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THE POTTSTOWN LANDFILL: OVERVIEW
Environmental Evaluation and Recommendations for Closure

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May 2005

Purpose. This overview summary report, written for the Pottstown Landfill Closure Committee, presents the findings and recommendations of an independent public health and environmental assessment of the releases from the Pottstown Landfill. The objective of the report is to help the Committee develop recommendations for a landfill closure that will provide long-term protection of public health and safety and the environment.

Documentation for the findings of this report including footnotes and references are contained in two attachments:

- Attachment 1. The Pottstown Landfill: Independent Environmental Review of Critical Issues - Detailed Discussion and Documentation, Henry S. Cole, Ph.D.
- Attachment 2. Expected Performance of the Pottstown Landfill Containment and Monitoring Systems, G. Fred Lee, PhD, PE, DEE and Anne Jones-Lee, PhD.

Principal findings and recommendations. The following provides a summary of principal findings and general recommendations to the Closure Committee. Recommendations to the Closure Committee are printed in italics.

1. Landfill wastes and chemicals. Pottstown Landfill wastes contain a large variety of hazardous and deleterious chemicals. These chemicals are constituents of the household wastes and industrial/commercial wastes (e.g. sludge, ash, residues) that have been deposited in the landfill. In the years prior to federal and state solid waste regulations (pre-1980), significant quantities of hazardous chemicals, which are now classified as hazardous waste, were likely deposited in the landfill. In addition, household waste contains highly toxic solvents, pesticides, batteries, used paints and oils and many other products containing hazardous chemicals. Hazardous chemicals in the landfill include volatile organic compounds (e.g., benzene, toluene and chlorinated solvents such as TCE and PCE), heavy metals such as lead, chromium and mercury, semi-volatile substances such as PCBs, PAHs and pesticides and radioactive materials. Many of the toxic and/or flammable chemicals present in landfill waste will remain hazardous for indefinitely long periods of time.

Methane gas is produced in large quantities as organic wastes (e.g., paper, food and yard wastes) decompose. Methane gas is explosive or flammable in certain portions with air. Methane generation begins after several years as conditions in the landfill grow increasingly anaerobic (void of oxygen) and continue for many decades so long as there is decomposable waste and a moisture supply. Landfill gas also contains a variety of volatile organic compounds some of which are highly toxic.

Other deleterious chemicals (organics and inorganics) are present in municipal solid waste and industrial/commercial “nonhazardous” waste which, while not “hazardous,” can be highly odorous and, if not adequately controlled, can cause severe offsite odors. Further, these chemicals can render a groundwater polluted by landfill leachate unusable as a domestic water supply, and thereby cause abandonment of a water supply well.

2. Containment and control systems. The hazardous and deleterious chemicals in the landfill must be contained or they will be released into air, groundwater or surface water. Key containment systems at the Pottstown Landfill are described below along with findings on the current condition and performance of these systems.

- Current regulations require several systems designed to prevent leachate from contaminating groundwater. These include a single composite bottom liner system, a leachate collection system, and a leak detection zone between the composite liner and an additional plastic sheeting liner.
- State regulations require that the landfill owner/operator must install a low-permeability cover system (consistent with current standards) within a year of the date of closure. Modern cover systems are designed to minimize rainfall penetration of the waste in closed cells. Greatly reducing or eliminating moisture from entering the wastes prevents leachate and methane production. Covers also help to prevent air emissions and odors from the landfill surface. Regulations also require that runoff must be controlled to prevent contamination of surface water and erosion of the cover.

- Current regulations also require municipal landfills to utilize gas control systems consisting of pumps, extraction wells, collector lines and combustion equipment (turbines and flares). These systems are designed to prevent lateral migration of landfill gas beyond the landfill's boundary through the subsurface and to prevent fires or explosions. Methane is flammable and explosive at 5-15 percent concentrations in air.
- The landfill operator must carefully adjust the rate of pumping (vacuum) applied to different parts of the landfill. Insufficient draw will lead to odors, landfill emissions, and potential landfill gas migration. However, too much draw will allow air into the landfill. Air can cause fires or explosions within the landfill if concurrent methane levels are in the explosive range. In 2003, Waste Management with DEP approval installed a conduit that allows gas generated in the Eastern Expansion to be piped to the gas-electric power plant located at the Western Landfill. This allows for the use of landfill gas for energy production.

