Guidance Document
SW920015

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GUIDELINES FOR REVIEW OF REQUESTS FOR EXEMPTIONS TO CONSTRUCT ON ABANDONED LANDFILLS

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I. INTRODUCTION

As development of Wisconsin's urban areas intensifies, landfills are increasingly being targeted as sites on which to build. The sites involved range from very old landfills that predate all solid waste regulations to highly engineered facilities which have recently closed or are in the process of closing.

Prior to the enactment of our NR 500 series administrative code, no explicit restrictions existed regarding use or development of closed landfills. Although we did have the ability to impose restrictions on a case-by-case basis through plan approval or enforcement processes, in practice, the issue was seldom addressed. This was particularly true for unlicensed facilities where construction usually occurred without the Department being apprised that waste had been encountered. In a number of cases, these practices resulted in uncontrolled and dangerous conditions.

As a result, when NR 500-520 was developed, explicit prohibitions were placed on building on abandoned landfills of any type or age. However, the code does allow the Department to grant exemptions for development on landfills if we believe that a particular site does not pose a threat or if engineering controls can be implemented to prevent harm to the public and environment.

Since promulgation of NR 500 - 520 in February of 1988, we've seen an increasing number of requests for exemptions to NR 504.07(8) and 506.08(5), Wis. Adm. Code. This trend has placed a significant burden on both District and Central Office staff due to the following factors:

- Reviews are time consuming and site specific given the significant concerns involved, such as methane gas explosion hazards.

- Most requests involve old landfills, and little or no information is available about even the most basic aspects of the landfill such as area, volume or type of waste disposed.

- Since construction is oftentimes underway when waste is discovered, time is very important to the developer and they tend to resent the longer review periods imposed by the Department.

- Owners of property and their consultants typically have little knowledge of solid waste management principles and of the risks associated with building on landfills. Once apprised of the risks, many also seem to be largely indifferent.

- In a number of recent cases, engineering controls required by the Department as conditions of the grants of exemption have been omitted entirely or seriously misconstructed. This has resulted in additional Department review time and enforcement efforts. Despite additional efforts expended on our part, the resulting level of protection is usually less than originally required due to the retrofitting needed when the construction was not performed properly the first time.

Based on the experience gained since 1988, we believe that two main changes are needed in our current procedures for dealing with exemption requests for building on abandoned landfills. First, minimum informational requirements must be established for exemption requests, and applicants must be held to these submittal requirements. Secondly, the standards for receiving an exemption must be tightened so as to ensure that the public and the environment are protected.

This report provides additional background on why building on abandoned landfills is of concern, it includes our plan for implementing both changes, and it also provides guidance in reviewing such requests.

II. CONCERNS

The concerns regarding construction on abandoned landfills are as follows:

1. Methane collecting in buildings. The anaerobic decomposition of organic wastes produces large amounts of methane gas. Methane can enter structures through cracks or improperly sealed penetrations and is explosive in concentrations of 5 to 15% by volume. A number of landfill gas related explosions have occurred in Wisconsin with at least one resulting in serious injuries. Methane can also act as an asphyxiate at higher concentrations.

2. Toxic gases collecting in structures. Other common components of landfill gas include various man-made organic compounds and hydrogen sulfide. These gases present both explosive and health-related problems.

3. Disturbance of the landfill 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 infiltration increases, thereby enhancing the formation of additional leachate.

4. Utility lines acting as conduits for gas and leachate. Because utility trenches are usually backfilled with granular soils, they can create easier routes for gases to migrate into the structure and for surface water to get into the waste and create additional leachate. These permeable trenches can also create conduits for gas and leachate to leave the landfill area.

5. Dewatering problems. If the proposed structure has areas which are to be constructed below 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 sewering or other treatment must be made.

6. Worker exposure. Safety hazards exist whenever waste is excavated, such as encountering hazardous waste or pockets of explosive or toxic gases. A safety plan addressing concerns such as these should be in place prior to beginning excavation.

7. Settlement problems. Over time, the wastes in a landfill settle unevenly. Additional settlement will occur due to the weight of any structure placed over waste. The following problems can be caused by differential settlement of a landfill:

   a. The foundation of a structure may crack and create routes for gases to enter as well as potentially make the building unsafe due to structural instability.

   b. Utility lines may crack or break. This is especially a problem with gas lines; however, if water utility lines crack, it can lead to possible contamination of the water supply. Also, the cracking of sewer laterals can cause contaminated liquid to enter the waste mass and/or the water table.

   c. 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 air tight, 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 aquifer, possibly allowing contaminants to migrate into the lower, unaffected aquifer.

