

# Wisconsin Landfill Air Emissions

- A Cross-Program Regulatory Approach -

## Air/Waste Workgroup on Landfill Gas

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(Updates July 2009 – NSPS in Wis. Adm. Code; and Updated Appendix E )

Approved:

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March 19, 2007 - Air Management Team

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### ***Disclaimer***

*This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.*

# I. Introduction

## I.I Purpose

Wisconsin municipal solid waste (MSW) landfill owners/operators and their consultants have expressed concerns to the department regarding the manner in which landfill gas rules and regulations are applied to landfills statewide. On March 1, 2006 the Wisconsin SWANA chapter co-sponsored an "Air & Landfill Workshop" during which the Air Management (AM) and Waste and Materials Management (WMM) programs were presented with 20 prioritized issues. This document addresses those issues and provides guidance intended to assure consistent, reasonable implementation of regulations controlling landfill gas emissions. Appendix A summarizes the March 1, 2006 issues and our cross-program responses.

## I.II Background

Wisconsin can be proud of its history of collection and control of emissions from landfills. Already in 1985, two Wisconsin landfills became industry leaders with the implementation of gas to energy facilities. Since 1988, Wisconsin rules have required that MSW landfills extract and treat landfill gas<sup>1</sup> to control hazardous air contaminants and capture methane emissions. Wisconsin was the first state in the nation to receive approval of its solid waste program by the U. S. Environmental Protection Agency.<sup>2</sup> Today in the United States, landfills are the largest sources of methane emissions due to the decomposition of wastes in landfills.<sup>3</sup> In Wisconsin, according to models used by the AM Program and landfill private sector experts<sup>4</sup>, in year 2000, there were between 117,000 to 170,000 short tons of methane flared or used in gas to energy projects.<sup>5</sup>

In 1996, the U.S. EPA promulgated a set of standards for the control of landfill gas – the new source performance standards (NSPS), 40 CFR 60, Subpart WWW. That NSPS has been incorporated into Wisconsin Administrative Code as s. NR 440.75, Wis. Adm. Code. In 2000, the AM and WMM programs published a guidance document on landfill gas related issues. This first cross-program document looked at the NSPS, other air program related requirements and how these meshed with existing waste rules. Now we have a number of years of experience and renewed efforts to coordinate guidance are justified. It is time to better integrate our programs and improve communications with landfill owners/operators and their consultants.

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<sup>1</sup> <http://dnr.wi.gov/topic/Landfills/emissions.html>

<sup>2</sup> <http://dnr.wi.gov/topic/Waste/Solid.html>

<sup>3</sup> EPA Landfill Methane Outreach Program, <http://www.epa.gov/climatechange/ghgemissions/gases/ch4.html>

<sup>4</sup> Paper published by Mike Michels and Gerard Hamblin (LFG Collection Efficiency Is Improving in Wisconsin) and assuming a 50% methane content of LFG produced in year 2000.

<sup>5</sup> <http://dnr.wi.gov/topic/airquality/>

## II. Air/Waste Workgroup on Landfill Gas

Having a consistent regulatory approach that successfully integrates state and federal air and waste rules for the collection and control of landfill gas is consistent with the Air and Waste Division's objectives for regulatory improvement. The landfill owners/operators and their consultants raised issues with landfill regulation, and as a result, the Air/Waste Workgroup on Landfill Gas was formed. Workgroup members are listed in Appendix G and may be contacted for additional background if questions arise related to this guidance.

The Air/Waste Landfill Gas Workgroup developed the following "guiding principles" for the landfill gas regulatory improvement effort:

- *Acknowledge and concur with EPA's opinion that human health risks are significantly reduced at landfills that collect and control landfill gas.*
- *Collecting and controlling landfill gas to the greatest extent possible just makes sense. It can prevent or minimize landfill gas migration and explosion risk; control and minimize emissions of air pollutants including hazardous air pollutants; control and minimize odors; reduce fugitive emissions of methane, a powerful greenhouse gas; and where possible, utilize landfill gas beneficially to generate on or off-site heat and/or power. Also, some evidence suggests that collecting and controlling landfill gas may have beneficial effects on leachate and groundwater quality.*
- *With the advent of bigger landfills, leachate recirculation and implementation of organic stability plans, the proper management of landfill gas will continue to be an important environmental control.*
- *The AM and WMM programs agree on the importance of collection and control of landfill gas, odors and fugitive emissions during all phases of landfill development. To that end, the AM and WMM programs, through the Air/Waste Landfill Gas Workgroup, will work together to improve internal and external communications relating to landfill gas management; address existing concerns regarding the department's current approach to managing landfill gas issues; and, finally, develop a shared framework for AM and WMM permit documents and guidance, integrating and building on respective program expertise and authority, offering statewide consistency and improved environmental outcomes.*

### **III. Recommendations**

This guidance is a tool intended to assure consistent and reasonable implementation of administrative rules and related legal requirements dealing with landfill gas. In the process of developing this tool, the Air/Waste Workgroup on Landfill Gas made the following recommendations, based on the “guiding principles” from Section II. The Air Management Team, Waste and Materials Management Team, and Air and Waste Team approve these recommendations. More detail on the recommendations can be found in the appendices noted in the bullet points below.

- Identify specific landfill components that can be exempted from operational standards. This will encourage the collection of landfill fugitive emissions and odors. See Appendix B.
- Require a thorough evaluation and systematic trouble shooting protocol to determine the cause of diminished gas collection prior to approving an alternate operating scenario. See Appendix C.
- Provide for consistent monitoring of landfill gas extraction and control systems, reflected in department permits and plan approvals. See Appendix D.
- Develop consistent frequency and procedures for surface emissions monitoring for all active and/or permitted landfills. See Appendix E.
- Update air permit requirements on a facility-specific basis considering the information contained in Appendices A-F.

## IV. Implementation

The information contained in Appendices A-F addresses the cross program concerns raised by landfill owners (see Appendix A) and includes monitoring that the department believes is appropriate for most MSW landfills. However, given staffing and regulatory authority limitations within the AM and WMM programs, implementation must occur in a stepwise manner over time, based on activities at individual landfills.

The general implementation approach will be to apply all appropriate provisions of Appendices A-E in either an AM Program permit or a WMM Program plan (or plan of operation) approval. The intent is to increase efficiency and reduce the potential for conflicting requirements between the two regulatory programs, while still having all monitoring information necessary to assess the adequacy of gas extraction system operation available to both programs. Parameters that have operational standard limitations based on NSPS requirements (gas extraction system oxygen concentration, temperature or pressure; and Appendix E surface emissions monitoring) should be placed in an AM Program operation permit. All of the Appendix D monitoring requirements should be considered by the WMM Program for inclusion in a plan approval. Landfills should electronically report all monitoring results (regardless of whether they are required by AM permit or WMM plan approval) to the WMM Program GEMS system, where all the data will be available to staff from both programs and to the public.

There are three general situations (described below) that define the steps the AM and WMM programs should take in implementing this guidance. Each of the three situations makes reference to permit language to establish a “gas system requirement approval process.” This means that changes to gas system requirements (Appendices B-E) would be authorized by AM Program approval of requested changes (supported by adequate justification from the source) for specific components of the gas system, rather than requiring that all changes be done via specific revisions to the air permit.