3. Current Status and Conditions

The Western Landfill consists of about 150 acres of disposal areas all of which have been closed (no longer receive waste). The Western Landfill contains six different units. Conditions in these units vary, having operated under different regulatory requirements for bottom liners and caps and other conditions. Stricter regulations apply to those units permitted after the 1988 enactment of municipal waste provisions of Pennsylvania's Solid Waste Act. Sections of the Western Landfill include:

- The original landfill of 30 acres was used as a dump from 1932 to 1978 and is unlined (see Figure 1). It is likely that a significant quantity of what are now classified as hazardous wastes were placed in the original dump and other older portions of the landfill.
- 1978 Expansion contains about 14 acres lined with asphalt.
- 1986 Expansion contains 25 acres with clay liner.
- Northern and Western Expansions were built in 1989 and 1992 with a single composite liner underlain by a leak detection system, as required by regulations under the 1988 Solid Waste Act.
- A vertical expansion area was built as a second layer over the Northern Expansion area in 1994.

We were not able to determine a detailed description of conditions existing in each of these areas. However, according to DEP, of the Western area's 150 acres, 50 were capped with clay and about 90-100 acres, with a geosynthetic (plastic) cap.

In addition, the Western Landfill includes:

- A leachate collection system. Leachate collected from both Western and Eastern Landfills is piped to the Pottstown Landfill wastewater treatment plant.
- 44 groundwater monitoring wells in and around the Western Landfill to detect groundwater contamination.
- An active gas extraction system with more than 200 extraction wells to pump and transmit landfill gas to several flares and turbines for combustion.
- A system of perimeter gas wells which is sampled monthly to detect possible offsite migration of landfill gas through subsurface soils.

Pump and Treat System. Groundwater monitoring in the 1980's indicated that leachate from older Western Landfill units contaminated groundwater. Contaminated groundwater migrated offsite and contaminated residential wells located near the landfill. To prevent additional offsite migration Waste Management installed a pump and treat system in 1991. This system appears to be effective at containing groundwater contamination, but does not prevent new releases of landfill chemicals into groundwater. The potential for offsite migration cannot be ruled out since the landfill area is underlain by fractured bedrock which makes it difficult to track all potential migration pathways. The groundwater pump and treat system will be needed so long as mobile chemicals remain in the landfill.

The Eastern Expansion, permitted in 1995 and operative in 1998, consists of about 51 acres of waste cells. The Eastern Expansion is scheduled for closure in October 2005. Landfill components include bottom liners and leachate control systems in accord with current regulations. Most of the cells are near capacity but remain without permanent cover systems. Only about 10 acres have been capped with geosynthetic cover to date.

Regulations require that permanent covers must be installed within a year of closure. Waste Management appealed DEP's denial of a permit for a vertical expansion and had planned to request permission to install a temporary rather than permanent cover in order to facilitate the expansion if approved. However, on May 19, 2005, the Pennsylvania Environmental Hearing Board upheld DEP's denial of the vertical expansion. Unless this decision is overturned in court, the landfill will be closed as planned in October 2005, with a permanent cover required by October 2006.

Attachment 2 contains a detailed description of the final cover system and the single composite bottom liner system used in the Eastern Expansion. There is no evidence that leachate is penetrating the bottom liner into the leak detection (witness) zone located between the composite liner and the plastic sheeting that is part of the leak detection zone.

Long-Term Protection. Evidence presented in Attachment 2 clearly indicates that containment and collection systems will inevitably deteriorate over time. In contrast, many hazardous/deleterious contaminants will remain a threat for indefinitely long time periods. Preventing serious releases (those that may harm public health, well-being and the environment) will require that key containment and collection systems be maintained in working condition for as long as the wastes in the landfill remain a threat to generate landfill gas and/or leachate. Sections on closure and post-closure care focus on currently planned and recommended measures needed to prevent, detect and correct and remediate releases in the future.

