Kansas Department of Health and Environment
Bureau of Waste Management
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Preparation of Postclosure Care Reduction and/or Termination Plans

Technical Guidance Document SW-2014-G1

This document provides recommendations for developing a plan that will be used to determine when certain postclosure care activities at municipal solid waste landfills may be reduced and/or terminated.

Background

The owner or operator of any municipal solid waste landfill (MSWLF) is responsible for long-term care of the site for at least 30 years after the facility closes. The Kansas Department Health and Environment (KDHE) may extend the postclosure care (PCC) period beyond 30 years if necessary to protect public health and safety or the environment. Bureau of Waste Management (BWM) Policy 2014-P2 provides for the possibility of reducing and/or terminating some PCC activities before the end of the standard 30-year PCC period. The policy also states the criteria that must be met to reduce or terminate particular PCC activities, whether before or after the end of the 30-year PCC period. For MSWLFs that are subject to full Subtitle D regulation, reduction and/or termination of PCC activities will be based on a PCC Reduction and/or Termination Plan that has been prepared by the facility and approved by KDHE.

Goal

The goal of the PCC Reduction/Termination Plan is to describe the methodology that will be used to:

- Predict a time when certain PCC activities may be terminated (before, at, or after 30 years); and
- Demonstrate that a particular PCC activity may be reduced or terminated without risk to public health or safety or the environment.

Stabilization of the Municipal Solid Waste (MSW)

Leachate and gas emissions emanating from a MSWLF will decrease at a rate dependent on the design, construction, and operation of the landfill units. Equilibrium is defined as a condition where quantity/flow rate and composition of emissions (or the mass flow rate) from the stored MSW are relatively constant. The MSW is considered stable (or inert) when the MSW does not change with changing environmental factors such as the addition of moisture or changes in temperature.

Two extremes of landfill design and operation are the dry tomb approach and the moisture-enhanced operation. The dry tomb approach is a landfill operation where addition of moisture to the waste is minimized by: restrictions on disposal of liquids; run-on control systems; prevention of groundwater intrusion; and an impervious final cover. Reactions in a dry tomb landfill should be minimal since moisture is the limiting reactant. This type of landfill will likely reach equilibrium faster than a moisture-enhanced landfill, but the MSW will not be as thoroughly stabilized, and leachate and landfill gas emissions could increase if the landfill cap is compromised after closure.

In moisture-enhanced landfills, moisture is added to the MSW before and/or after closure in order to promote stabilization of the MSW to a more inert mass. (Moisture-enhanced landfills do not include higher moisture level bioreactor operations.) Reactions in a moisture-enhanced landfill do not end with initial closure since previously added moisture allows reactions to occur after closure and a pervious cover will allow reactions to continue until the MSW is stabilized. A moisture-enhanced landfill will

take longer to reach emission equilibrium than a dry tomb landfill because of the time that must be allowed for the MSW, microbes, and liquids to fully react. The end result however, is a more stable landfill, which is less likely to create future problems that could affect public health and safety or the environment.

Stabilization Indicators and Trend Analysis

Trend analysis may be used to determine when equilibrium has been reached. This procedure involves the measurement and statistical analysis of leachate and landfill gas (LFG) emission values, which indicate the physical, chemical and biological transformations occurring within the landfill units.

Trend analysis of key leachate and LFG parameters can be used to define the degree of MSW stabilization. These parameters are not measurements of the MSW itself but are the by-products of the reactions between the MSW, microbes, and available moisture.

KDHE suggests collecting supplemental data, as described in this document, at a frequency which can confirm expected trends and explain variations of the key emission parameters so that actual trends can be determined. For example, compaction of the MSW as it degrades can be monitored by measuring the settlement or subsidence of the landfill.

PCC Reduction and/or Termination Plan

General Requirements

The PCC Reduction and/or Termination Plan should:

- Be integrated into the Closure and Postclosure Plan for the facility;
- Include the monitoring requirements for the characterization of the composition and quantity/flow rate of leachate and landfill gas emissions for units of the landfill or for the entire landfill. The measurements must be able to define the trends in these data for a period sufficient to relate the emission values to the input, output, and accumulation values of the MSWLF;
- Provide for the confirmation of equilibrium for 15 years prior to the projected PCC activity termination date. Confirmation assumes that the trend values can be validated by non-parametric statistical analysis;
- Ensure that landfill emissions after reduction or termination of any PCC activity do not endanger public health and safety or the environment and are not detrimental to the proposed use of the closed landfill site.
- The landfill owner or operator (O/O) may propose alternatives to the recommendations provided in this technical guidance document (TGD) and supporting TGDs.

Trend Analysis

The proposed trend methodology to determine when one or more PCC activities may be reduced and/or terminated will involve a minimum of 3 major evaluation periods of at least 5 years each where each period is statistically verifiable. The determination of equilibrium for leachate and landfill gas emissions can be accomplished by quarterly sampling over a 5-year demonstration period, during which there is no statistically significant difference in key parameter values with time. If there is a statistically significant difference in any of the key parameters, a new 5-year demonstration period must begin. After 1 demonstration period in which key parameters are shown to be in equilibrium, reduction of appropriate activities may begin, after approval by KDHE. After 3 consecutive demonstration periods in which key parameters are shown to be in equilibrium, appropriate activities may be terminated, after approval by KDHE.

