Angeles, CA
Main San Gabriel Basin Watermaster - CA
Metropolitan Water District of Southern California - Los Angeles, CA
San Diego Unified Port District - San Diego, CA
Delta Wetlands - CA
Simpson Paper Company - Humboldt County, CA
City of Sacramento - CA
Northern California Legal Services - Sacramento, CA

Rocketdyne - Canoga Park, CA
RR&C Development Co. - City of Industry, CA
American Dental Association - Chicago, IL
Emerald Environmental - Phoenix, AZ
Clayton Chemical Company - Sauget, IL
Stanford Ranch - Rocklin, CA
Public Liaison Committee - Kirkland Lake, Ontario
Miller Brewing Company, Los Angeles, CA
ASARCO Inc., Tacoma, WA
CALAMCO, Stockton, CA
Yunkong Gas Company, South Korea
Sutherlands, Pembroke, Ontario
Silverado Constructors, Irvine, CA
Agricultural Interests in Puerto Rico
City of Winnipeg, Manitoba
Strain Orchards, Colusa, CA
Davis South Campus Superfund Oversight Committee, Davis, CA
Monterrey County, California Housing Authority, Salinas, CA
CROWD, Tacoma, WA
Newport Beach, CA
SOLVE, Phoenix, AZ
Sports Fishing Alliance, San Francisco, CA
Caltrans (California Department of Transportation)
Citizens Group near St. John's, New Brunswick
Colonna Shipyards, Norfolk, VA
Clermont County, OH
Wright County, MN
Waikato River Protection Society, New Zealand
Drobac & Drobac, Attorneys, Santa Cruz, CA
Phelps Dunbar, L.L.P., Houston, TX
Walters Williams & Co, New Zealand
Environmental Protection Department, Hong Kong
NYPRIG New York City, NY
DeltaKeeper, Stockton
City of Stockton, CA
Central Valley Regional Water Quality Board, Sacramento, CA
Carson Harbor Village, Carson, CA
Sanitary District of Hammond, IN
South Bay CARES, Los Angeles, CA
Memphremagog Regional Council, Quebec, CANADA
Mobile, AZ
Pottstown Landfill Closure Committee, Pottstown, PA
Grand Forks County Citizens Coalition, Grand Forks, ND
Sunshine Canyon Landfill, Sylmar, CA
Meriwether County, GA
Hancock County, GA
Louisiana Environmental and Action Network, Baton Rouge, LA

This report contains several references to the report,

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 (2005).
http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf

This report was part of the report submitted to POWER and OUTRAGE. It is available from the Lee and Jones-Lee website, www.gfredlee.com at
http://www.members.aol.com/apple27298/SubtitleDFlawedTechnPap.pdf

This website also contains many of the Lee and Jones-Lee papers and reports that provide additional information on the issues discussed in the report on the potential problems of the Kankakee Landfill.

G. Fred Lee