### **Situation I: Landfill with Expiring AM Program Operation Permit**

In this situation, there is no expansion or modification proposed to any part of the landfill. The AM Program operation permit is expiring and must be renewed. During the renewal process, the AM permit staff should verify whether the source wishes to include gas system requirement approval process language in their operation permit. If so, that language should be added during the permit renewal process.

- **AM** – Renew permit using existing permit renewal procedures.
- **AM** – Follow the Air Inspector Guidance (Appendix F).
- **WMM** – Consider including appropriate Appendix D monitoring in their approval at the time of the landfill’s next plan of operation or gas-related plan modification request.

### **Situation II: Landfill Request for Air Permit Revisions to Gas System Requirements (All or Part of Appendices B-E)**

In this situation, the source is not expanding or modifying any part of their landfill, and the AM operation permit is still current. However, the source requests to have revised gas system requirements apply to specific components of its gas system.

- **Source** – Submits to the AM Program a request to revise the air operation permit to include language to establish a “gas system requirement approval process” (if not already included in their operation permit). Source also submits a plan modification request, including Appendix D gas extraction system monitoring, to the WMM Program. The source should submit a letter to AM and WMM programs designating which specific components of the landfill they wish to have

included under a Supplemental and/or Temporary Odor and Gas Control System (STOCS) exemption (the STOCS designation letter). STOCS is further defined in Appendix B. Similarly, the source may request an alternate oxygen, temperature or pressure operational standard for one or more specific gas extraction well. The request must include appropriate justification (Appendix C).

- **AM and WMM** – Coordinate and consult on review of submittals.
- **AM** – If requested by the source, the permit should be revised to include annual surface monitoring requirements (Appendix E) for the entire landfill. The permit should also be revised to remove any gas extraction system monitoring requirements beyond oxygen, temperature, and pressure for the entire gas extraction system (e.g., NSPS related requirements), if requested by the source (Appendix D requirements should be included in the WMM Program approval). Language should also be included specifying that permit required monitoring data should be submitted electronically to the WMM Program GEMS system.
- **WMM** – With input from AM Program, consider appropriate Appendix D monitoring and include in the plan modification approval. Appendix D monitoring requirements should be applied to the entire gas collection system as part of this approval.
- **AM** - Follow the Air Inspector Guidance (Appendix F).

### **Situation III: Solid Waste Plan of Operation or Gas-Related Plan Modification Requested and AM Construction Permit Required**

In this situation, proposed additions or modifications at a landfill trigger the need for a plan of operation or gas-related plan modification approval by the WMM Program, and (in most cases) issuance of a construction permit by the AM Program.

- **Source** – Source submits a plan of operation or plan modification request, including Appendix D gas extraction system monitoring as part of their plan submittal, to the WMM Program; and an AM construction permit application (or operation permit revision request).
- **AM and WMM** – AM and WMM regional staff coordinate and consult on reviews of respective materials and coordinate timing of plan approval and permit issuance.
- **WMM** – Issues plan approval incorporating appropriate gas extraction system monitoring (Appendix D). If a situation occurs where an AM operation permit does not exist, and a construction permit is not required, all appropriate requirements of Appendices D and E should be incorporated into the WMM Program approval.
- **AM** – Issues construction permit and revised operation permit following integrated permit process. During the permit process, the AM permit drafter verifies whether the source wishes to include language to establish a “gas system requirement approval process” in their operation permit.
- **AM** - Follow the Air Inspector Guidance (Appendix F).

## Appendix A

### Response to SWANA concerns presented at the March 1, 2006 Air and Landfill Workshop

Issue #	Description
1	<b>Requests for alternate five percent oxygen and negative pressure in landfill gas (LFG) wells.</b>
LF Owner Perspective	<p>Many landfill owners are having problems keeping individual gas wells at or below five percent (especially in older parts of the waste fill area), yet the combined measurement at the flare is less than five percent.</p> <p>Example #1: If high oxygen is found then we need to close the valve; if you close the valve it decreases flow; if you decrease flow in winter months the valves freeze up from condensate; if valves freeze and blocks vacuum, then the well goes under pressure and you are out of compliance for pressure.</p> <p>Example #2: A portion of the landfill is old and gas generation is on the decline curve; it experiences very little LFG flow at some LFG wells. During winter months, the low flow of LFG thru the well head and valve is not enough to prevent the condensate from freezing and ultimately blocking the flow of LFG past this location. When LFG flow is blocked due to a freezing situation, pressure builds up in the LFG well creating an exceedance. As soon as the weather warms up, the valve thaws, vacuum is restored to the wells and low flow of LFG resumes.</p> <p>A condition in the air permit allows 120 days for the landfill owner to make corrections to address the positive pressure. The work (albeit by mother nature) was done within 120 days of the initial pressure exceedance. The challenge is to collect as much gas as possible but yet keep within the five day, 15 day, 120 day compliance and also not fail the surface emissions or perimeter gas monitoring.</p>
Department Response/ Recommendation	Please see Appendix C.
2	<b>Failure to report exceedances the next business day. What exactly is an exceedance versus a violation? Does the DNR really want only violations reported or do they want every exceedance?</b>
LF Owner Perspective	<p>Since the landfill owner did not believe these items to be violations of the permit, they were not reported the next business day, but rather were reported with the semi-annual reports. The landfill owner's belief is supported by two air permit conditions that state:</p> <p>“Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance; the actions specified in the compliance demonstration conditions shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of 40 CFR 60.753(d).”</p> <p>“If monitoring demonstrates that the operational requirement for oxygen in the well head is not met, corrective action shall be taken as specified in compliance demonstration conditions. If corrective actions are taken as specified in those conditions, the monitored exceedance is not a violation of the operational requirements.”</p>
Department Response/ Recommendation	Please see Appendix F, issues 1 and 2.
3	<b>Consistency of regulators throughout the state with all landfills.</b>
LF Owner Perspective	Many landfill owners are concerned about regulators asking for additional monitoring that is not required in the permit. This causes additional work and additional expenses. Some regulators are very rigid; other regulators have little input.