Reporting

Throughout the PCC period, the O/O must provide an annual report to BWM that summarizes and interprets the data that has been collected and analyzed in accordance with the approved PCC plan. Any deviation from the approved PCC plan should also be reported. In some cases, modification of the PCC plan may be required.

Plan Contents

The PCC Reduction and/or Termination Plan should describe the following:

- The criteria that will be used to determine when a particular post-closure care activity can be reduced or terminated
- Key monitoring parameters that will be used to determine the degree of equilibrium and/or the stability of the waste.
- Supplemental monitoring parameters that will be used to interpret and validate trends in the key parameters
- Sampling points and sampling frequencies
- Equipment that will be used to collect the samples
- Methods that will be used to analyze the data and provide quality assurance and quality control
- Statistical methods that will be used to evaluate the data

Leachate Monitoring

The PCC Reduction and/or Termination Plan should define the leveling out of leachate composition and quantity/flow rate (which together define the mass flow rate of a contaminant) that can signal the reduction and/or termination of PCC activities. Key leachate parameters for demonstrating the degree of MSW equilibrium and/or stability include:

- Quantity
- Temperature
- Five-day biochemical oxygen demand (BOD_5)
- Chemical oxygen demand (COD)
- Ammonia (NH_3)
- pH
- Total suspended solids (TSS)

The BOD_5/COD ratio represents the fraction of organic matter in the leachate which is biodegradable compared to the total organic content and is a reflection of the MSW stabilization process. The higher the ratio, the more organic matter is left to degrade. A decreasing ratio indicates increased stabilization of the MSW.

KAR 28-29-104(i)(6) requires annual leachate sampling and sampling prior to treatment or pretreatment. Sampling for these purposes typically measures leachate composition from combined landfill units prior to the leachate leaving the MSWLF site, but it does not necessarily represent the actual character of the leachate produced by an individual disposal unit. Samples that accurately represent the individual disposal unit are the best indicators of MSWLF unit equilibrium and/or stabilization.

Refer to Technical Guidance Document (TGD) SW-2013-G3 for information on leachate sampling for the purpose of demonstrating the degree of MSW equilibrium and/or stability.

Landfill Gas Collection and Control System (GCCS) Monitoring

The O/O of any landfill that has a GCCS may use data collected from the system to demonstrate the degree of MSW equilibrium and/or stability. The PCC Reduction and/or Termination Plan should define the leveling out of LFG composition and flow rates which can signal the reduction and/or termination of PCC activities, either on their own or in combination with an evaluation of leachate emissions. Key LFG parameters for demonstrating the degree of MSW equilibrium and/or stability include:

- Flow rate
- Methane (CH_4)
- Non-methane organic compounds (NMOC)
- Carbon dioxide (CO_2)
- Oxygen (O_2)

The CH_4/CO_2 ratio represents the relative activity of methane formers to overall biological activity. The ratio will vary in a predictable way throughout the stabilization process.

The gas sampling component of the plan should be coordinated with Clean Air Act monitoring requirements, as administered by the KDHE Bureau of Air.

Ideally, the LFG sampling frequency should match the leachate sampling effort since both leachate and landfill gas are typically the result of the same reactions within the MSW mass. The coordination of the two sampling efforts will allow comparison of the sampling results and provide a better confirmation of the trend analysis. Samples that accurately represent the individual disposal unit are the best indicator of MSWLF unit equilibrium and/or stabilization.

Refer to TGD SW-2014-G2 for information on GCCS sampling for the purpose of demonstrating the degree of MSW equilibrium and/or stability.

Groundwater Monitoring – See KAR 28-29-111 through 28-29-113.

Collection of Supplemental Data

In addition to the key monitoring parameters described in this document, KDHE suggests collecting the following supplemental data which can be used to interpret and confirm trends related to MSW equilibrium and/or stability, and to facilitate the establishment of a PCC Reduction and/or Termination Plan.

1) LANDFILL INPUTS, including:
   a) MSW disposal data, including:
      i) Quantity (tonnage)
      ii) Composition
      iii) Disposal sequence
      iv) Disposal locations
   b) Added moisture data, including, as available:
      i) Quantity
      ii) Composition
      iii) Temperature

      Examples of added moisture sources include: active area precipitation and storm water run-on; infiltration through intermediate and final cover; research, development, and demonstration (RD&D) liquids; and recirculated leachate and/or storm water

2) LANDFILL OUTPUTS including:
   a) Toe drain, cleanout, and LFG condensate data including:
      i) Quantity
      ii) Composition
      iii) Temperature
   b) Leachate seep and fugitive LFG emission data including:
      i) Flow rate estimates
      ii) Composition
      iii) Locations

3) STATE OF THE WASTE, including:
   a) Temperature of the MSW
   b) Topographic changes in the surface of the landfill

4) CLIMATIC DATA including:
   a) Wind velocity
   b) Temperature
   c) Atmospheric pressure

Additional documents concerning PCC reduction and/or termination are available on the PCC Policies and Guidance web page at: www.kdheks.gov/waste

For additional information regarding the proper management of solid or hazardous waste in Kansas, you may visit the Bureau of Waste Management website at http://www.kdheks.gov/waste/ or contact the Bureau at: (785) 296-1600, bwm_web@kdheks.gov, or the address at the top of this document.