Will the Kankakee Regional Landfill pose a serious threat to our environment and public health?

Here's what the experts have to say:

Stuart Cravens worked on the Illinois State Water Survey which plotted the hydrogeology of Kankakee County in the 1980's. He is a registered hydrogeology professional and he is president of Kelron Environment a private hydrogeology firm.

Conclusions by Reviewer: Stuart J. Cravens, Kelron Environmental

Based on an inaccurate hydrogeologic evaluation, the landfill design, groundwater impact evaluation, and groundwater monitoring programs put forth by Evirogen (the company hired by the investors) for the proposed Kankakee Landfill are all incorrect. They are based on a mischaracterization of the geology and hydrogeology, which means that the data inputs into the landfill design, groundwater impact evaluation, and groundwater monitoring programs are incorrect.
As was discussed earlier throughout this critique, along with the provided evidence, the distinction being made of weathered vs. "competent" dolomite by Envirogen is a false one meant to mislead and allow Envirogen to:

(1) propose removal of a significant thickness of the top of the Silurian Dolomite aquifer, even to depths of several feet below any weathered zones;
(2) propagate the false notion that there are two uniform and distinct hydraulic layers of the Silurian Dolomite across the proposed site and adjacent to site with one layer being a consistent weathered zone versus a second layer called the "competent" zone;
(3) incorrectly model the Silurian Dolomite aquifer and to disregard regional fracture systems as identified in the published literature for the immediate region;
(4) disregard that most water wells in the immediate region within 2miles of the site obtain groundwater from depths below the uppermost 5 feet of the Silurian Dolomite aquifer;
(5) rely on very localized permeability testing methods via slug testing and packer testing while disregarding the necessity to conduct large scale aquifer tests;
(6) propose monitoring only the uppermost Silurian Dolomite aquifer and disregard the uppermost aquifer called the Henry Formation and deeper portions of the Silurian Dolomite aquifer itself.

The most egregious aspect of the application is the proposal to excavate not only through the uppermost aquifer, a sand and gravel unit called the Henry Formation which is probably used as a source of drinking water by poorer homeowners in the immediate vicinity of the landfill, but they propose to excavate through the naturally protective silty clay till layer (called the Yorkville Till) and at least 10 feet into the Silurian Dolomite aquifer, which is used by hundreds of well owners within 2 miles of the site and thousands of homeowners and other users within Kankakee County. So not only are they

proposing to remove the uppermost aquifer, they propose to excavate an average of 4 feet and at least 10 feet into the major regional bedrock aquifer supplying groundwater to the region. Finally, they claim that they are only removing the weathered portions of the Silurian Dolomite aquifer when their own logs show that they will in fact be removing significant portions of hard, good quality (although fractured) rock without offering any details beyond a few sketchy statements as to how that dolomite will be removed, what depth and volume of dolomite will be removed, and how that potentially thousands of fractures which permeate the dolomite over the footprint of the landfill will be adequately located, grouted and sealed to prevent direct migration of contaminants into the aquifer. Essentially, the landfill applicant is proposing to create a 400 acre plus quarry in order to install a landfill directly into a major regional aquifer.

An additional area never touched upon concerning the landfill construction is the very liberal assumption that this location meets the standard for an inward gradient landfill design. The inward gradient design requires that the landfill base be below the potentiometric surface of the units (i.e., Henry Formation, till unit, and Silurian Dolomite) it is installed within. However, as has been demonstrated very completely in areas of Kankakee County immediately to the east, the fluctuation in groundwater levels within the Silurian Dolomite during the year may be tens of feet, with groundwater levels dropping to below the top of the Silurian Dolomite (see reference RI111). Currently, Kankakee County is the 2nd largest irrigated area by volume groundwater used within the State of Illinois, with all that groundwater for irrigation coming from the Silurian Dolomite. Any combination of drought and increased use of groundwater for irrigation could very easily result in declines in groundwater levels at the proposed landfill site. The assumption of an inward gradient at this site 5, 10 or 20 years hence absolutely cannot be made. During the 1987 and 1988 study of the dolomite in Kankakee and Iroquois Counties, water levels within the Silurian Dolomite aquifer decreased over a 3 month period by as much as 72 feet in one area, and as much as 8 feet within about 1mile of the proposed landfill site (see page 44, Figure 25of RI111). An increase in irrigation use combined with below-normal precipitation could result in the potentiometric surface of the Silurian Dolomite dropping to levels that would invalidate the inward-gradient design. Water levels within one mile of the proposed landfill have already been shown to drop 8 feet in a 3 month period, so it is absolutely clear that no one can guarantee or even predict the success of an inward gradient design at this location.