Department Response/ Recommendation	Please see Appendices D-F.
<b>4</b>	<b>Should horizontal LFG collectors and leachate cleanouts that are connected to active LFG extraction be subject to the well head operational standards (40 CFR 60.753(c))?</b>
LF Owner Perspective	Horizontal LFG collectors and leachate cleanout tie-ins are not interior well heads. They are used simply for better odor control. They are typically not designed with well seals like the vertical wells. Therefore they will likely perform differently than the vertical wells. These devices should be eliminated from the monitoring because such added monitoring and reporting provides a disincentive to install or connect such devices.
Department Response/ Recommendation	Please see Appendix B.
<b>5</b>	<b>May a LFG well be temporarily decommissioned or placed on an inactive list to accommodate for declining landfill gas generation thus declining flows?</b>
LF Owner Perspective	Landfill gas declines in certain areas quicker than others, trying to keep the gas well in compliance becomes more difficult. As landfill gas declines, methane decreases allowing oxygen to increase in the gas well; as oxygen increase, valves need to be closed to decrease oxygen allowing the valves or piping to either freeze in winter.  The advantages of decommissioning a gas well for both the landfill operator and the DNR regulator are two fold, it reduces the times a landfill operator needs to get the well within compliance and it reduces the amount of time that the regulator needs to spend with wells that have little impact on the overall system.
Department Response/ Recommendation	Please see Appendix C.
<b>6</b>	<b>Failing to monitor surface emissions, well heads, and other items soon enough. LF owner thought he did not have to start monitoring until the nonmethane organic compounds (NMOC) emission rates were greater than 50 Mg/year.</b>
LF Owner Perspective	NSPS regulation 40 CFR 60.752(b)(2) states, "as long as the non-methane organic compound (NMOC) emission rate remains below 50 Mg/yr the landfill is not required to meet all the provisions of NSPS" (i.e., no NSPS required monitoring, such as surface emissions).  The May 2000 DNR Guidance and 40 CFR 60.752(b)(2)i allows 12 months from the date of emitting more than 50 Mg/yr of NMOC to submit a design plan. In addition, 40 CFR 60.752(b)(2)ii allows 18 months from submittal of the design plan to begin operation of the gas collection system in accordance with the NSPS. This 30 month timeframe is restated in a June 16, 1998 Federal Register clarifying the NSPS rule and a February 1999 EPA report summarizing the NSPS requirements for states to use as an implementation guide.  The landfill first reported its emissions greater than 50 Mg/yr on Jan. 1, 2001, per a tier 2 test. The landfill should not be required to monitor for surface emissions until July 1, 2003 (30 months after Jan. 1, 2001).
Department Response/ Recommendation	Please see Appendix F, issue 4.
<b>7</b>	<b>Failing to adequately monitor the landfill side slopes for surface emissions.</b>
LF Owner Perspective	The landfill air permit states: "... the owner or operator shall conduct surface testing around the perimeter of the LFG collection area along a pattern that traverses the landfill at 30 meter intervals...The permittee may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing."  Since there was no definition of a steep slope in the permit, the landfill owner looked to industry standards which appeared to use 5:1 slopes as criteria for steepness. The actual slopes on this landfill are 3.5:1 at the lower regions and 4:1 on the upper portions (which are steeper than 5:1). An interpretation printed in Solid Waste Technology magazine recommended that slopes steeper than 5:1 be evaluated for safety prior to starting monitoring. In addition, the landfill owner was

	<p>aware of a landfill located in Illinois that had an approval from the Illinois EPA that does not require 5:1 or steeper slopes to be monitored under the NSPS requirements.</p> <p>As for dangerous areas, one area that landfill owner considers to be dangerous is the active filling area with truck and compactor traffic. Most landfill owner's safety policy prohibits individuals from walking across this area.</p>
Department Response/ Recommendation	Please see Appendix F, issue 5.
<b>8</b>	<b>Permit does not regulate for flow, but the landfill owner gets an notice of violation (NOV) for not having flow at some well heads.</b>
LF Owner Perspective	<p>40 CFR 60.758 does not list flow as a requirement to be measured at the well head. The only items required to be measured and meet certain criteria, at the well head, are oxygen, pressure and temperature. Just because the landfill owner measures and records flow, DNR should not subject them to a new requirement that is not listed in the air permit.</p> <p>Lack of flow for a LFG well may be an indication that other LFG wells zones of influence are overlapping the LFG well without flow. These other LFG wells may be pulling the LFG away from this low flow well. Alternatively the LFG well without flow may have been installed in a portion of the landfill where non-decomposable waste was placed, just the lack of LFG flow.</p>
Department Response/ Recommendation	<p>The department has the authority under s. NR 507.22(2), Wis. Adm. Code, to require the monitoring of parameters that are not listed in the new source performance standard when deemed necessary to assure that the landfill gas extraction system is operating properly. Section NR 507.22(2), Wis. Adm. Code, states, "The department may require the owner or operator to install monitoring ports and conduct monitoring activities to determine the effectiveness of any gas extraction or venting system."</p> <p>In addition, the department has the authority under s. NR 407.09(4)(a)1., Wis. Adm. Code, and s. 285.65(3), Wis. Stats., to require the monitoring of parameters that are not listed in the new source performance standard in air permits when deemed necessary to ensure that the gas collection system effectively captures landfill gas.</p> <p>Please see Appendices C and D, as well as Appendix F, issue 3.</p>
<b>9</b>	<b>Failure to maintain negative pressure at each well head. Readings were zero pressure / vacuum; why is this non-compliance?</b>
LF Owner Perspective	A zero pressure reading versus a small negative pressure reading (such as -0.1" water column) has very little mathematical difference and literally no environmental impact. A zero pressure means, there is no driving force for gas to escape the area. Considering that the intent of NSPS is to minimize the escape of landfill gas to the environment, the landfill owner believes having a zero pressure meets the intent of the NSPS rule.
Department Response/ Recommendation	Please see Appendices B and C.
<b>10</b>	<b>Power failures and storms sometimes shut down equipment; permit indicates must be up within 1 hour.</b>
LF Owner Perspective	Can't restart equipment until the power comes back on unless the landfill owner keeps a standby generator available. There is a significant cost for a standby power generator. Landfills have the ability to store LFG until the gas pressure gets so great that LFG leaks out through the cap or other areas.
Department Response/ Recommendation	<p>The DNR's Air Program has consistently required sources to operate control devices at all times. Landfills are encouraged to have backup landfill gas control devices.</p> <p>Please note that whenever landfill gas is routed to a gas treatment system that processes that collected gas for subsequent use, any device that fires that treated landfill gas is not subject to operational requirements pertaining to landfill gas control devices, including restarting the device within one hour.</p>
<b>11</b>	<b>Does the landfill owner only need to record the date and time when the landfill gas collection system is inoperable "for more than 5 days" and when the landfill gas treatment system and/or flare are inoperable "for more than one hour"?</b>
LF Owner	Recording every inoperable event, no matter how short, seems excessive.

