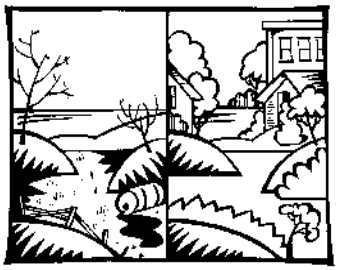

Development At Historic Fill Sites And Licensed Landfills: Considerations And Potential Problems

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A historic fill site is a landfill that was established before 1970 and was not licensed by the DNR.

This publication is the third of three fact sheets in an exemption application packet for development at historic fill sites and licensed landfills. Applicants are urged to carefully read all three documents before completing the Exemption Application Form. The application packet includes the following documents:

- *Development at Historic Fill Sites and Licensed Landfills: What You Need to Know (RR-683)*
- *Development at Historic Fill Sites and Licensed Landfills: Guidance for Investigation (RR-684)*
- *Development at Historic Fill Sites and Licensed Landfills: Considerations and Potential Problems (RR-685)*
- *Development at Historic Fill Site or Licensed Landfill - Exemption Application (Forms 4400-226 and 226A)*

As development of Wisconsin's urban areas intensifies, properties that contain solid waste are increasingly being targeted as potential building sites. Many of these properties have desirable locations for commercial, industrial or residential development. These sites range from places where waste materials such as foundry sand or cinders were used to fill low areas, to very old landfills that predate all solid waste regulations, to highly engineered facilities which have recently closed or are in the process of closing. Adequate information about the waste materials on the property must be available to consider whether the potential development is compatible with the site.

This fact sheet provides general information about potential problems associated with development of sites that contain solid waste. It also provides general information on engineering controls for these sites, but is not a technical reference. The site owner and developer are responsible for providing a demonstration that the proposed land use meets regulatory requirements as well as any safety concerns. The ultimate responsibility for safe development of these sites resides with the property owner, the developer and professionals who are responsible for the work at the site.

Background

Before 1988, no explicit restrictions existed regarding use or development of closed landfills. Although the Department of Natural Resources (DNR) had the authority to impose restrictions on a case-by-case basis, in practice, the issue was seldom addressed. This was particularly true for unlicensed facilities where construction usually occurred without the DNR being notified that waste had been encountered. In a number of cases, these practices resulted in uncontrolled and dangerous conditions.

As a result, when the current solid waste rules were developed, Section NR 506.085, Wis. Adm. Code, explicitly prohibited constructing buildings and other development activities on abandoned landfills of any type or age. However, this code allows the DNR to

grant exemptions for development on landfills, which would be appropriate if a particular site does not pose a threat or if engineering controls can be implemented to prevent harm to the public and the environment.

Non-structural development such as parks or open space may present fewer potential problems. If the existing cap and underlying wastes are not disturbed, then many of the potential problems described in this fact sheet can be avoided. However, no matter what the final land use is, it is important to evaluate carefully whether the activity is compatible with public health and safety.

Potential Problems With Development Activities

In evaluating whether the planned land development is compatible with the waste conditions at the property, the following factors must be considered:

Methane gas accumulation in buildings and other enclosed structures
The anaerobic decomposition of organic wastes can produce large amounts of methane gas. Methane is explosive in concentrations of 5 to 15% by volume. A number of methane gas related explosions have occurred in Wisconsin with at least one resulting in serious injuries. Because it is an odorless, colorless gas, methane can enter structures through cracks or improperly sealed penetrations. Methane also causes asphyxiation when present at higher concentrations.

Toxic gases collection in buildings and other structures
Other common components of waste decomposition gases include various man-made organic compounds (sometimes referred to as volatile organic compounds or VOCs) and hydrogen sulfide. These gases can present both explosion and health-related concerns.

Disturbance of the soil cap
A major function of the cover of a closed landfill is to limit surface water infiltration. Once disturbed the cap becomes much more permeable and surface water infiltration increases, thereby enhancing the formation of contaminated liquids (commonly called leachate), that can cause groundwater contamination.

Utility lines acting as conduits for gas and leachate
Utility trenches for electrical lines, water supply pipes, sewer pipes, etc. are usually backfilled with granular soils. As a result, they can create routes of less resistance for gases and liquids to migrate into and out of waste fill areas. These permeable trenches can also create conduits for gas and leachate to leave the landfill area, putting nearby structures at risk. In addition, there are concerns with leachate coming into contact with water supply pipes and possibly contaminating the drinking water.

