UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

JAN 26 2011

REPLY TO THE ATTENTION OF W-15J

MEMORANDUM

SUBJECT: Clinton Landfill

FROM: Tinka G. Hyde
Director, Water Division

TO: Bruce F. Sypniewski
Acting Director
Land and Chemicals Division

Attached is Water Division's evaluation of the geology and hydrogeology beneath the Clinton Landfill in DeWitt County, Illinois.

Attachment

Clinton Landfill Evaluation

The Water Division was asked to 1) summarize and evaluate the geology and hydrogeology beneath the permitted (for municipal solid waste facility) Clinton Landfill No.3 as to the suitability of the site for the development of a Chemical Waste Unit, and 2) determine if the proposed landfill will be protective of underground sources of drinking water. The Clinton Landfill No.3 is located at 9550 Heritage Road, Clinton in DeWitt County, Illinois. The proposed landfill cell and larger facility are located over the Mahomet Valley Aquifer, which underlies most of DeWitt County. The Mahomet Aquifer is used extensively throughout central Illinois (by approximately750, 000 people) for drinking water and irrigation.

On February 5, 2008, the Illinois Environmental Protection Agency received an application from Clinton Landfill Inc. (CLI) for a permit to redesign 22.5 acres of the southwest corner of the landfill for the disposal of a variety of non-hazardous industrial process and pollution control wastes including polychlorinated biphenyl (PCB) wastes. The Chemical Waste Unit has a design capacity of 2.55 million cubic yards of airspace, which includes daily cover; CLI estimates an airspace utilization of one ton of waste per cubic yard of airspace, and anticipates approximately 34 years of operation based on 75,000 tons of waste that will be accepted per year.

Findings

Simon Manoyan of the Watersheds and Wetlands Branch, Steve Roy of the Underground Injection Control Branch and Bill Spaulding of the Groundwater and Drinking Water Branch concluded the following:

1) The hydrogeologic characteristic, engineering design and the groundwater Impact Assessment indicates that the Clinton Landfill No. 3 is appropriate for the development of a Chemical Waste Unit if approved design and construction plans, monitoring and operating plans are adhered to.
2) The proposed landfill will be protective of underground sources of drinking water.

The reasons for their findings are as follows:

- An engineered multiple layer-composite liner system was constructed across the base and sideslopes of the proposed Chemical Waste Unit in order to contain the waste materials and prevent contaminants from leaving the landfill and impacting the water. The engineered multiple layer-composite liner system will be comprised of a primary composite liner consisting of compacted cohesive earth overlain by a geomembrane, a geocomposite drainage layer and a second geomembrane. At the base of the Chemical Waste Unit, there is an additional geosynthetic clay liner and a third geomembrane will be installed above the primary composite liner system. The compacted cohesive earth liner will consist of a minimum of 3-foot thick layer of compacted soil with a maximum permeability of 1×10^{-7} cm/sec. The geomembranes will consist of double-sided textured 60-mil HDPE.

- A succession of low-permeability cohesive soil units are present beneath the site which will separate the footprint of the proposed Chemical Waste Unit from the regional aquifer, and have an average thickness of approximately 200 feet at the site and approximately 170 feet of which will remain between the bottom of the proposed liner invert and the regional Mahomet sand aquifer.

- A leachate drainage system/collection system will be constructed on the bottom of the landfill to remove leachate from the landfill. The primary leachate drainage/collection system includes a highly permeable drainage layer to transmit leachate to a series of high-strength plastic pipes placed at intervals on the bottom liner. A redundant leachate drainage /collection system has also been included within the proposed liner system directly beneath the primary liner system in order to provide additional leachate removal capabilities if necessary. Both primary and redundant leachate drainage/collection systems will rapidly transmit leachate to collections sumps from which the leachate will be extracted.

- Upon the Chemical Waste Unit being filled to its intended height, it will be overlain by Municipal Solid Waste to achieve the final proposed grades and a final cover system will be constructed to cap the waste. From the bottom up, the final cover system that will cap the landfill will consist of five layers:

1. a 12-inch thick compacted low permeability final cover barrier soil (maximum permeability of 1x 10^{-7} cm/sec);
2. a 40-mil high density polyethylene (HDPE) geomembrane to serve as an impermeable barrier against infiltration of moisture into the landfill;
3. a drainage layer consisting of a drainage net overlain by a non-woven geotextile to reduce the hydraulic head acting on the final cover;
4. a minimum three-foot thick protective soil layer overlaying the low permeability layer with the uppermost six inches consisting of soil suitable for vegetation; and
5. a vegetation layer.

To facilitate drainage and minimize erosion, the slope of the final cover will be between a minimum of 5 percent and a maximum of 25 percent. The final slopes of the landfill will be vegetated and will incorporate drainage terraces to effectively control erosion. After the placement of final cover, precipitation that falls on the landfill will be diverted into the stormwater management system to minimize percolation through the final cover system.