Perspective	
Department Response/ Recommendation	The semiannual monitoring report will require the landfill owner to report only deviations from and violations of the applicable requirements in the permit (e.g. – occurrences when the landfill gas collection system was inoperable for more than five days, occurrences when the landfill gas treatment system, control device and/or flare was inoperable for more than one hour).
<b>12</b>	<b>Maintaining a vacuum is a problem at an old landfill where the landfill has settled and headers sag allowing condensate to fill them up and stop the flow / vacuum distribution.</b>
LF Owner Perspective	Repair is very expensive especially if the LFG header is located under the geo cap or the cap is frozen during winter months.
Department Response/ Recommendation	Please see Appendix C. Repairs must be made in accordance with permit and plan approval requirements.
<b>13</b>	<b>SEM done with DNR on-site, but DNR asked that we not follow the 30 meter (i.e., 100') serpentine path in our plan.</b>
LF Owner Perspective	Why develop a serpentine path and file it in our operating record, if we are not going to follow it?
Department Response/ Recommendation	Please see Appendix E and Appendix F, issue 5.
<b>14</b>	<b>Monitoring the flare flow or temperature only if the flare is running.</b>
LF Owner Perspective	When zero flow is measured at the inlet to the flare (this often occurs when the energy plant is taking the LFG instead of flaring), monitoring for flare temperature is only monitoring the ambient air temperature and this temperature monitoring does not increase protection of the environment.
Department Response/ Recommendation	Current permit requirements specify that a landfill shall operate a flare whenever landfill gas is routed to it. If necessary, permit conditions could be changed to make it clear that monitoring flow and temperature at the flare tip will only be necessary when the flare is operating or when landfill gas is routed to the flare.  At the request of the applicant, the department may change a landfill permit to include this language either by revising the operating permit or by incorporating the changes when the operating permit is renewed.
<b>15</b>	<b>Failure to install and maintain a gas flow rate measuring device capable of recording the flow to the control device every 15 minutes. Is a continuous recorder that sums the totalized flow once per day allowed?</b>
LF Owner Perspective	A flow measuring device was installed and maintained but it recorded the flow to the control device “continuously” and summed the tally once per day. A continuous monitor of flow (scf / day) provides better information than a snap-shot of flow (scfm) every 15 minutes.
Department Response/ Recommendation	No, this will not be an acceptable alternative because the totalized flow will not necessarily reflect whether there was continuous flow throughout a particular day. As an alternative to recording flow to the control device every 15 minutes, the air permits allow the landfill owner to secure the bypass valve in the closed position and to verify that closed position via visual inspections.
<b>16</b>	<b>U.S. EPA determined that the landfill owner’s compression and dehydration system qualified as a treatment device and, as such, exempts all engines or boilers that utilize treated gas from the requirements of monitoring. Discuss what notification the landfill owner must make to DNR of this U.S. EPA determination and what must be done to change the permit.</b>
LF Owner Perspective	Should not have to monitor nor report combustion temperature or other items at the control device (engine, boiler, flare, etc.) since U.S. EPA determined I have an approved treatment device.
Department Response/ Recommendation	For Wisconsin landfills, U.S. EPA has made several determinations in which it has defined landfill gas treatment to include compression, dewatering and filtering out particles of at least 10 microns. The notification should include a description and either an applicability determination from U.S. EPA, or a block diagram of the landfill gas treatment system. Whenever a landfill submits the latter, please note that any new treatment system should be similar to and/or more effective than those that have been determined to be landfill gas treatment systems by U.S. EPA.  At the request of the applicant, the department may change a landfill permit to reflect the existence of a landfill gas treatment system either by revising the operating permit or by incorporating the changes when the operating permit is renewed.
<b>17</b>	<b>Permits contain numerous conditions that are referenced to the federal new source</b>

	<b>performance standards. In some cases, the permit wording had been slightly changed from that of the NSPS. For example: per NSPS, oxygen may be determined by method 3A or 3C. Some DNR air permits do not include Method 3C.</b>
LF Owner Perspective	Why does the DNR make these slight changes? They create confusion. Does DNR intend to maintain the NSPS language? Is there any intent to change the meaning of the NSPS or are there any specific items from NSPS excluded purposely?
Department Response/ Recommendation	<p>The Municipal Solid Waste NSPS was finalized in March 1996. Since then, that NSPS has been revised several times, including October 2000 when the rule was revised to add Method 3C to Method 3A as methods to determine the oxygen content in the landfill gas at each well head.</p> <p>The department aims to have the air permits for municipal solid waste landfills reflect the most recent version of the Municipal Solid Waste NSPS or s. NR 440.75, Wis. Adm. Code at the time of permit issuance. There have also been limited instances in which the department and the landfill have agreed to include only one method or one option in a permit when more than one method or option is listed in the NSPS.</p> <p>At the request of the applicant, the department may change a landfill permit to reflect the current NSPS either by revising the operating permit or by incorporating the changes when the operating permit is renewed.</p>
<b>18</b>	<b>Challenges of well field tuning – one change affect another – barometric pressure affects – others.</b>
LF Owner Perspective	<i>[no further elaboration provided]</i>
Department Response/ Recommendation	Aspects of Appendices B-F address the myriad challenges of well-field tuning.
<b>19</b>	<b>Cost of maintaining older gas system</b>
LF Owner Perspective	<i>[no further elaboration provided]</i>
Department Response/ Recommendation	Yes, maintaining all environmental controls, especially with older infrastructure can be expensive.
<b>20</b>	<b>HDPE pipe and some gas equipment are not available within 120 days necessary to repair LFG collection system in a timely fashion.</b>
LF Owner Perspective	<i>[no further elaboration provided]</i>
Department Response/ Recommendation	<p>Landfills may propose, and the department may authorize an alternative timeline for conducting such repairs.</p> <p>However, landfills are expected to stock a reasonable amount of spare parts.</p>
<b>21</b>	<b>Leaks from manhole structures and from geomembrane boots on LFG extraction wells.</b>
LF Owner Perspective	<i>[no further elaboration provided]</i>
Department Response/ Recommendation	Based on the field experience of staff in both the AM and WMM programs, vertical and other penetrations of the landfill surface can be an important source of fugitive emissions. Appendix B encourages collection of fugitive emissions from some specific landfill components. Repairs to surface seals and boots (often identified during surface emissions monitoring, see Appendix E; also trouble shooting in Appendix C) must be made to landfill components to minimize leaks.
<b>22</b>	<b>Asbestos management at landfills.</b>
LF Owner Perspective	<i>[no further elaboration provided]</i>
Department Response/ Recommendation	None required.
<b>23</b>	<b>The landfill owner does not plan to install a temperature monitoring device on each well head, instead the landfill owner plans to carry a portable temperature gauge to each well head, insert that gauge into a sample port on the well head, take the measurement, then extract the temperature gauge and carry it to the next well head for the next measurement.</b>
LF Owner Perspective	<i>[no further elaboration provided]</i> .

<p>Department Response/ Recommendation</p>	<p>Many landfill permits reflect the March 12, 1996 version of 40 CFR s. 60.756(a) as follows: “Each owner or operator seeking to comply with s. 60.762(b)(2)(ii)(A) for an active gas collection system shall install a sampling port and a thermometer or other temperature measuring device at each well head.”</p> <p>In June 1998, 40 CFR s. 60.756(a) was revised to read as follows: “ Each owner or operator seeking to comply with s. 60.762(b)(2)(ii)(A) for an active gas collection system shall install a sampling port and a thermometer, other temperature measuring device, or an access port for temperature measurements.”</p> <p>The current reading seems to indicate that a landfill may simply install an access port at each well and measure temperature with a portable temperature measuring device.</p> <p>Some landfill permits include the “access port” language, while many others do not. At the request of the applicant, the department may change a landfill permit to reflect the current NSPS either by revising the operating permit or by incorporating the changes when the operating permit is renewed.</p>
<p><b>24</b></p>	<p><b>4” flex tube wears quickly and is expensive.</b></p>
<p>LF Owner Perspective</p>	<p><i>[no further elaboration provided]</i></p>
<p>Department Response/ Recommendation</p>	<p>None required.</p>

## **Appendix B**

### **STOCS**

Supplemental and/or Temporary Odor and Gas Control System (STOCS) components include leachate cleanouts, leachate recirculation, horizontal gas collectors and other landfill structures such as manholes that are not subject to oxygen, pressure and temperature standards. Where horizontal gas collectors are located in areas where waste has been in place for greater than five years or two years if closed or at final grade, the negative pressure, the less than five percent oxygen, and less than 131 deg. F. operational standards will apply, as they do for vertical gas extraction wells. STOCS may be further defined as systems or components whose primary intended purpose is not gas collection (i.e., leachate collection cleanouts, leachate recirculation lines) and used for SUPPLEMENTAL control of fugitive gas and odors. STOCS can also include TEMPORARY supplemental/sacrificial portions of the gas system (i.e., horizontal collectors which are abandoned in place). While oxygen, temperature, and pressure operational standards may not apply to STOCS, monitoring for oxygen, temperature and pressure will continue\*.

