Addendum to

"Preparing for Termination of Post-Closure Activities at Landfills Closed Under Chapter 173-304 WAC"

Prepared August 2012, Revised January 2013

Landfill Owners, Operators and Jurisdictional Health Authorities:

In February 2011, the Department of Ecology (Ecology) published "Preparing for Termination of Post-Closure Activities at Landfills Closed Under Chapter 173-304 WAC" (Publication No. 11-07-006). That document provides Ecology's recommendations on information a landfill owner or operator could submit to make a case for ending post-closure care. This document provides more detail on the technical information expectations.

As required by WAC 173-304-407(8)(b and c), to end post-closure care, an owner/operator and professional engineer need to demonstrate that a landfill is stable by showing there is little or no settlement, gas production or leachate generation. This document attempts to answer the questions:

1. How should a facility measure settlement to show there is "little or no" settlement?
2. How should a facility monitor landfill gas to show there is "little or no" gas production?
3. How should a facility measure leachate to show there is "little or no" leachate generation?

Settlement

Ideally, an owner/operator will have surveyed a landfill's cap a few times through the post-closure period in order to show settlement has minimized. If such data does not exist, Ecology recommends an owner/operator conduct at least two benchmark surveys at least two years apart. When surveying, an owner/operator should:

- Use survey points from fixed points on the closure cap. An owner/operator should use permanent markers, such as a rod of rebar, to denote survey points – taking care not to punch holes through anti-infiltration layers or geomembranes.
- Measure one point for every 20,000 square feet and additional points to cover anomalies such as dead vegetation or depressions.
- Use equipment that is precise to within ½ inch.

A landfill is experiencing little or no settlement if:

- It has a uniform slope between 2% and 33% and generally maintains design slopes.
- Site inspections show no evidence of differential settlement.
- The settlement trend curve approaches a zero slope.
- Uniform settlement is less than ½ inch over a two-year period.

An owner/operator should submit information on:

- ✓ Type of survey.
- ✓ Images showing the location and number of survey points.
- ✓ Survey point markers used.
- ✓ Measuring equipment used, including its precision and accuracy.
- ✓ Dates and results of surveys.
- ✓ Trend curves.
- ✓ An explanation by the owner/operator and a professional engineer licensed in the state of Washington of how data shows the landfill is experiencing little or no settlement as described above.

Landfill Gas

Ecology recommends an owner/operator measure landfill gas at a frequency approved in the post-closure plan at vents within the landfill, perimeter monitoring probes, vaults and enclosed spaces, and at landfill surfaces where plants are stressed or absent. When measuring gas, an owner/operator should:

- Use equipment that can measure to 0.1% methane.
- Calibrate and warm up equipment according to manufacturer instructions prior to each monitoring event.
- Close holes or cracks in vent pipes to prevent air intrusion and place probe far enough into vent pipes to avoid ambient air dilution (three or more feet of probe length should be fine).
- Monitor for a long enough time to remove air from equipment and get a stable reading, sometimes described in manufacturer instructions.
- Measure concentrations during periods of steady or falling barometric pressure to ensure gas is exiting the landfill.

A landfill is experiencing little or no gas production if:

- Gas concentrations at all monitoring points are below regulatory limits for the last eight consecutive sampling events, including:
  - On-site structures: 25% LEL (for methane, 25% LEL is 1.25% by volume)
  - Off-site structures, if applicable: 100 ppm methane
  - Property boundary: 100% LEL (for methane, 100% LEL is 5% by volume)
- Gas concentrations in vent pipes during periods of steady or falling barometric pressure are below 25% LEL for methane for the last eight consecutive sampling events
- Analysis of data shows statistically significant steady or declining trends in concentration.
- There are no ongoing requirements from the air permit authority beyond solid waste requirements.

There are situations where gas production is over 25% LEL at gas vent pipes, but a landfill otherwise appears to be stable. WAC 173-304 allows variances from rule requirements when "solid waste handling practices or location do not endanger public health, safety or the environment" and when compliance "would produce hardship without equal or greater benefit to the public." A variance from showing a facility meets the standard of little or no gas production may be appropriate. In such circumstances, Ecology recommends that the owner/operator place access controls and use restrictions on the property through an environmental covenant and submit proposed language in a variance request. WAC 173-304 places no restrictions on use of the property once a jurisdictional health department approves the ending of post-closure care so it is appropriate to prevent human contact if there is ongoing production of landfill gas.

An owner/operator should submit information on:

- ✓ Monitoring procedures, including equipment used and its precision, calibration procedure and frequency, equipment warm-up, placement of probe at each type of monitoring location and duration of measurements.
- ✓ Dates, times and the percent of explosive gases (i.e. methane) measured at each location.
- ✓ Barometric pressure with trend (rising, steady or falling) at the time of measurement. Go to weatherspark.com, or others, for this information. Specify source of pressure data.
- ✓ Statistically significant trend data.
- ✓ An explanation by the owner/operator and a professional engineer licensed in the state of Washington of how data shows the landfill is experiencing little or no gas production as described above.

Leachate Generation

Ecology recommends an owner/operator measure and complete statistical analyses on leachate or groundwater samples as described in approved sampling and analysis, quality assurance or post-closure plans. An owner/operator may show that a landfill is producing little or no leachate in many ways, depending on whether they collect leachate, discharge leachate, monitor lysimeters or monitor groundwater.

A landfill is experiencing little or no leachate production if:

- For landfills with leachate lagoons, volumes of liquids have reduced over time (at least two years of regular volume measurements) or accumulated liquids are primarily the result of precipitation falling on lagoons. Landfills that produce a slightly higher volume than would be expected from precipitation alone, but that evaporate naturally (no control equipment), may also be considered to be producing little leachate.
- For landfills linked with a discharge permit, the discharge permit authority no longer requires a discharge permit.
- For landfills with lysimeters, there have been no measurable amounts of liquid accumulation over the last two years of regular monitoring.
- For landfills with groundwater monitoring, there have been no recent or ongoing exceedances of Chapter 173-200 WAC criteria for parameters specified in approved post-closure plans from at least semi-annual groundwater monitoring. In addition, through statistical analyses, trend slopes have been zero or less over a statistically significant period (generally the latest eight consecutive sampling events) and groundwater data does not show other signs of potential negative landfill impacts. Generally, Ecology will not support ending post-closure care for any landfill with existing groundwater contamination. (Information regarding methods of analyses is available in "*Guidance for Groundwater Monitoring at Landfills and Other Facilities Regulated under Chapters 173-304, 173-306, 173-350 and 173-351 WAC*" available at https://fortress.wa.gov/ecy/publications/publications/1207072.pdf.)

An owner/operator should submit information on:

- ✓ Monitoring procedures, including equipment and measuring tools used.
- ✓ Dates and results of monitoring events.
- ✓ For landfills linked with discharge permits, information from the discharge permit authority that shows a discharge permit is no longer required.
- ✓ For groundwater monitoring, comparisons with Chapter 173-200 WAC criteria, statistical trend analyses, comparisons of upgradient and downgradient water quality data, and a discussion of any potential groundwater contamination.
- ✓ An explanation by the owner/operator and a professional engineer licensed in the state of Washington of how data shows the landfill is experiencing little or no leachate production as described above.

If you have questions about the above recommendations, please call your regional Ecology Waste 2 Resources Program staff. They would be happy to answer any questions or work with you on alternative ways to show stability if the above information is difficult or impossible to obtain.