4. Significant concerns regarding current conditions

- a. **Excessive Leachate.** The quantity of leachate being generated by the Pottstown Landfill is far greater than that predicted by Waste Management's computer modeling. DEP recently estimated that the landfill generates more than 3 million gallons per year greater than Waste Management's estimate. As a result DEP has recently required that Waste Management install additional leachate storage capacity to ensure that all leachate collected will be treated.

Several factors appear to contribute to the large quantity of leachate being produced. Although the Western Landfill is closed and covered, it accounts for 65 percent of the leachate; thus it is apparent that there are significant deficiencies in the integrity of the cover that allow rainfall to penetrate into the waste cells. Waste Management with DEP oversight is attempting to resolve the problem by reducing the permeability of Western Landfill drainage ditches. However, it is not certain that these limited efforts will achieve the goal of modern cover systems – to severely limit the moisture supply that generates leachate.

In the case of the unlined portions of the Western Landfill, moisture penetrating the landfill surface will generate leachate that can contaminate groundwater; thus, the pump and treat system now in place will have to operate for a long period of time, especially if there are insufficient improvements in the landfill cover.

The Closure Committee should consider a recommendation to DEP requesting that permeable sections of the Western Landfill be re-covered in a manner that meets current landfill cover standards. This measure would reduce both leachate and methane generation and would reduce fugitive air emissions and odors from the landfill.

- b. **Eastern Expansion – Open Cells.** Once a cell is filled, the best management practice is to install a permanent cover; this practice greatly reduces the infiltration of water and the release of odors and air emissions through the top of the landfill. However, Waste Management has filled a number of cells to near capacity and delayed installation of final cover in about 40 of the 51 acres of Eastern Expansion disposal areas. Waste Management has followed this practice to save the cost of installing and later removing a permanent cover to construct the vertical expansion.

As stated previously, both the DEP and the Environmental Hearing Board have now rejected Waste Management's bid for an eastern vertical expansion.

Leaving cells without cover may have contributed to several problems at the landfill, including excessive leachate generation and odor releases. However, any such problems should be diminished once the landfill is closed and a permanent cover installed. Once the moisture supply through the cover is significantly curtailed, leachate and methane generation should be greatly reduced. However, as is discussed in subsequent sections, problems are likely to recur as the integrity of the landfill cover low-permeability plastic sheeting layer inevitably deteriorates.

c. Potential problems related to control of landfill gas

- i. Gas Generation. Evidence presented in this report indicates that the Eastern Expansion generates significantly more landfill gas than that estimated by Waste Management. DEP cited Waste Management for an exceedance of the 1800 cubic feet per minute limit on the total quantity of methane flowing from the Eastern Expansion to the interconnect pipeline and to Flare 3. This exceedance resulted in a \$100,000 civil penalty.
- ii. Offsite Migration. Attachment 2 presents evidence for potential offsite migration of landfill gas north of the Eastern Expansion. The evidence includes repeated perimeter subsurface gas readings that exceed federal and state requirements that perimeter readings be less than 5 percent as methane.

Although no exceedances have been observed over the past year, the Closure Committee should consider recommending additional field investigation to ensure that the gas control system prevents offsite migration of landfill gas before and after the landfill is closed (see recommendations). Measurements should continue following the installation of the permanent cover since pressures within the landfill may change once an impermeable cover minimizes gas fluxes to the atmosphere.

- iii. Infiltration of air - fire hazard potential. Gas measurements made at certain gas extraction wells within the Western Landfill over the past four years indicate that there have been a number of ongoing exceedances of the federal limit for oxygen (5 percent). Oxygen (air) is regulated because excess air combined with certain levels of methane poses a risk of fire or explosion if an ignition source such as a spark or spontaneous combustion were present.
 - Federal regulations require that such exceedances be corrected within 5-15 days. However, the records show that oxygen levels at a number of gas extraction wells in the Western Landfill remained out of compliance for a much longer period (weeks and months).