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\* For “non-NSPS” landfills (those with NMOC emission rates of less than 50 Mg/year), STOCS are exempted from operational standards. For landfills required to meet all provisions of the NSPS, the department will need to coordinate with U.S. EPA, Region 5, before exempting STOCS at NSPS sites from operational standards.

## Appendix C

### Landfill Gas Collection Alternate Operating Scenario Requests

#### Introduction

Generally speaking, as municipal solid waste landfills age, there is less gas produced by decomposition. Eventually the waste will be substantially degraded. The rate at which this occurs is variable and may take many decades to go to completion. When an area or phase of the landfill has reached substantial degradation or the owner has documented that specific areas of the landfill do not include significant quantities of putrescible waste, the operator may request an alternate operating scenario for one or more specific gas collection well(s). Alternate operating scenarios may include alternative limits for temperature, positive pressure, and/or oxygen concentration or shutting off wells temporarily or permanently.

In order to demonstrate that the waste is substantially degraded and an alternative operating scenario is appropriate for a specific well, the operator must demonstrate that the gas generation rate within the area of influence of the particular gas collection well has diminished significantly. Only after a thorough evaluation and systematic trouble-shooting protocol has been followed, will an alternate operating scenario request be considered for specific gas collection well(s).

The evaluation is necessary because a decrease in gas collection could also be due to other factors that can be managed or corrected rather than a reduction in gas generation. It is more likely that a well (or other landfill gas extraction component such as a header) simply needs to be replaced or repaired, not decommissioned.

Requests for alternate operating scenarios should be submitted to air program staff. All alternate operating scenario requests should be jointly reviewed by AM and WMM staff. Approval letters may be drafted by either air or waste staff, but shall be signed by both. Listed below are items that need to be reviewed and/or witnessed before any well can be shut off (decommissioned) or any changes can be made to operational standards contained in air permits. It is anticipated that the vast majority of landfills in Wisconsin will not reach diminished generation rates warranting alternative approvals for decades.

#### Evaluation

1. Review of monitoring parameters, including temperature, well head pressure, header pressure, flow, valve setting, and the concentrations of methane, carbon dioxide, oxygen, and balance gas for the previous 24 months or more. For instance, reduced header pressure can be indicative of a sagging or otherwise blocked header (the header should be repaired instead of decommissioning a LFG well or assigning an alternate operating parameter at the LFG well).
2. Review of liquid levels in the wells for the past eight quarters or more. A liquid level in the well above the screen perforations can prevent landfill gas from entering the well. If liquid levels are covering more than 25 percent of the LFG well casing perforations, the landfill should consider installing a permanent or temporary leachate pump in the LFG well to see if LFG collection returns in this area.
3. Inspection of the well head for air intrusion, including sampling ports, leaky pneumatic leachate pump, well head boot seals, caps, hoses, etc.

4. Verification that air intrusion is not occurring from air being pulled through the landfill cap or well casing down into the well. This would involve visual observation of the landfill cap and well casing condition (including bentonite seal) and verification that the valve setting is not too great.
5. Verification of the physical condition of the well, including a review of the video from televising the well. The well may be sheared or collapsed due to differential settlement or the screen may be plugged. If the physical condition of the well is satisfactory, allowing the well to be temporarily shut off and to go under pressure to see if methane returns to this location may be granted by department staff prior to allowing permanent decommissioning of this LFG well.
6. Witness surface methane monitoring in the area.
7. Verification of the age and type of waste in the area of the well(s). Photographic or written records of the material that was removed during well drilling may indicate a substantial amount of construction/demolition material in the area. Boring samples can be taken if records do not exist.
8. Review the performance of surrounding gas collection wells, along with a review of boring log(s) or other documentation (including photographs, disposal/filling records, etc.) of the well for which an alternate operating scenario is being proposed and the surrounding wells for evidence of non-degradable wastes in the area of influence; and verification of the age of waste in the area of influence for the proposed well(s).

If the landfill owner/operator inspects and cannot find any physical problems with a gas well head experiencing high oxygen levels and none of the other well head parameter information noted above suggests air intrusion (i.e. through the soil cover, etc.), discuss the issues with each program's supervisor prior to approval of an alternate operating scenario for a particular well head.

## Notes

Balance gas means those gases other than methane, oxygen and carbon dioxide that are present in the gas stream. Balance gas is typically mostly nitrogen; however, depending on the types of waste disposed, it could be many other types of gases. Typically, a balance gas reading  $\geq 15$  percent is indicative of excessive air intrusion into a LFG well head. Staff can also require periodic analysis for nitrogen (requires lab testing by gas chromatograph) at the well head (however, this can be time consuming and expensive and should only be done in rare cases and with proper cause). The presence of nitrogen in the landfill gas is also evidence of air intrusion (some of which is acceptable and expected).

Landfill gas temperatures in excess of 55 degrees Celsius may be associated with disposal of special waste; insufficient vacuum being applied to a well head and surrounding area; allowing heat from decomposition to build up; or air intrusion (through the soil cover) which allows aerobic decomposition of waste to occur (aerobic decay usually occurs at higher temperatures than anaerobic). Areas with leachate recirculation may have elevated temperatures due to the additional liquids accelerating the decomposition processes.

Areas with final cover, particularly those with composite barrier layers, should be very resistant to air intrusion except in the case of a cut in the geomembrane or in areas of boots. Areas with intermediate or daily cover are more likely to allow air intrusion. Practices that could mitigate air intrusion include: reducing vacuum to a LFG collector; increasing thickness of cover soils; densifying and compacting cover soils; using finer grained soils for intermediate cover; and closing off or sealing vents, leachate cleanouts or other penetrations of the cover.

Insufficient vacuum may be the result of: too small of a blower for the LFG that is being generated; startup conditions where time is needed to pull-down the LFG bubble; short circuiting to the atmosphere by leaks at the well head or header risers through sampling ports or boot seals, too small of LFG headers or laterals; or by blockages in the associated gas header lines (e.g., subsidence of header lines has allowed condensate to accumulate and reduce overall vacuum to system, etc.).

An operator should distinguish between elevated temperatures due to decomposition of waste and those due to subsurface fires (sometimes referred to by industry as subsurface oxidation events). Operators should investigate any physical signs of fire such as release of smoke, flames, soot in the header pipes or burn odor (careful as burn odor may not be conclusive since many special wastes give off this odor but are not on fire), physical sensation of heat on ground surface, excessive settlement and excessive carbon monoxide (typically greater than 1,000 ppm unless some special wastes are involved that naturally release CO even though they are not under fire, such as foundry sand) in extracted landfill gas. Temperature probes can be drilled or pushed several feet into the waste to define hot zones. Fire should be determined if it is the cause of elevated gas temperatures because continued gas extraction might exacerbate a fire.