8. Prohibition on water supply wells within 1200 feet of the waste limits. Water supply regulations prohibit the construction of a water supply well within 1200 feet of a waste disposal facility.

III. PROCEDURE TO BE FOLLOWED AND MINIMUM INFORMATION WHICH MUST BE SUBMITTED FOR EXEMPTION REQUEST.

The following is the procedure which must be followed when requesting an exemption for construction on an abandoned landfill:

1. The developer must submit all existing information on the site, and propose the number and exact location of all borings, backhoe pits, gas wells and groundwater monitoring wells.

2. The Department will comment in writing on the adequacy of the submitted proposal.

3. The developer performs the approved field work and required investigation. The completed exemption request must then be submitted to the Department for review.

4. The Department will review the exemption request and then decide whether an exemption can be issued (the Department's criteria for deciding whether to grant an exemption are outlined in the next section).

An investigation must be performed for the developer to collect the information needed to complete the exemption request. The purpose of the investigation is to determine the characteristics of the site, whether the site can be developed without endangering public health and safety and to determine which of the aforementioned problems will have to be addressed in the exemption request. The following represents the minimum items that must be identified in an investigation (any information existing prior to the investigation should be submitted to the Department in the initial submittal):

1. Ownership, location of site by quarter-quarter section, zoning, and current land use;

2. Topographic map of site (identification of structures, and utilities and drainageways, as well as surface topography);

3. Local and regional hydrogeologic information including groundwater depth, flow direction, gradients, downgradient users, and groundwater quality;

4. Type of waste disposed of at the site;

5. Depth and horizontal extent of the waste;

6. Concentration of methane present;

7. Existing cap conditions.

An investigation must consist of the following:

1. Backhoe pits and/or soil borings to determine the depth and lateral extent of the waste and general waste composition.

2. Waste characterization tests to determine whether any waste may be classified as hazardous, and also its basic physical and chemical properties.

3. At least two rounds of groundwater elevation and quality results from groundwater monitoring wells installed on site to determine groundwater quality in the area, as well as flow direction and

gradients. The Department may waive these requirements on a site-by-site basis when: the proposed development and associated utilities are not extending below the groundwater table; no pilings are associated with the structure; and no short or long-term dewatering will take place unless that liquid is subsequently treated prior to discharge.

4. Methane readings to determine the presence of methane and if so, the concentration. Gas monitoring wells must be installed on each side of the proposed structure with the wells being no more than 300 feet apart around its perimeter and offset from the building a maximum of 100 feet (see Appendix 1 for a detail of a gas monitoring well). The wells should be screened directly in the waste in order to measure the highest levels of methane present. Gas monitoring well data may be required to be supplemented with bar hole probe readings. (Bar hole probes involve taking a metal bar and pounding it into the ground several feet. Then a portable methane meter probe is stuck into the hole and the methane level is read).

   The gas monitoring must be performed daily for a two week period. The monitoring must consist of measuring the percent methane and percent oxygen. The date and time of sampling should be recorded at each sampling round. A qualitative description of the vegetation and/or cap condition (frozen saturated, etc.) should also be noted. Atmospheric pressure trends should be recorded at the time of sampling.

   The Department may waive the requirement for gas monitoring probes on a case-by-case basis.

5. HNu readings to determine the presence of any hazardous or toxic gases.

IV. DEPARTMENT CRITERIA FOR GRANTS OF EXEMPTION

The Department may grant an exemption to allow construction on a closed landfill if, after an investigation has been performed, all of the following have been determined not to be a problem at the site:

1. <u>No methane problem.</u> If methane values are found to be higher than 25% of the lower explosive limit (the LEL is 5% methane by volume, so 25% of the LEL is 1.25%) no exemption will be given for construction on this site <u>regardless</u> of the proposed engineering controls. If the methane values are found to be less than 25% of the LEL, but greater than zero, then construction may take place provided there are safeguards to prevent the gas from collecting in the structure. Of course, if no methane is detected, no engineering safeguards would be needed.

   If the methane levels detected during the gas monitoring are less than 25% of the lower explosive limit but greater than 0%, then

the installation of vents, trenches, methane alarms, flexible membrane liners under foundations, and constructing with slab foundations can prevent the migration of methane into the building. (See Appendix 2 for detail drawings).