It has been demonstrated by Cravens during a pump test conducted less than one quarter mile east of the proposed landfill that the hydraulic conductivity of the Silurian Dolomite aquifer is sufficient at 6.6x10-3 cm/sec for possible construction of an irrigation well. The installation of one or more irrigation wells immediately east or the site could very likely result in invalidating the inward gradient design of the proposed landfill by drawing down the potentiometric surface of the Silurian Dolomite [see “Bedrock Observation Well Installation and Aquifer Characterization, Kankakee County, Illinois”; authors Kelron Environmental (Champaign, IL) and Natural Resource Technology, Inc. (Pewaukee, WI); June 20, 2003].

Based on the gross misinterpretation and/or purposeful misrepresentation of the hydrogeology by Environgen on behalf of the landfill applicant, in addition to the misrepresentation of the hydrology by Environgen on behalf of the landfill applicant, in addition to the misrepresentation of construction requirements for the landfill by excavating many feet below a non-uniform and in many cases non-existent weathered zone of the Silurian Dolomite aquifer, in addition to ignoring natural groundwater level fluctuations that would invalidate an inward-gradient design, it is clear that the proposed landfill as designed and monitored is not protective of the public health, safety and welfare. Although Envirogen has provided additional site specific data since the original 2003 application, the content and conclusion by Kelron Environmental that the landfill construction as proposed, in addition to the groundwater monitoring system as proposed, fail to adequately protect the public's health, safety, and welfare or the safety of the environment as it relates to surface water resources (i.e., Minnie Creek and the Iroquois River) and the wildlife using such resources.

Sondra K. Sixberry is a Hydrogeologist who was a Professor of Geology at Olivet Nazarene University on June 25, 2002 when she submitted the following to the Kankakee City Council Hearing Committee.

Dear Hearing Committee:

Upon reviewing the hydro geologic conditions at the proposed landfill site, several concerns have arisen. This letter serves as a professional opinion concerning Criteria 2, which addresses the appropriateness of the site location that has been chosen. This letter is focused on three areas of concern:

- problems associated with an inward flow landfill design
- the complex nature of the site specific geology, and
- the lack of acknowledging that the Silurian Dolomite is identified as an aquifer at depths below the weathered bedrock zone.

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 will move with the existing flow of water. Diffusion is a process by which existing contaminants will move with the existing flow of water. Diffusion is a process by 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 significantly different from field to laboratory studies; and has been described as not well understood and difficult to constrain (Richard et al., 1989).

It also seems that this upward gradient forcing water into the landfill may result in an uplift force that actually may disrupt the original structure of the liner. A constant force upward on the base of the landfill may cause some shifting of the basal clay liner and the leachate recovery system. It is uncertain how the applicant plans to deal with this buoyant, uplifting force.

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 began to melt, a deposit at the furthest extent of the glacier consisting of mostly clay, silt, and sand was laid down. This deposit is commonly referred to as a moraine.