Dewatering problems
If the proposed development plans have areas that are to be constructed below or near the groundwater table, then dewatering may be necessary. Dewatering activities in or near areas of waste can cause contaminants to be pulled into previously uncontaminated areas. Also, if the groundwater being removed is contaminated, provisions for discharging to a sewer line or other

wastewater treatment systems must be made. Wisconsin Pollutant Discharge Elimination System (WPDES) permits for the discharge of this contaminated water must be obtained from DNR regional offices.

Worker exposure

Safety hazards exist whenever waste is excavated. These hazards can range from physical hazards such as sharp objects including glass, metal, needles and nails to encountering asbestos and hazardous chemicals or pockets of explosive or toxic gases. Because the characteristics of wastes at these sites are generally unknown, it is best to assume the worst and protect workers accordingly. A safety plan addressing these concerns should be in place prior to beginning excavation.

Settlement problems

Over time, the wastes in a landfill decompose and consolidate, causing uneven settlement. Additional settlement will occur due to the weight of any structures or fill placed over waste. The following problems can be caused by differential settlement of waste material:

- The foundation of a structure may crack and create routes for gases to enter. Structural instability can also result.

- Utility lines may crack or break. This is especially a problem with gas lines. However, if water utility lines crack, the water supply can become contaminated. If sewer laterals crack, contaminated liquid can enter the waste mass and/or the groundwater.

- Caissons and pilings, used due to unstable foundation conditions, create conduits for gas and/or leachate. The space between the pilings and the soil is not airtight, and therefore creates possible conduits for gas to migrate toward the structure. Also, depending on the site geology, the pilings can completely penetrate the waste and extend into a non-contaminated groundwater aquifer, possibly allowing contaminants to migrate into the lower, unaffected aquifer.

Prohibition on water supply wells within 1200 feet of the waste limits

Water supply regulations in chs. NR 811 and 812, Wis. Adm. Code, prohibit the construction of water supply wells within 1200 feet of a waste disposal facility. This is a precautionary measure due to the potential for waste to contaminate the groundwater within this radius.

Considerations for Addressing Site Conditions to Prevent Problems

Many of the concerns discussed in this fact sheet relate to development where building structures are involved. If development consists of parkland, athletic fields and other similar nonstructural land uses, then the concerns are reduced proportionally.

Methane gas

Caution should be exercised in situations where methane may be present due to waste decomposition. If methane gas concentrations in the soil are found to be higher than 25% of the lower explosive limit (LEL), the DNR recommends that no enclosed structures be constructed regardless of any proposed engineering

controls. Since the LEL is 5% methane by volume, 25% of the LEL is 1.25% total methane. The DNR makes this recommendation based on the reality that engineered systems can malfunction due to mechanical failure or human errors and that a methane gas explosion can be catastrophic.

If this recommendation is not followed, then these engineering controls should be considered as a minimum. The structure should be adequately ventilated to prevent accumulation of gas in "dead space" areas. The foundation of the building should include an appropriate gas vapor barrier. All penetrations of the foundation (for utility lines, etc.) should be carefully sealed and checked on a routine basis. An active gas extraction system should be installed around and under the foundation. The gas extraction blower should be equipped with an alarm system (e.g. an automatic telephone dial to a 24-hour answering service) in case the power is interrupted or the equipment shuts down. All appliances in the structure should be spark proof and equipment requiring a pilot light should not be installed.

If the methane values are found to be less than 25% of the LEL, then construction may take place provided there are safeguards to prevent gas from collecting in the structure. The installation of vents, trenches, methane alarms, flexible membrane liners under foundations, and constructing with slab foundations may prevent the migration of methane into the building. At a minimum, the external venting system should consist of a 6 to 12 inch pea gravel layer laid directly over the waste with an interconnected system of 4-inch diameter polyvinyl chloride (PVC) or corrugated drainage pipe installed in the top 4 inches of the pea gravel. This system can also be installed beneath the foundation, if it isn't possible to put it over the waste. A vapor barrier consisting of a minimum 30-mil thick polyethylene (PE) geomembrane welded at the seams to provide a continuous barrier between the venting system and the floor slab should be installed. Filter fabric or a 6-inch layer of fine sand should be placed on top of the geomembrane to act as a cushion. Care must be taken during the placement of the foundation so as not to penetrate the geomembrane. Any penetrations should be carefully repaired.

Settlement

Non-organic wastes settle less than organic municipal wastes if compacted properly during initial placement. For example, ash or foundry sand would be expected to settle a very small amount provided it was properly compacted during placement. A municipal waste landfill with high amounts of organic waste would settle at much higher rates due to the degradation of the organic matter and the difficulty of compacting over non-homogeneous waste. Demolition waste, although it doesn't contain the amount of organic waste as municipal waste, can still settle significantly due to the sifting of finer soils into the voids created by the inability to properly compact the larger, more rigid parts of the waste stream.