In some cases, the landfill owner/operator may not be able to determine any specific cause for elevated temperatures in the well head such as those described above. U.S. EPA has approved higher operating temperatures at landfills in Virginia and Ohio (see EPA Applicability Determination Index Web site under NSPS, Subpart WWW; letters dated 11/27/01 and 1/11/02) where the landfill owner or operator demonstrated all of the following: landfill gas had low oxygen content and methane > 45 percent, carbon monoxide levels below 100 ppm and no evidence of charred debris / soot observed in the gas collection system. Therefore, it may be appropriate to approve alternate operating scenarios for higher temperatures in specific well heads where no other underlying cause can be identified.

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## Appendix D

### Monitoring and Reporting Requirements Under the Bureau of Waste and Materials Management

#### For MSW Landfills

The department has authority under s. 289.30(6), Stats., to condition an approval to comply with standards for solid waste disposal. The department has authority under s. NR 507.22(2), Wis. Adm. Code, to require a landfill to conduct monitoring activities to determine the effectiveness of a gas extraction system required by s. NR 504.08, Wis. Adm. Code. In addition, s. 285.65(3), Stats. and s. NR 407.09(4)(a)1., Wis. Adm. Code, provides the department the authority to require additional monitoring, because these parameters are necessary to ensure that the gas collection system effectively captures landfill gas.

In an effort to standardize the monitoring requirements for municipal solid waste landfills designed with an active gas extraction system, the department recommends consideration of the following monitoring and reporting requirements. Results should be electronically reported to the WMM GEMS system on a semi-annual basis. This information would be accessible to both AM and WMM staff.

Monitoring Point	Frequency	Parameter
Well Head	Monthly	Well head pressure (inches of water)
		Gas temperature (°F)
		Flow rate (SCFM)
		Valve setting (% open)
		Methane concentration (% dissolved gases)
	Semi-annual	Oxygen concentration (% dissolved gases)
		Carbon dioxide concentration (% dissolved gases)
		Balance gas concentration (% dissolved gases)
		Liquid level (depth in well)
Blower /Compressor	Monthly	Pressure (inches of water)
		Gas temperature (°F)
		Flow rate (SCFM)
		Total gas volume collected in previous month (SCF)
		Methane concentration (% dissolved gases)
	Annual	Oxygen concentration (% dissolved gases)
		Carbon dioxide concentration (% dissolved gases)
		Balance gas concentration (% dissolved gases)
		Total sulfur concentration
		VOCs, in Gas (NL/L)
Flare	Continuous	Flame (heat sensing device, report all dates and times when flame is not present)

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**Appendix E**  
**Recommended Surface Emission Monitoring**  
**At**  
**Municipal Solid Waste Landfills**  
(updated July 2009)

The department has authority under s. NR 507.22(2), Wis. Adm. Code, to require a landfill owner or operator to conduct monitoring activities to determine the effectiveness of the gas extraction system. Surface emissions monitoring has proven to be a useful tool in determining if a landfill gas control system is adequately preventing methane and other landfill gases from escaping through the landfill cover. Therefore, the department recommends routine surface emission monitoring at all MSW landfills with a design capacity of greater than or equal to 500,000 cubic yards and designed with an active gas recovery system.

The NSPS and many air permits require quarterly surface emissions monitoring. Surface emissions monitoring should be scheduled when atmospheric conditions are adequate to obtain accurate measurements and should include serpentine monitoring, as well as monitoring of all penetrations, areas of distressed vegetation, cracks or seeps. For landfills that are not subject to the surface emissions monitoring requirements of the NSPS, the department recommends, at a minimum, annual surface emissions monitoring.

Landfill owners and operators have requested the department consider reducing the frequency of surface emissions monitoring for NSPS affected landfills from quarterly to one, two, or three times per year. The department feels that, on a case by case basis, it may be reasonable to reduce the frequency of serpentine path monitoring. However, the department believes that periodic monitoring of surface penetrations is warranted, as there is a higher potential for landfill gas to escape at these locations\*.

The department will need concurrence from U.S. EPA on any reduction of quarterly surface emissions monitoring at NSPS sites. Consequently, requests for reduced surface monitoring frequency should be made as a permit revision request for an alternate testing pattern under s. NR 440.75(4)(a)4. and (6)(c)1., Wis. Adm. Code. Information included with the revision request should include but not be limited to the following:

- identification of any areas deemed to be too steep (see Appendix F, item 5.) or otherwise dangerous to be included in serpentine surface testing;
- results of past department witnessed surface emissions monitoring justifying reduced monitoring frequency; and
- other information as appropriate.

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\* s. NR 440.75, Wis. Adm. Code, authorizes the department to require surface monitoring at penetrations. The landfill NSPS says that surface testing shall be conducted at 30 meter intervals and “where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation, and cracks or seeps in the cover.” Past inspections conducted in Wisconsin and at landfills within EPA Region 3 states have shown that penetrations are highly likely to have high methane concentrations. EPA Region 5 concurs the department may require surface emissions monitoring at penetrations because there is a history of penetrations having high methane concentrations.

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## Appendix F

### Air Inspector Guidance

#### Introduction

The purpose of this guidance is to help establish statewide consistency for the AM Program's inspection and compliance activities at landfills. It is not intended to cover all aspects of compliance activities or permit language interpretation at landfills. The development of this guidance was set in motion through discussions and presentations that occurred between landfill owners and operators, consultants and department solid waste and air management staff at the Air/Landfill Workshop held in Stevens Point on March 1, 2006. Future guidance issued jointly by the AM and WMM programs may supplement or modify aspects of this AM Program compliance guidance.

Although produced as an AM Program internal document to assist with the interpretation of existing air permits, this guidance is also being provided to both landfill personnel, consultants and other department regulatory staff, to improve communications and to foster an understanding of our respective roles in the management of air emissions from landfills.

When performing an inspection of a landfill, it is recommended that the air management inspector be accompanied by WMM staff with compliance responsibility for the landfill. At a minimum, air inspectors should give WMM compliance staff a head up of upcoming air compliance activity at a landfill facility. Besides promoting good communication and cooperation between the two department programs, combined inspections may provide staff an opportunity to better understand the other program's requirements, be more efficient with limited time and resources and better understand the complexity of the source.

#### 1. Definition of the terms deviation, exceedance, non-compliance, and violation

Background – There is concern that the terms “deviation,” “exceedance,” “non-compliance” and “violation” are being used interchangeably and incorrectly and need to be better defined. The landfill NSPS in s. NR 440.75, Wis. Adm. Code, makes references to the terms “exceedance” and “violation.” In the NSPS, the term deviation is not used and where the term exceedance is used it is associated with required follow-up action(s). In the case of surface emissions monitoring, for example, as long as specific actions are taken, an exceedance (even if it is reoccurring) is not necessarily a violation of the operational standards.

To achieve some consistency in dealing with landfills, the term “deviation,” “exceedance,” “non-compliance” and “violation” will be used in the following contexts:

- A **deviation** occurs any time an owner or operator cannot claim complete conformance with every term and condition of applicable permits and regulations.

- An **exceedance** occurs when an emission limit, monitoring parameter or other quantifiable term is exceeded. Exceedances are considered deviations.
- **Non-compliance** and **violation** are terms used to identify non-conformance with the conditions and requirements of permits and regulations, including all deviations and exceedances unless otherwise stated. For instance, some deviations are not considered violations if prescribed corrective action is taken within a time frame specified in a permit or regulation.