A venting system in conjunction with a vapor barrier must be installed below any structure where methane is found to exist in the waste at values between 0% and 25% of the LEL (remember, no construction may be allowed when the methane values are greater than 25% of the LEL). The venting system must consist of a 6 to 12 inch pea gravel layer directly over the waste with an interconnected system of 4-inch diameter PVC or corrugated ADS pipe installed in the top 4-inches of the pea gravel. The vapor barrier must consist of a minimum 40 mil thick PE geomembrane welded at the seams to provide a continuous barrier between the venting system and the floor slab. Filter fabric or a 6 inch layer of fine sand must 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 must be carefully mended.

2. No settlement problem.

   a. Non-organic wastes settle less than organic municipal wastes if compacted properly during initial placement. For example, a flyash landfill 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.

   b. Use specialized foundations. A slab (floating) foundation or the use of pilings are useful to prevent settlement from being detrimental to a structure. Keep in mind however, that the use of pilings can create conduits for gas and leachate and that even a floating foundation requires that differential settlement be maintained within specific tolerances.

3. Prevent surface waters from infiltrating to wastes and creating leachate. At the end of construction, the integrity of the cap should be better than it was initially and all land should have some kind of impermeable cover on it, whether it be a roof, concrete, or recompacted clay, so that additional leachate is not created by the infiltration of water. This can be accomplished by completing the following:

   a. Replace cap over all disturbed areas or upgrade, if necessary. If the original cover was nothing more than a few inches of vegetated topsoil, we may want to require two feet of recompacted clay (with quality and placement meeting

smelling materials) must be set aside and tested. If any waste is found to be hazardous, it must be disposed of in accordance with applicable hazardous waste regulations;

b. The Department may allow some of the more inert waste (such as foundry sand) to be used on site as berms or embankments as long as a clay cap is placed over the top of these embankments.

V. CONCLUSION

Construction on abandoned landfills can create many health and safety problems and should therefore be avoided whenever possible. Any development which does occur must be considered very carefully to ensure that all safety and environmental risks have been avoided.

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NR 504, Wis. Adm. Code specifications - see Appendix 3) and 6 inches of vegetated topsoil;

b. Create positive drainage by sloping the ground 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 up above or adjacent to the waste.

4. Make workers aware of safety problems. 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 which should be covered in a safety manual are as follows:

   a. Training on how to properly excavate waste (for example, the use of sparkless equipment);

   b. 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;

   c. Workers should be given proper safety equipment, e.g., suits and respirators.

5. Underground utilities. Utilities running through closed landfills present a special problem to construction on an abandoned landfill. The following points should be considered when installing utilities through waste:

   a. 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 four feet long and placed according to NR 504 standards (see Appendix 3). They should be placed in the trenches as the line enters and exits the waste as well as where the line enters the structure;