A moraine is distinguished by the characteristic sediments (clay, silt, & sand) and can often be observed on a topographic map by a noticeable increase in elevation. Figure 1a & 1b (attached) depicts the location of a moraine in Kankakee County commonly referred to as the Marseilles Moraine. Inspection of the moraine in the proposed landfill site indicates a gap in an otherwise continuous morainal boundary. Geological mapping in this area has indicated that abundant sand and gravel deposits have been observed (Berggren, 1980). The abundant sand and gravel deposits noted in this area are the remains of a huge flooding event known as the Kankakee Torrent (Frankie, 1997 & Berggren, 1980). The Kankakee Torrent resulted from large amounts of water that accumulated behind the moraine as the glacier continued to melt. The morainal boundary could no longer hold the glacier melt waters, so the melt water broke through the moraine depositing large amounts of sand and gravel (known as outwash material), often is a chaotic fashion.

The geological history of the site has greatly influenced the observed hydro geologic conditions at the site. The site-specific hydrogeology is quite complex in nature and varies quickly across the site, as is observed for the boring log records in the Town and Country application. A reinterpretation of cross-section C-C' has been completed and is attached as figure 2. This reinterpreted cross-section indicates that the site geology is not so simple.

The reinterpreted cross-section C-C' illustrates that it is common to find within the predominately sandy unit (Henry Fm) both lenses of 'sand and gravel' as well as lenses of sandy clay. Also within the predominately clay unit (Yorkville Fm), variable moisture contents can be observed. Close inspection indicates that softer clay with a higher plasticity index is present immediately atop a more dense lower plasticity clay. (This can be observed within the boring log descriptions and the driller's blow counts. Driller's blow counts are indicative of the strength of the subsurface material, i.e. the higher the blow counts, the stronger the subsurface material encountered.) This variability within the Yorkville Fm suggests that at least in part this formation is capable of transmitting fluids can be observed in the borings logs (B-3, B-6, B-13, B-20) where wet sand and gravel lenses were encountered within the Yorkville Fm. The potetiometric surface associated with the Henry Fm, indicates that water across the north portion of the site

flows toward the north branch of Minnie Creek and that water across the southern portion of the site flows toward the south branch of Minnie Creek (Figure 2).

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 that has been commonly utilized as a water supply source. The depths of water wells 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:

- 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.
- The complex geologic setting will make it difficult to track migration of contaminants through preferential path ways (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 hydro geologic setting that would be capable of adequately protecting humans and the environment.

G. Fred Lee, PhD, PE, DEE of G. Fred Lee & Associates El Macero, California is one of the nation's, if not the world's, leading landfill expert.

• Undergraduate studies in Environment Health Sciences at San Jose State College
• Master of Science in Public Health, University of North Carolina
• PhD Environmental Engineering/Sciences, Harvard University
• 30 years graduate-level teaching and research positions
• Investigated the impact of municipal solid waste landfills on groundwater quality during a thirteen year span with the University of Wisconsin.
• At the University of Texas at Dallas Dr. Lee helped establish and the UTD Center for Environmental Sciences and spent five years as its director. During this time he 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.
• Mr. Lee taught graduate-level courses on landfill design to engineers.
• Conducted over $5 million in water quality research
• Published over 500 papers and reports on his studies
• Worked with his wife Dr. Anne Jones-Lee, who has also held positions in universities' departments of civil and environment engineering, as full-time consultants for 16.5 years.
• Developed over 600 additional papers and reports many of which were publications dedicated to landfill impact issues.
• Developed in 2005 a report entitled, Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste, which addresses many of the issues which need to be evaluated for the proposed landfill.
• His 1993 work, Landfills and Groundwater Pollution Issues: 'Dry Tomb' vs. F/L Wet-Cell Landfills included a review of the reverse (inward) gradient landfill design.

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 post closure monitoring and maintenance for the **minimum** period that the State of Illinois requires for post closure care. The Illinois landfilling regulations are specific that the 30-year post closure 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 post closure funding forever. With no assured funding by the landfill owner, there are major deficiencies in the assured post closure 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 the groundwater.

Volini, as the private landfill applicant, apparently assumes that the post closure 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 post closure 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 post closure 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.