GUIDANCE - A landfill's air construction or operating permit contains conditions and requirements that must be met by the landfill during its construction and operation. A permit is a legally enforceable document and should be reviewed thoroughly by the landfill's owners and/or operators during its development and during the public comment period before it becomes final. Thorough review of a draft permit by both DNR compliance staff and the landfill owner prior to its issuance will help to ensure that conditions and requirements that become part of a permit are understandable and attainable. This will likely help to prevent certain violations from occurring in those cases where a landfill is not meeting or fulfilling a condition in its permit that the owner or operator was unaware of or didn't understand.

Whether a deviation or an exceedance is considered a violation is always determined by the department on a case-by-case basis, taking into account the magnitude, type and frequency of the deviation or exceedance.

## **2. Next business day reporting of deviations requirement**

Background – Section NR 439.03(4), Wis. Adm. Code, requires next business day reporting of certain exceedances and deviations. Some landfill operators may monitor at least a few wells every day. In the past the department has requested notifications be sent the next business day after a gas well exceeded an operational standard contained in the air permit. This situation could result in the department receiving notifications on a daily basis. The air permits require monthly monitoring of each well and subsequent re-monitoring if exceedances (a type of deviation) occur. These requirements assumed that the monitoring would be conducted over a one to two day period each month. In the past, the deviation report would be expected to be submitted the next business day after the completion of this monitoring. After a deviation is recorded, corrective action shall be initiated within five calendar days and corrected within 15 calendar days or the gas collection system shall be expanded.

GUIDANCE - NR 439.03(4) requires that any deviations from air operation permit requirements, or any malfunction or event that might cause an emission limit violation, be reported the next business day to the department. The reporting can be accomplished via a facsimile, an email or letter to the department. The department's position is that monitored gas collection system temperatures, pressures or oxygen concentrations that fall outside permitted ranges do not require next business day reporting unless and until they cannot be corrected within the permit specified 15 calendar day correction period. For surface

emissions monitoring, if any location where monitored methane concentration equals or exceeds 500 ppm methane above background three times within a quarterly period, the next business day reporting applies. Other next day reporting of other air permit requirements remain unaffected. All reports should be submitted to the AM Program compliance inspector responsible for the landfill. Attached are format examples for a Gas Extraction Monitoring Data Report (Attachment 1) and a Monthly Gas Well Deviation Report (Attachment 2) that may be useful in keeping required records.

### **3. Sufficient gas extraction rate and operational parameters**

Background – Landfill air permits usually contain a condition that states, “The gas collection system shall collect gas at a sufficient extraction rate.” Air permits require the monitoring of three operational parameters, temperature, pressure and oxygen or nitrogen concentration which have operational limits. It can often be difficult to determine if the system is well-tuned based on these parameters alone. That is why landfill operators monitor additional parameters and the department’s WMM Program often requires the reporting of this data. These additional parameters can include liquid depth, flow rate, methane concentration, carbon dioxide concentration and balance (100 minus the concentrations of methane, carbon dioxide and oxygen).

The landfill NSPS defines sufficient extraction rate as a rate sufficient to maintain negative pressure at a well head without causing air intrusion. It is important for landfill owner/operators to review more than just the three operational limits at individual well heads in order to determine if these extraction wells are operating as designed and the well field is well-tuned and operating properly. For instance, if a well is flooded with leachate or damaged below ground surface, temperature, oxygen concentration and pressure may be within the permitted limits. However, only a portion of landfill gas (if in fact there is landfill gas being generated within the zone of influence of the well) may be collected by the potentially damaged or impacted extraction well and gas flow from the well may be reduced significantly.

GUIDANCE – Review operational data to evaluate the manner in which a source adjusts, fine-tunes or repairs individual gas extraction wells and/or headers to balance and fine-tune the well field and maximize collection of landfill gas and fugitive emissions.

### **4. Gas collection system start-up and compliance date**

Background – Landfill air permits contain a condition, consistent with the landfill NSPS, that states, “The permittee is not required to expand the gas collection system as required in condition I.A.1.b.(12), (14), and (19) during the first 180 days after gas collection system start-up.” Several landfill owners and consultants believe that start-up should be considered the date of the air permit issuance for existing sources and that they should be entitled to 180 days after permit issuance to comply with the permit conditions. Section NR 400.02(152), Wis. Adm. Code, states, “Startup” means the setting in operation of a facility or its emission control equipment for any purpose which produces emissions.

**GUIDANCE** - The gas collection system start-up is the date of initial gas extraction from a particular well. The date of permit issuance does not affect the date of start-up. Gas collection is required from each area, cell or group of cells in the landfill in which the initial solid waste has been in place for five years or more if active, or two years or more if closed or at final grade. In some cases, landfill owners/operators may collect gas earlier in conjunction with solid waste approvals and this early gas extraction is encouraged by the department.

## **5. Surface methane monitoring – plan, side slope and execution**

**Background** – In order to convey the expectation that the entire landfill should be visually observed for indications of fugitive releases of landfill gas a minimum traverse pattern is described in the permits. Areas of the landfill that have been found to have fugitive releases include areas with distressed or non-existent vegetation and cracks in the cover and around penetrations such as gas wells, header risers, etc. Several landfill owners and consultants have indicated that some inspectors allow the monitoring to only occur on the traverse pattern and some inspectors also require the suspect areas to be monitored. Several landfill owners and consultants also wanted clarification of what constitutes “areas with steep slopes or other dangerous areas that may be excluded from the surface testing.”

**GUIDANCE** – It is recommended that all surface methane monitoring should be witnessed by department staff. The traverse pattern is to be considered a baseline and all ‘suspect’ areas described above are to be monitored. Active waste disposal (also known as the working face) and heavy traffic areas are considered dangerous and are not required to be monitored. The WMM Program approves landfill final slopes at 4 horizontal to 1 vertical or less. Therefore, slopes that are 4 to 1 or less steep are generally not considered dangerous. Slopes steeper than 4 to 1 or slopes in a condition that pose unacceptable risk may be exempted by department staff on a case-by-case basis taking actual surface conditions (e.g., snow and ice cover) into account.

## **6. Well decommissioning and alternate oxygen concentration levels**

**Background** – Oxygen readings greater than five percent occur primarily for two reasons: 1) either the landfill is not in phase 4 of the gas generation cycle (see accompanying diagram – Attachment 3); or 2) air is infiltrating the well. In order for the department to consider an alternate oxygen concentration or a request to decommission a well, the landfill owner must prove that the high oxygen readings are being caused by lack of methane generation and not by air infiltration. Air can infiltrate the well by a leak in a well head component such as a bad seal, loose fitting, cracked cap, worn tubing, etc. It can be pulled through cracks in the landfill cap. It can also enter the well through a leak in the pneumatic pump air line. Additionally, for facilities with Title V permits needing to meet the control requirements of the landfill NSPS, any alternative operating parameters must be submitted to regional DNR Air Management compliance staff for approval.

**GUIDANCE** – It is recommended that any requests to decommission gas extraction wells be discussed during the monthly air compliance and enforcement team meetings after a thorough evaluation of infiltration is conducted in conjunction with solid waste staff. Wells cannot be decommissioned without both air and solid waste approval.