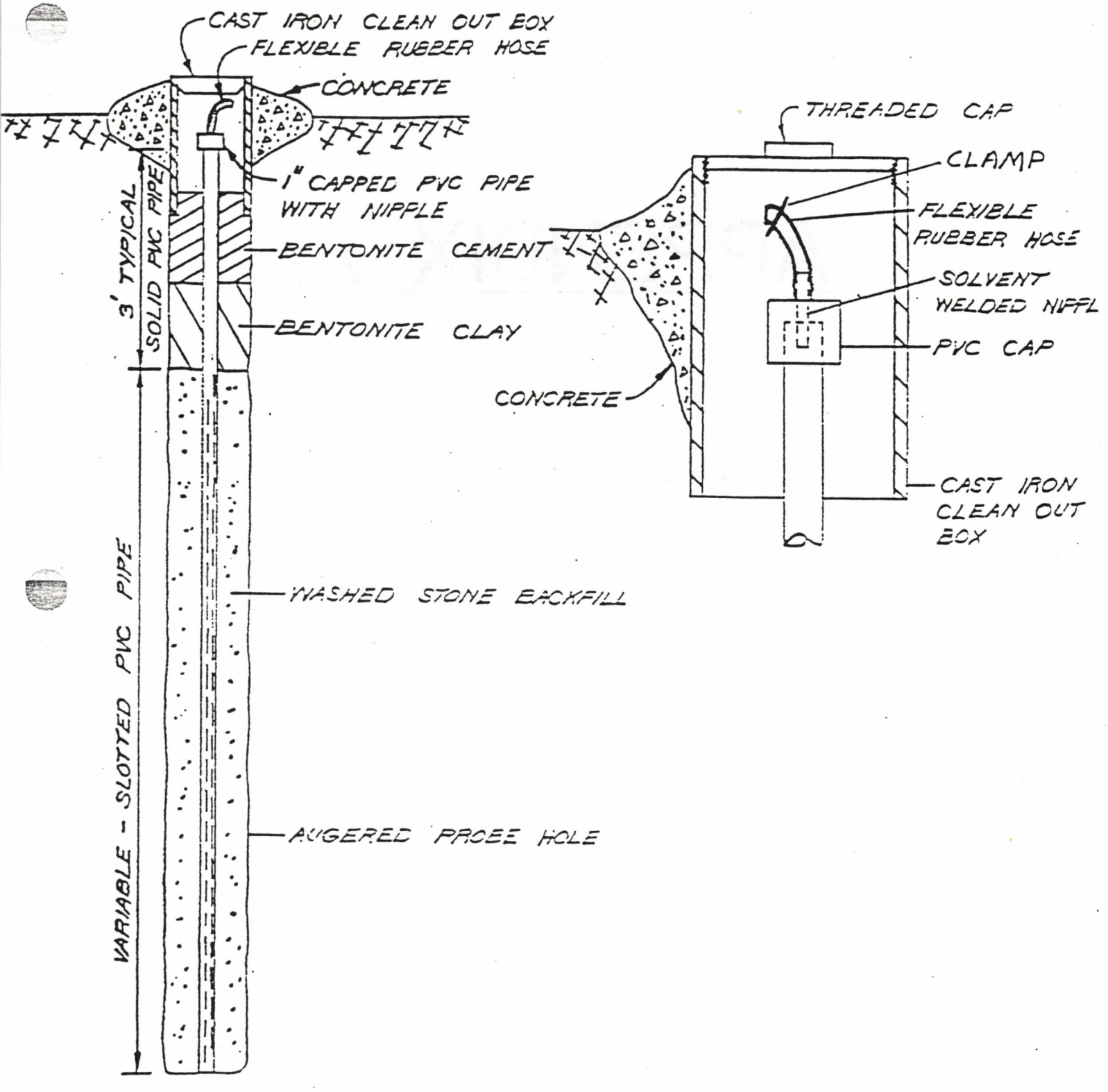
   b. According to water supply regulations, water supply wells must be located greater than 1200 feet from the limits of the waste;

   c. 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.