- Based on the waste streams anticipated, landfill gas generation is not expected, however the permitted Clinton Landfill No. 3 Municipal Solid Waste Unit has been designed with a permitted landfill gas management system. Additionally, ambient air monitoring will be performed at the Chemical Waste Unit.

- The Groundwater Impact Assessment was approved by Illinois Environmental Protection Agency for the permitted Clinton Landfill No. 3 municipal solid waste landfill. The Groundwater Impact Assessment included fate and transport modeling (conservative one- and two-dimensional models approved by the Illinois Environmental Protection Agency) to assess whether the landfill would have any impact on the groundwater quality. The models used to determine leachate migration included

    - Digital Terrain Model (DTM);
    - a two-dimensional contaminant transport model (MIGRATE, groundwater modeling software designed for the sole purpose of modeling landfills); and
    - a one-dimensional model for Hydrologic Evaluation of Landfill Performance (HELP), jointly developed by U.S. EPA and the Army Corps of Engineers for conducting water balance analyses of landfills and other solid waste containment facilities.

  EPA TSCA staff used a one-dimensional contaminant transport model (pollutant migration through a clay layer (POLLUTE)) to help assess the results of the applicant's models.

- PCBs are not mobile from properly constructed landfills – they tend to stay where they are put. There are redundant leachate collection systems with multiple layers of HDPE, bentonite and compacted clay at the base of the landfill, and over at least 150 ft of native clay.

- If PCBs were to get through the bentonite and HDPE layers, the three feet of compacted clay will retard movement for at least 1000 years.

- If PCBs were to get through the compacted clay layer, there is still at least 150 feet of native clay between the landfill and the Mahomet Aquifer.

- The Mahomet Aquifer is over-pressured, that is, artesian conditions exist: water would flow upward if flow paths existed. The maintenance of this pressure over time demonstrates the integrity of the native clay layer.

- Water is extracted from shallower zones in some areas but these shallower aquifers are also protected by the liner and compacted clay later. In addition, none of these wells is "downstream" of the landfill and the location of the site essentially precludes use of any such location in the future.

Modeling issues raised in the KPRG Report

Summarized briefly, KPRG states that they reviewed the permit application submitted by Clinton Landfill, Inc. (CLI) and found it to be inadequate based on their understanding of the modeling effort conducted by CLI. The inadequacies that KPRG report listed are "lack of calibration, absence of fundamental hydrogeologic data and lack of evaluation lateral migration." KPRG recommended an unnamed 3-dimensional groundwater model.

The selection of an appropriate model depends on the application needs, objectives of the project, and what question(s) needs to be addressed by the model. The definition of modeling objectives is an essential first step in the development of a modeling approach. In some cases, objectives will be best met by using a combination of models, and in other cases, a very simplified model might be sufficient to support decision making needs. The selection of the model can be based on criteria such as value of the resource considered, data needs, application cost, the required accuracy, type of pollutants/stressors considered, management considerations and user experience. The groundwater modeling software (MIGRATE) selected by the Applicant was developed and designed for the purpose of modeling landfills and incorporates engineered systems (liners, clay layers etc.) and the hydrogeologic conditions. MIGRATE model has been used in landfill designs and accepted as an industry standard.

The KPRG recommendation is generic and may not improve the model results significantly.

IEPA performed a review of the hydrogeological investigation (which was developed and performed in accordance with the requirements of 35 Ill. Admin. Code, Sections 811.315, 812.314, and 812.315 and Federal TSCA regulations) and agreed with the findings and issued a permit for the site. The Applicant's hydrological investigation included boring logs, cross sections, private water well logs, geotechnical information, slug testing, and potentiometric maps. Additionally, CLI collected over twenty years of groundwater monitoring data for the facility and excavated and constructed landfill cells in the clays at the site and found them to be as identified in the hydrological investigation. The Groundwater Impact Assessment completed by the Applicant was developed based on State regulations and IEPA Guidance Document LPC-PA2. Based on IEPA's conclusions, sufficient and appropriate data was available to conduct modeling to address the project needs.

In addition to the low mobility of PCBs , the Illinois Geological Survey concluded that the groundwater within Mahomet Aquifer is separated from the bottom of the landfill by the engineered liner system and at least 150 feet of glacial clays and receives very little surface recharge in the site vicinity, therefore the facility is deemed to be safe.

The HELP model was used to aid in the design of the leachate collection system, which is what this modeling program was designed to do.

Issues raised by Lee and Lee-Jones

In September, 2009, Rep. Timothy Johnson wrote Region 5 Regional Administrator Mary Gade with concerns about the proposed landfill. He included a report written by G. Fred Lee and Anne Jones-Lee for the DeWitt County Board to provide information related to his concerns. Lee and Lee-Jones raised the following issues:

1) PCBs are hazardous essentially forever.

Response: the information indicates that they are essentially immobile and will stay within the landfill once it is capped. PCBs are very stable and hardly degrade naturally, although some can be degraded by certain anaerobic bacteria. They degrade to water, carbon dioxide and chlorine.