As stated above, a landfill is allowed under the NSPS rule to apply to regional DNR Air Management compliance staff for an alternative timeline to correct any O<sub>2</sub>, pressure or temperature exceedance (s. NR 440.75(6)(a)4. & 6., Wis. Adm. Code.). In addition, landfills are allowed to establish a higher oxygen value at a particular well (s. NR 440.75(4)(a)3., Wis. Adm. Code). Requests for extended timelines or higher O<sub>2</sub>, pressure drop, or temperature values at particular wells should be made to regional DNR Air Management compliance staff

## **7. Leachate collection and flooded wells**

**Background** – Wells (and gas headers) flooded with leachate have been found to be one of the biggest problems preventing sufficient gas collection at Wisconsin landfills. The landfill permits contain a condition that states, “The permittee shall ensure that the applicable specifications of the landfill gas collection system in 40 CFR 60.759 (or s. NR 440.75(10), Wis. Adm. Code) are met.” Section NR 440.75(10), Wis. Adm. Code, and 40 CFR s. 60.759 indicate that leachate and condensate management are to be addressed in the design. The WMM Program often requires routine monitoring of liquid depth in vertical gas extraction wells in addition to routine monitoring of leachate head levels over the landfill liner system.

**GUIDANCE** – The effectiveness of gas collection systems at many landfills (design and operation- specific), can often depend on the proper management of leachate (and condensate), especially within vertical gas extraction wells and within gas headers. Liquid depth data, leachate head levels, and volume of condensate collected (if collected separately and reported through a WMM Program approval) should be reviewed as part of the air inspection. Header vacuum surveys can work to identify sagging headers which may be partially or fully blocked with condensate.

## **8. Well spacing and confirmed surface methane emissions exceedance actions**

**Background** – The WMM Program has explicit code requirements for the minimum spacing of vertical gas extraction wells, in addition to the sizing of blowers and other aspects of the gas moving infrastructure. These gas extraction system designs are approved in the landfill owner/operator’s WMM Program plan of operation approval document. Surface methane emissions exceedances can be due to many factors including cracks or irregularities in the final cover systems, permeable cover materials, problems with seals around final cover penetrations and other general scenarios where gas collectors are unable to capture gas within their design radius of influence.

**GUIDANCE** – .. Surface methane exceedances may require one or more of the following corrective actions: installation of additional LFG collectors; repair of seals around vertical penetrations; repair of cracks or areas of differential settlement; placement of less permeable

cover materials and/or repair of ripped geomembrane, if applicable; or operational adjustments (applying more vacuum) and/or repairs to the existing collection system. The WMM Program can work together with air compliance staff and landfill owner/operators to help determine whether the installation of additional or replacement landfill gas collection devices are warranted.

## **9. Determination of sulfur dioxide emissions**

Background - Many landfills accept construction and demolition debris, paper mill sludge and certain boiler ashes (especially fluidized bed). These materials may contain significant sources of sulfur. It is converted to reduced sulfur compounds in the landfill gas. When placed in an anaerobic environment these materials can produce hydrogen sulfide gas. When hydrogen sulfide gas is collected and controlled it can produce sulfur dioxide.

Sulfur dioxide emissions from sites controlling landfill gas may be under reported by the EPA AP-42 default value (46.9 ppmv as S for all TRS compounds). Recent tests for sulfur dioxide precursors at the WM-Ridgeview landfill show concentrations of 310 ppm, 1,200 ppm and 1,400 ppm in the collection headers (2005). The precursors resulted in 99 tons of sulfur dioxide in 2005, emitted from engines and flares. The landfill has needed to raise engine stacks to meet the SO<sub>2</sub> increment in a new source review, based on these emission rates.

Other landfills also generate higher concentrations of TRS compounds than predicted. The Brown County East and West landfills have measured 345 and 23.6 ppmv hydrogen sulfide, respectively. Outagamie County East and West landfills measured 240 and 699 ppmv total sulfur compounds, respectively.

The department and SWANA have agreed to work together to establish more representative emissions factors than those in AP-42.

GUIDANCE – Utilize the best available data (site specific gas chemistry, if available, for all LFG compounds, including sulfur, are preferred over EPA defaults) to determine sulfur dioxide emissions. The results of the evaluation conducted with SWANA will be shared with staff and additional guidance will follow.

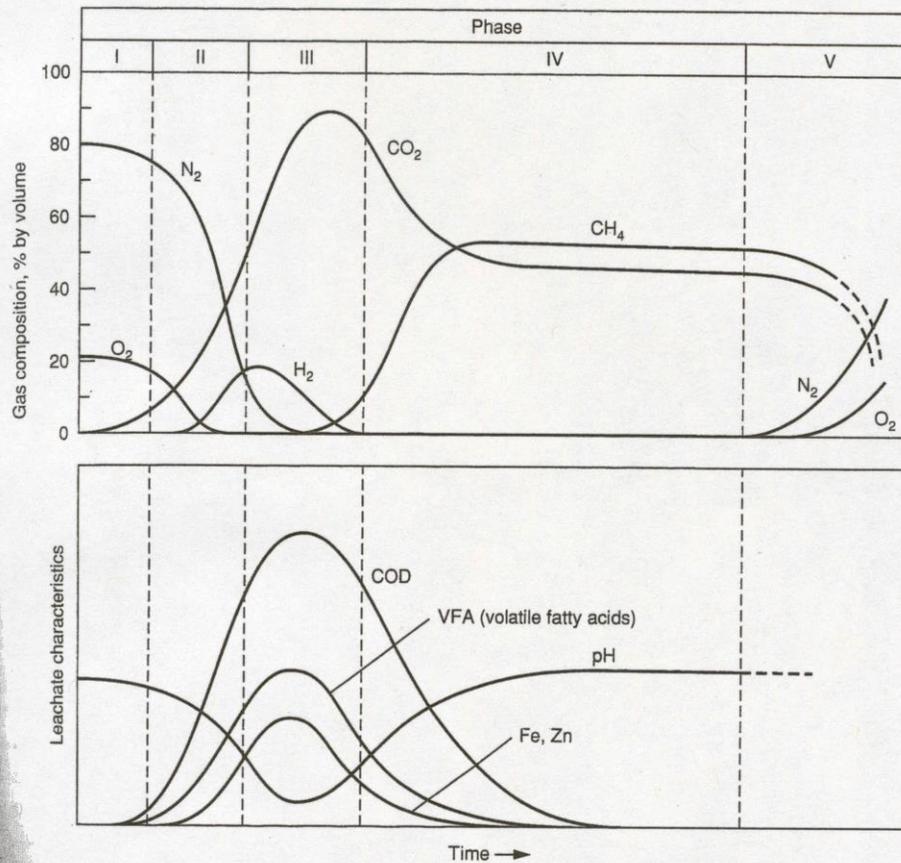
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### Attachment 3: Composition and Characteristics, Generation, Movement and Control of Landfill Gases



**FIGURE 11-11**  
 Generalized phases in the generation of landfill gases (I = initial adjustment, II = transition phase, III = acid phase, IV = methane fermentation, and V = maturation phase). (Adapted from Refs. 13, 34, 37, and 38.)

## Appendix G

### Air/Waste Landfill Gas Workgroup Members

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