6. Waste handling. Any excavated waste should be handled as follows:

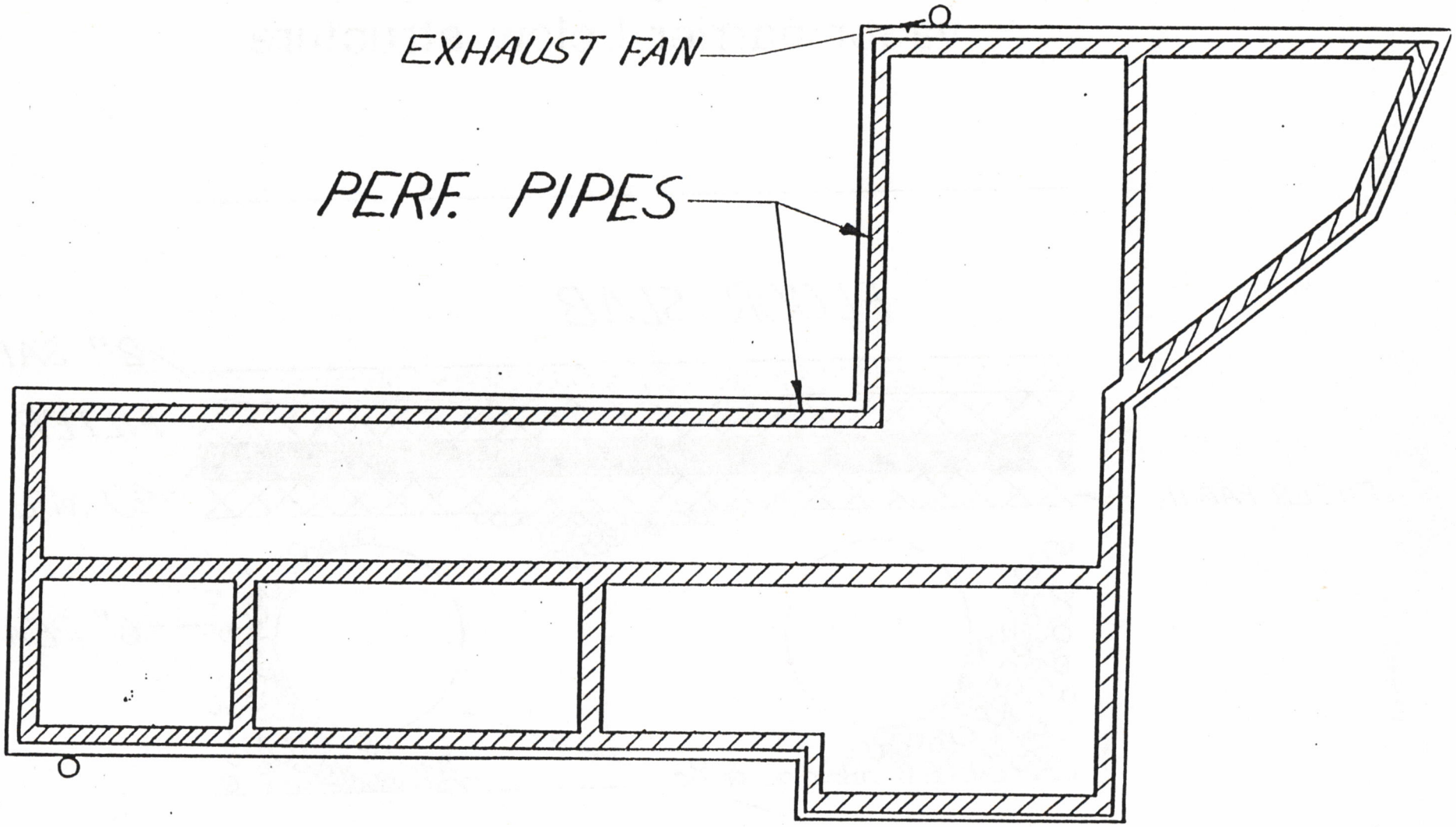
   a. Excavated waste should be disposed of at a licensed sanitary landfill. Suspect waste (such as oily, sludgy, or solvent

APPENDIX 1



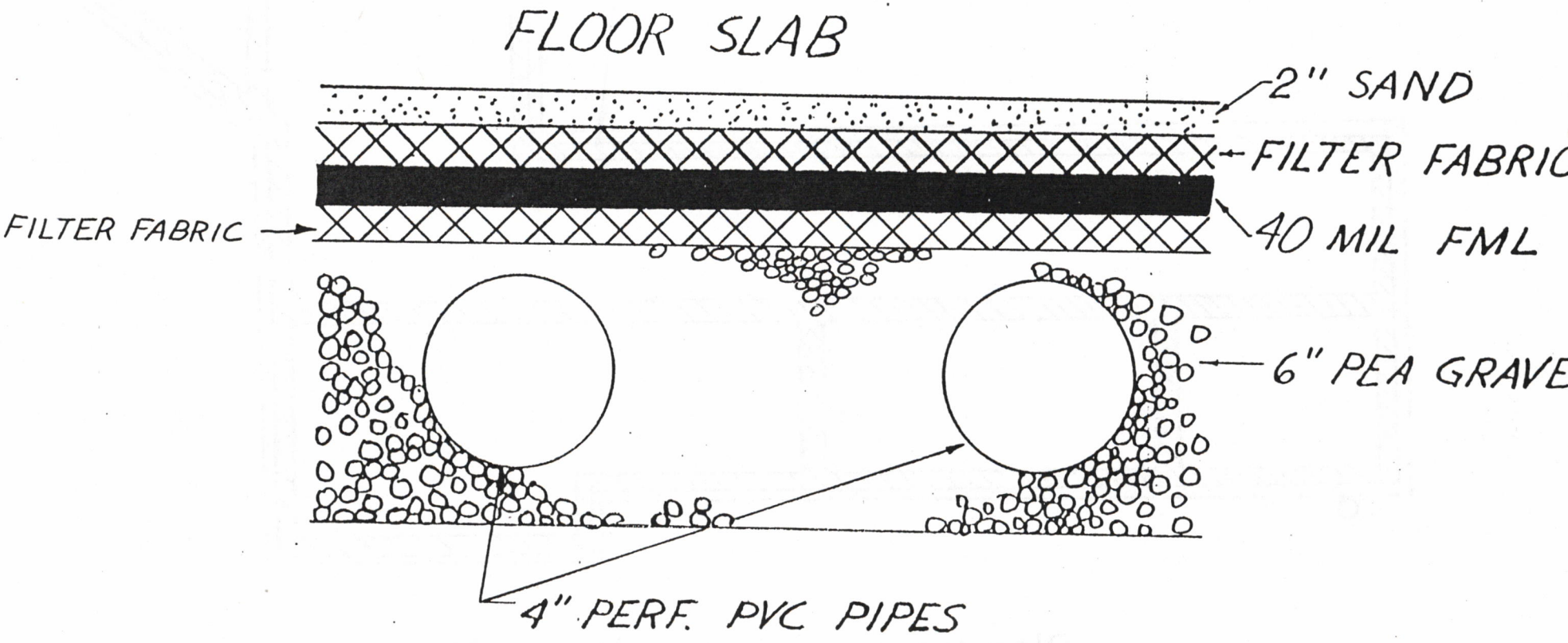
Typical Continuous Source
Landfill Gas Monitoring Well