2) Cover materials will eventually deteriorate, allowing water to penetrate.

Response: Cap maintenance is required by permit conditions.

3) Liner materials will eventually deteriorate allowing leachate into the substrate. Note: the only citation referenced by Lee and Lee-Jones is a report which they themselves wrote.

Response: Given the highly redundant and conservative nature of the liner *system*, leakage of leachate into the substrate is not expected. The system consists of three HDPE liners and two leachate collection systems over a three-foot thick layer of compacted clay which overlays at least 150 ft of native clay above the Mahomet Aquifer.

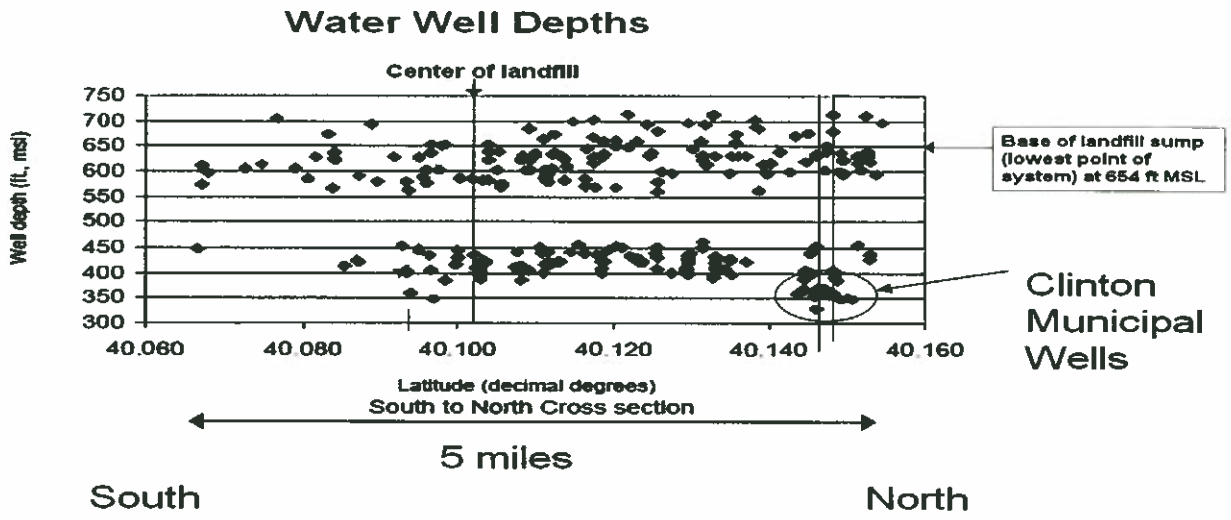
4) Liner is inaccessible: leaks will not be detected in a timely way and repair is difficult.

Response: Leakage will be detected by the volume of liquid pumped from the leachate collection systems. However, repair would probably be difficult.

5) There are pathways through the substrate into the Mahomet Aquifer:

Response: This does not seem to be true. Water in the Mahomet in this area does not show the influence of water from the surface and is in fact under artesian pressure (flow would be upward if a flow path were available). The existence of this artesian pressure demonstrates the integrity of the native clay.

Reports and other documents prepared by EPA RCRA (TSCA) staff show that no community water wells within a 15-mile radius (confirmed in SDWIS) will be threatened by this landfill. They are either 1) upstream or sidestream of the landfill (based on groundwater flow direction) and therefore they cannot be impacted by the landfill (even if there were to be a leak) or 2) they draw water from the deeper aquifer (the Mahomet), in which case the nature of the deposits between the landfill and the Mahomet Aquifer is protective. All existing wells draw water either from a shallow aquifer or a deep aquifer but no wells draw water from the zone between these two, indicating that no water is available in this "dry zone". This can be seen in the following figure which plots depth of water wells (as elevation above mean sea level (MSL)) against the number of such wells. There are no wells in the zone between approximately 460 to 550 ft above MSL. (The "dry zone" appears to be less than 150 feet thick because the figure includes wells within several miles of the landfill and the formations at these distances are not at the same depth as they are beneath the landfill. At the site of the landfill, the clay layer is at least 150 feet thick.)



The following documents prepared by EPA RCRA (TSCA) staff were reviewed:

Response to Preliminary Notice of Deficiency and Subsequent Supplemental Letter,
Clinton Landfill No.3 Application for permit to develop a Chemical Waste Unit,
Section 2: Hydrologic Summary,
Section 3: Design Report,
Attachment 2: Polychlorinated Biphenyls Groundwater model Assessment,
Attachment 1: Summary of Active Community Supply Wells (borelogs),
KPRG and Associates, Inc.'s Review of the Permit Application,
Applicant's Response to KPRG Review Comments,
Section 7: Environmental Monitoring,
Appendix K: Construction Quality Assurance,
Appendix N: Permitted Groundwater Impact Assessment,
US EPA Region 5Power Point Presentation and various geologic and hydrogeologic figures.