Testing should be performed on the in-place waste to determine its stability and the need for specialized foundations. In some cases where the waste is not extensive, it may be more cost effective to excavate the waste and send it to a licensed landfill.

Specialized foundations such as a slab (floating) foundation or the use of pilings are useful to prevent settlement from being detrimental to a structure. However, the use of pilings can create conduits for gas and leachate, and even a floating foundation requires that differential settlement be maintained within specific tolerances.

Surface Water Infiltration

It is important to prevent surface waters and precipitation from infiltrating into the wastes and creating leachate. At the end of construction, the integrity of the cap should be better, that is, less permeable, than it was initially. The entire surface should have an impermeable cover on it, whether it be a roof, concrete, asphalt parking lot, or recompacted clay, so that additional leachate is not created by the infiltration of water. This can be accomplished by completing the following:

- Replace the soil cap over all disturbed areas or upgrade the cap, if necessary. If the original cover was insufficient, two feet of recompacted soil should be replaced as a barrier layer. Clay is the best soil for reducing infiltration of precipitation into the waste. The DNR's administrative code, ch. NR 504 contains clay specifications for quality and placement of landfill covers that can be used as a guide. The two-foot barrier layer should then be covered with 6 inches of topsoil and seeded and mulched. A good vegetative cover will help to prevent erosion problems. Alternatively, buildings, concrete structures and asphalt pavement will act as impermeable barriers to surface water infiltration.
- Create positive drainage by grading so that all surface water is drained away from the structure and away from the waste. Do not allow any areas where surface water may pond above or adjacent to the waste.

Worker Safety

All applicable OSHA rules should be reviewed and complied with, and the following concerns should be addressed. The workers who will be in contact with any excavated material should be made aware of the potential dangers involved and given instructions on how to deal with the possibility of coming into contact with hazardous or toxic waste. Some of the points that should be covered in a safety manual are as follows:

- Training on how to properly excavate waste (for example, the use of sparkless equipment).
- Training on the proper handling of hazardous materials. Depending on the waste present, areas may need to be set up for the storage of suspect waste so it can then be tested and managed appropriately.
- Workers should be given proper safety equipment, e.g., suits and respirators to protect against asbestos in the air, etc.

Underground Utilities

Utilities running through waste present a special problem to development. The following points should be considered when installing utilities through waste:

- Clay plugs or anti-seep collars should be installed in the utility trenches to prevent the trench from becoming a conduit for the migration of gas or leachate. The clay plug

should be at least four feet long. They should be placed in the trenches as the line enters and exits the waste as well as where the line enters the structure.

- In accordance with water supply regulations, water supply wells must be located greater than 1200 feet from the limits of the waste. If it cannot be avoided, you can apply to the DNR's Drinking Water and Groundwater program for a variance to this setback. In addition, the DNR recommends that water supply piping such as mains and laterals are not placed through waste. If it cannot be avoided, it will be necessary to apply to the DNR's Drinking Water and Groundwater program for a case-by-case approval. If water supply lines are placed through waste, there are special provisions that must be followed to hydraulically isolate the lines from the surrounding waste and to provide flexible joints to prevent cracking and breakage due to waste settlement. This is to reduce the potential for contamination from the waste.

- Whenever possible, utilities such as telephone and electrical should enter the structure from above ground to prevent methane from entering the structure through the utility trench. Water and sewer entrances must be carefully sealed.

Waste Handling

Any excavated waste should be handled as follows:

- All excavated waste must be disposed of at a licensed sanitary landfill or as otherwise approved by the DNR, except as described under the next bullet. Suspect waste (such as oily, sludgy, or solvent smelling materials) should be set aside and tested. If any waste is found to be hazardous, it must be managed in accordance with applicable hazardous waste regulations.

- Lower risk waste, such as demolition waste, foundry sand and coal ash may be used on site as berms, embankments or fill as long as a two foot thick soil cover or other impermeable surface is placed over the top of these materials. The use of other lower risk non-hazardous and non-suspect wastes other than demolition waste, foundry sand and coal ash for on-site fill or for returning to the excavation may also be considered, provided a two foot soil cover or other impermeable surface is placed over the top.

Conclusion

Construction on abandoned landfills can create many health and safety problems if improperly done. Sites that contain waste can be successfully developed. However, any development that does occur must be considered very carefully to ensure that all safety and environmental risks have been avoided.