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- Concurrent oxygen and methane readings during 2004 demonstrate that certain wells had flammable/explosive combinations of oxygen and methane (oxygen in the 5-20 percent range and methane in the 5-15 percent explosive range).
- Although Waste Management has taken measures to bring oxygen levels into compliance over the past nine months, we are concerned that this potentially dangerous situation could reoccur in the future given (a) the continued presence of methane and (b) the potential for air to penetrate through defective areas of the landfill cover.

As stated previously, re-covering older portions of the Western Landfill (those without plastic sheeting covers) would have multiple benefits including reduced air penetration. Increasing the impermeability of landfill cover would enhance the effectiveness of the gas extraction system, since more gas from the landfill and less air would be collected by the gas control system.

- d. Odor Complaints and Violations.** Over the history of the landfill there have been numerous odor complaints from nearby residents. Many of the complaints were confirmed as sustained offsite odors by DEP inspectors and have led to a number of Notices of Violation (NOVs) and fines. Most odors appear to be associated with landfill gas rather than freshly placed garbage. Both Western and Eastern landfill portions are likely to contribute to odor problems.
- In the case of the Eastern Expansion, more than 40 acres have remained open for an extended period without permanent cover. This condition may have allowed odors and fugitive emissions to escape from the surface of the landfill. This potential will diminish once a permanent cover is placed over the waste cells and an effective gas collection system is installed and operated.
 - Lack of impermeable cover or breaches in cover in portions of the Western Landfill may also have contributed to offsite odor complaints and may continue to do so without adequate measures to improve cover layers.
 - Chemicals in the landfill that cause odors are likely to be present for many decades. *Thus it is critical to determine the location and cause of the odor releases and to ensure that (a) the problem will not continue to impact nearby residents and (b) any future problems will be corrected rapidly and effectively. Again, installing a new cap over defective cover areas in the Western Landfill would reduce the potential for odors.* As stated previously, the presence of an effective cap results in more effective collection of landfill gas.
- e. Air Emissions.** The gas control system is designed to prevent odors and fugitive air emissions. Many of the volatile organic chemicals contained in landfill gas are toxic or photochemically active (generate smog and ground-level ozone).

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- Stack Emissions: In 2004, PA DEP issued a Notice of Violation to Waste Management and substantial fine for exceedances of permit limits and violations of regulations involving (a) destruction efficiencies and emission limits of non-methane organic compounds (NMOC) for Turbines 1 and 2 and (b) exceedances of NMOC limits for Flares 1 and 3.
- DEP's NOV was based on recent stack tests of turbines and flares. Using DEP's stack emissions to estimate annual stack emission results in a yearly total of about 45 tons of NMOC per year compared to Waste Management's estimate of about 8 tons per year.
- Current estimates of fugitive air emissions from the landfill surface are based on modeling rather than measurement. Waste Management's modeling applications have yielded under (low) estimates for both leachate and gas generation. A detailed evaluation of air emissions modeling was outside the scope of our work. *Our analysis suggests that several methods based on measurements (e.g., flux boxes to determine emission rate coupled with modeling, or remote sensing of the landfill plume) would provide more reliable estimates.*

5. TCE Groundwater contamination (East of the landfill). The Montgomery County Health Department and PA DEP have carried out several monitoring programs to determine the extent of TCE contamination along Farmington Avenue east and northeast of the Pottstown Landfill. More than 100 residential wells were found to have TCE contamination in excess of the drinking water standard (maximum contaminant level – MCL) of 5 parts per billion (ppb). Maximum concentrations were on the order of 200 ppb. PA DEP has proposed to provide public water to homes with contaminated wells. PA DEP has not determined the source of contamination. Members of the public have raised the possibility that the landfill may be the source of this contamination.