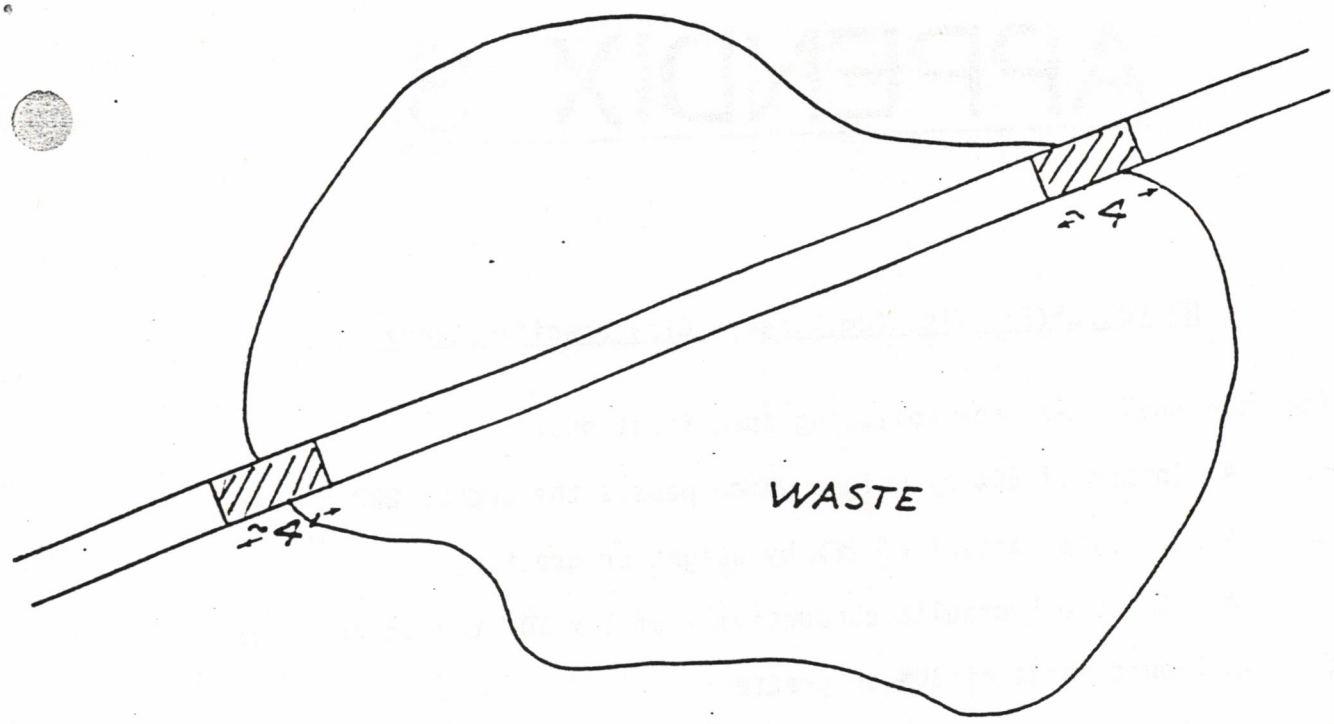
APPENDIX 2



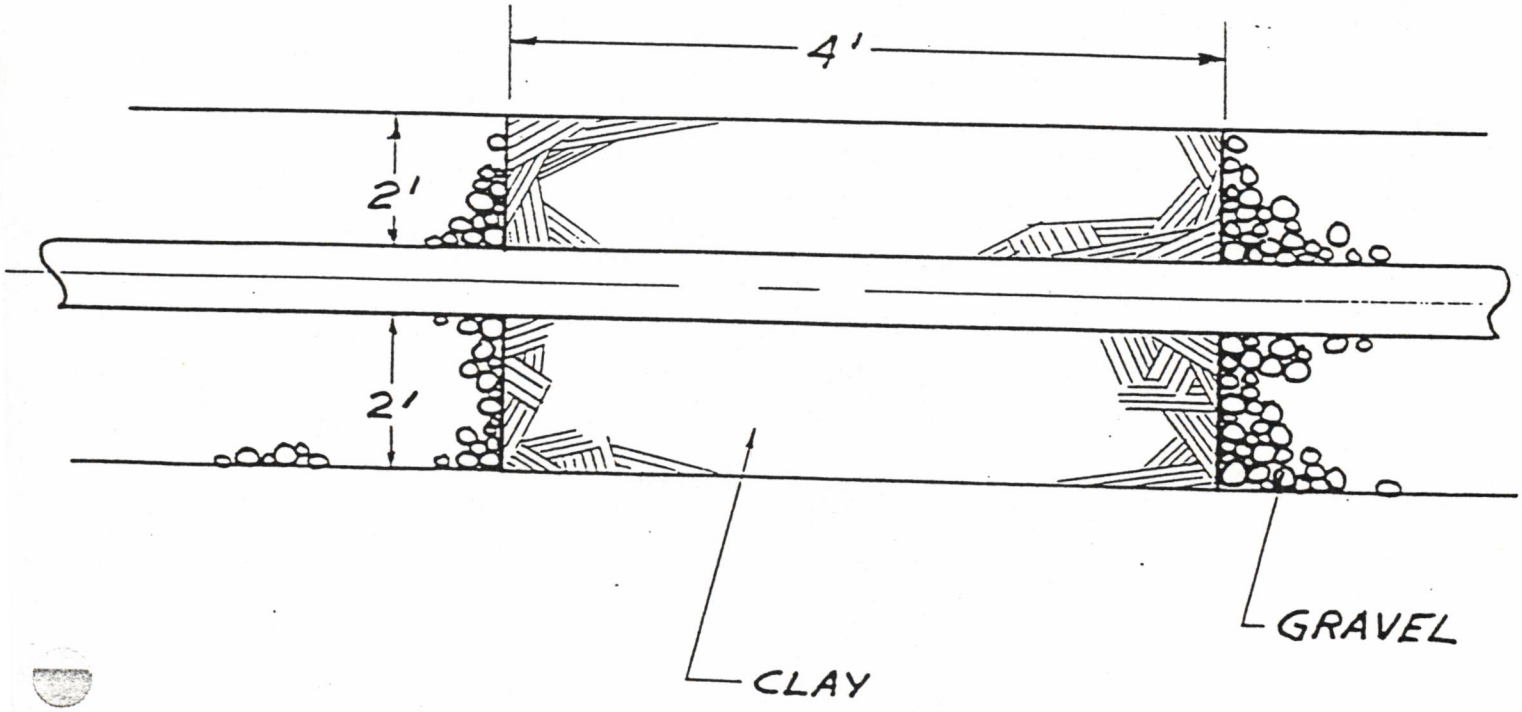
Plan view of gas venting system
and vapor barrier below structure.

Cross-section of gas venting system and vapor barrier below structure.





Clay plugs in utility lines constructed through waste. The clay quality and placement must follow NR 504.05(5).



APPENDIX 3

NR 504.05(5), Wis. Adm. Code - Clay Specifications

The soil shall meet the following specifications:

a. A minimum of 50% by weight which passes the number 200 sieve;

b. A clay size content of 25% by weight or greater;

c. A saturated hydraulic conductivity of 1×10^{-7} cm/sec or less;

d. A liquid limit of 30% or greater;

e. A plasticity index of 15% or greater;

f. Compacted to 90% modified or 95% standard Proctor density or greater.