The authors' review of available evidence suggests that the Pottstown Landfill is not the source of TCE contamination to the east. For example, leachate has apparently not been found in the leak detection zone located below the primary bottom liner of the Eastern Expansion, the landfill area closest to the area of TCE contamination. Secondly, measurements of TCE in groundwater below and at the perimeter of the landfill were non-detect or too low to explain the levels recorded along Farmington Avenue. Nevertheless, we are unable to reach a definitive conclusion due to the complexity of the fractured bedrock that underlies the area and gaps in water quality and groundwater elevation data especially between the landfill and the contamination zone to the east. *We recommend that additional field investigation be carried out to better define hydraulic gradients in the area between the Eastern Expansion and the area of TCE contamination.*

6. Radioactive materials in the landfill. According to DEP, radioactive materials allowed at Pottstown Landfill currently include:

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- Naturally occurring radioactive material (e.g. soils, ores)
- Waste from nuclear medicine patients after released from treatment facilities
- Consumer products such as smoke detectors
- Natural materials that are processed including coal ash or processed metal ores.

In January 2004, DEP issued a permit modification approving Waste Management's application for a "Radiation Protection Action Plan." The Action Plan includes radiation screening at the facility's entrance gate. Detection of gamma radiation in the trucks transporting waste to the landfill sounds an alarm. Once the alarm is sounded, the operator must follow guidelines to ensure that radioactive material detected is properly characterized and managed in accordance with state and federal regulations. Scanning waste delivery trucks for radioactivity based on gamma scanning would not detect radioactive wastes that are alpha- and beta-emitters.

Available evidence indicates that significant volumes of radioactive waste have been buried in the Pottstown Landfill for 30 years or longer. Until recently, the landfill had no radiation monitors at its gates, and therefore there was no way to determine whether regulatory limits on radioactive waste disposal were being violated and the true extent to which radioactive materials were disposed of in the landfill.

Attachment 1 provides evidence on a number of sources or potential sources of radioactive materials in the landfill, including:

Cabot Corporation. The landfill has received residual wastes from Cabot's tantalum ore processing facilities since the 1970's. Evidence from 1983 indicated 12,000 – 24,000 tons of waste per year. The license required that levels of radioactivity be limited to less than 10 picocuries per gram. However, limited sampling makes it difficult to estimate the quantities of radioactive substances contained in this waste.

Medical Waste. State and federal regulations require hospitals to treat radioactive materials as radioactive wastes. These wastes are not allowed to go into the landfill. However, patients who have left medical facilities can dispose of contaminated materials in garbage that goes to the landfill. However, it is not certain that the level of control was sufficient prior to the Radiation Protection Action Plan to know that the restrictions were followed.

Sludge from Royersford laundry (INS). There is evidence that sludge from Interstate Nuclear Services (INS) in Royersford was shipped to the Pottstown Landfill. The sludge is a residual from the washing of garments from the Limerick Nuclear Power Plant that were contaminated with low-level radioactivity.

Limerick Nuclear Power Plant. Wastes from non-controlled areas of the plant (e.g. offices, cafeteria) are checked to ensure that there is no detectable radioactivity prior to being trucked to a transfer station and landfill. The Pottstown Landfill received this kind of waste in 1998 and 1999. However, in at least one incident five bags of waste that were clearly labeled "radioactive waste" were inadvertently sent to the Pottstown Landfill.

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This incident illustrates that what goes into a landfill is not always consistent with regulatory restrictions – especially prior to the installation of radiation screening at the landfill gate.

Wastes in older landfill areas. Industrial wastes including those with radioactive materials brought to the landfill prior to the mid-1980's would have been buried in the oldest, unlined or poorly lined and capped sections of the landfill. Thus waste constituents disposed during the earlier period are more likely to reach groundwater than in later periods when disposal occurred in the composite-lined sections of the landfill.

Tritium in leachate and landfill gas. Tritium (heavy, radioactive isotope of hydrogen) found in both leachate and landfill gas indicates the presence of radioactive materials in the landfill. DEP attributes the tritium to the disposal of self-luminous signs. This hypothesis is consistent with articles in the literature. However, a report on Scottish landfills found that tritium from self-luminous devices is soluble and reaches leachate in significant quantities as the materials break down.

Concerns and recommendations. The evidence indicates that substantial but unknown quantities of radioactive materials may have been disposed of in the Pottstown Landfill. While some radioactive materials continue to be accepted at the landfill, there is currently a monitor at the entrance and a protocol to prevent unauthorized gamma-emitting materials. However, monitoring and information requirements appear to have been inadequate to characterize and control wastes received. Further, the levels of radioactivity in leachate and landfill gas demonstrate that some of the radioactive substances in the landfill are mobile and must be contained and controlled. Our recommendations are as follows:

- *Monitor for tritium in the wastewater treatment and turbine buildings since tritium is contained in water vapor and methane and workers may be subject to long-term exposure.*
- *Continue leachate monitoring for tritium, gross beta and gross alpha, with cell-specific monitoring to determine maximum levels. This is especially important in older, unlined or poorly lined cells where leachate is more likely to reach groundwater.*
- *Upgrade cover systems in older portions of the Western Landfill, especially for areas that lack adequate bottom liners and also for areas where leachate contains elevated levels of radiation.*

In addition, it is possible that future generations will seek to develop or even mine the landfill. While some of the substances have short or intermediate half-lives, others have longer half-lives and will continue to be hazardous for very long periods. For this reason, we believe that it would be prudent to develop better information on the location of potential hot spots within the landfill as follows:

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- *Attempt to determine which landfill cells received largest quantities of radioactive materials. This can be done to some extent using records of waste disposal (including information on cells in use during specific time periods).*
- *Set up an ongoing comprehensive cell-specific monitoring program for radioactivity in leachate and landfill gas.*

7. Closure and Post-Closure Care

Western Landfill. All of the sections of the Western Landfill have been closed. Yet evidence presented in the attachments indicates that the Western Landfill continues to generate significant levels of leachate. The continued flux of moisture into waste cells in these areas causes continued generation of methane. Waste Management with PA DEP oversight is engaged in activities aimed at reducing the infiltration of water into landfill cells. The company's focus is to correct stormwater channel performance to reduce infiltration.

We are not certain that the focus on stormwater channels will be sufficient to prevent the high rates of infiltration and leachate generation.

For this reason, we *recommend measures sufficient to cut off (significantly reduce) water penetration in problematic cells. This may include measures to bring these areas into compliance with standards for landfill cover systems. Such measures are especially important in portions of the landfill that are unlined or ineffectively lined.*

The need for long-term care. Current state and federal closure regulations require landfill caps and liners designed to greatly restrict water infiltration which leads to methane and leachate generation. Waste Management is required to install a permanent cover system by October 2006, a year after closure. The installation of the final cover over the Eastern Expansion should significantly reduce the moisture supply and curtail methane and leachate generation (“dry tomb” approach). However, as discussed in Attachment 2, evidence of dormancy should not be mistaken for an end to the need for post-closure care or perpetual surveillance. Evidence presented in the attached reports demonstrates that while hazardous chemicals will remain for indefinitely long periods, even contemporary containment and control systems will inevitably fail while the wastes in the landfill are still a threat to generate leachate and landfill gas. Over time, the integrity of the low-permeability layer of the landfill cover will deteriorate, and unless a highly effective landfill cover monitoring system is implemented that will reliably detect when the plastic sheeting layer of the cover deteriorates, and repairs are made to this layer, water will be reintroduced into waste cells, with the formation of leachate. Eventual failure of the bottom liner would then allow the release of leachate into groundwater, requiring remedial action to contain and remove contamination from groundwater.

Evidence for the deterioration of key landfill containment and collection systems is presented in Attachment 2.

Regulations affecting closure. Our review of PA regulations finds that there is not a 30-year limitation on post-closure care. In fact, Waste Management will be responsible to provide post-closure care for as long as the wastes in the landfill will be a threat to generate landfill gas and leachate. However, we have several concerns:

- DEP's current approach is to require assured funding projections for 30 years. The estimated post-closure funding needed is reviewed periodically and updated until a Final Certificate of Closure has been issued by DEP.
- Pennsylvania's municipal landfill regulations enable an operator to obtain a Final Certificate of Closure providing the operator can demonstrate that there are no remaining releases, odor or compliance problems. However, while operator liability continues, the burden of proof shifts from the operator to the DEP. In other words, the DEP would have to demonstrate that the landfill has or will cause adverse impacts before it can require corrective action. This approach is not preventive nor is it protective of public health and the environment; it can lead to serious impacts on surrounding communities with no guarantee that corrective measures will be implemented in a timely manner.
- Complacency may set in if landfill control systems are successful in preventing leachate and gas generation for a number of years. Landfill operators will pressure DEP to issue a Final Certificate of Closure. However, the most significant problems may occur years later as containment systems deteriorate.
- We regard the absence of a well-organized database on the landfill (especially for portions of the Western Landfill) as a potential obstacle to those in the future who will need to deal with problems (e.g. releases) or who are attempting to examine development options. Fifty years from now someone may need information rapidly without having to dig through ancient and fragmentary files.

Recommendations on closure/ post-closure. Our recommendations are as follows:

1. DEP should increase the level of regulatory enforcement and require corrective measures for problematic areas of the Western Landfill. The goals should be to significantly reduce water infiltration, leachate formation, methane generation, and air infiltration and odor problems. This may include upgrading to current landfill cover standards. This will be most important for areas where breaches in the cover contribute to odors, oxygen exceedances, air emissions and/or problematic levels of radiation and leachate generation.
2. A policy is needed that ties final certification of closure to a positive demonstration that releasable hazardous and deleterious materials are no longer present in the landfill.

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- *This policy will essentially require an indefinite hold on the issuance of a Final Certificate of Closure.*
 - *This policy should ensure that key control and collection systems are maintained so long as hazardous and deleterious materials remain in the landfill. Gas collection systems and, to the extent possible, leachate collection systems should be maintained in an operable or stand-by condition, even if the Eastern Expansion and Western Landfill sections go into a dormant stage -- i.e., no longer produce leachate and methane. This is necessary since deterioration of the cover will reintroduce moisture in the remaining wastes.*
 - *It would be useful for the Closure Committee to receive information on the long-term performance of the gas and leachate collection systems and how the company would ensure their continued readiness for as long as the wastes are a threat. Note that with renewed gas generation (following dormancy) landfill pressures in the absence of a collection system would increase as would the potential for lateral gas migration toward surrounding neighborhoods.*
 - *This policy should ensure that critical monitoring (witness zone detection, leachate monitoring, groundwater monitoring, perimeter gas monitoring, and well-head gas monitoring) continue as long as the wastes in the landfill, in contact with water, have the potential to generate leachate and/or landfill gas.*
 - *This policy should ensure that DEP has the long-term enforcement power to require corrective measures based on early detection rather than proof of adverse impact (which can cause delay and potentially greater damage). Diminished levels of leachate and methane generation should not be used as the benchmark for final closure.*
3. *The landfill cover should be routinely inspected for areas of stressed vegetation that is indicative of landfill gas migration and air emissions through the cover. Renewed landfill gas and/or leachate generation after a dormant period (with little or no leachate generation) is an indication that moisture has been entering the landfill. Under those conditions, the landfill owner must be required to locate the area of the cover that is no longer preventing moisture from entering the landfill and repair the low permeability layer of the cover. This process will have to be repeated as needed for as long as the wastes in the landfill are a threat.*
 4. *DEP should attempt to renegotiate financial assurance terms with Waste Management to more adequately provide for long-term maintenance and monitoring and for repairs and remedial measures that will be inevitably needed. The need for financial assurance goes well beyond 30 years.*
 5. *As part of closure, Waste Management should provide funds to enable PA DEP to develop a "legacy information system" on the Pottstown Landfill. This system should include critical information and should be electronic and*

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should allow users to easily search and retrieve needed information. This system should also be readily accessible to the public.

6. *The Pottstown Landfill Closure Committee should explore with PA DEP and Waste Management the development of funding that would provide for third-party independent monitoring of the landfill. Further information on this monitoring is provided in Attachment 2.*

References

Attachment 1. Henry S. Cole, Ph.D., “The Pottstown Landfill: Independent Environmental Review of Critical Issues - Detailed Discussion and Documentation.” May 2005.

Attachment 2. Lee, G. F. and Jones-Lee, A., “Expected Performance of the Pottstown Landfill Containment and Monitoring Systems.” Report submitted to the Pottstown Landfill Closure Committee by G. Fred Lee & Associates, El Macero, CA, March (2005).

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