

Kansas Department of Health and Environment
Division of Environment

REGULATORY IMPACT STATEMENT

Pursuant to K.S.A. 77-416

Proposed Amended Regulation:

K.A.R. 28-29-300

Proposed New Regulations:

K.A.R. 28-29-330

K.A.R. 28-29-331

K.A.R. 28-29-332

K.A.R. 28-29-333

K.A.R. 28-29-334

K.A.R. 28-29-335

K.A.R. 28-29-336

March 6, 2012

Executive Summary of Proposed Amended and New Regulations

Construction and demolition (C&D) landfills that are not designed and managed to prevent waste from becoming saturated with water can emit hazardous and explosive gases, endangering the health and safety of persons working at or living near the landfill. Performing corrective action activities at a site where major gas generation occurs could exceed \$1,000,000.

These proposed new regulations will apply to the subset of C&D landfills in Kansas that are most likely to produce hazardous and explosive gases such as hydrogen sulfide and methane. Most of these are located either in flood plains or quarries. Some operational and monitoring requirements will apply to existing units at these landfills. Additional design and operational requirements will apply to new units at these landfills, i.e. units for which the design plan is submitted to the Kansas Department of Health and Environment (KDHE) on or after July 1, 2013. These requirements will reduce the risk of the public being exposed to dangerous landfill gases.

K.A.R. 28-29-300. Definitions. This proposed amended regulation contains definitions of terms used in the regulations concerning C&D landfills. This regulation has been amended to expand the applicability of the definitions to include the proposed new regulations concerning the control of hazardous and explosive gases at C&D landfills. New definitions for “habitable structure” and “used and unused disposal capacity” have been added. Other non-substantive changes have been made to improve the clarity of the regulation and to correct obsolete references.

28-29-330. Control of hazardous and explosive gases at C&D landfills; applicability of additional requirements. This proposed new regulation defines which landfills will be subject to the additional operational and/or design and/or monitoring standards of K.A.R. 28-29-332 through 28-29-335. The only regulation that will apply to all C&D landfills in Kansas is K.A.R. 28-29-336, concerning what must be done if potentially dangerous levels of a gas are detected at a landfill.

No operational, design, or monitoring standards beyond those required for all C&D landfills will apply unless the landfill meets all of the following criteria:

1. The landfill is located in a county that receives, on average, more than 25 inches of precipitation per year; this will include all counties in the vertical grouping from Jewell on the north to Harper on the south, and all counties east of this line. The same precipitation criterion was used for this determination as was used to determine which counties qualify for the small arid landfill exemption of K.A.R. 28-29-103.
2. The landfill has the long-term potential to hold 100,000 or more cubic yards of waste, since more waste can generate more gas.
3. The landfill has one of the following characteristics, which increases the degree of saturation.
 - a. The landfill is located in a 100-year flood plain, or
 - b. Groundwater is less than five feet below the bottom of the landfill, or
 - c. Water cannot naturally drain out of the landfill due to the low permeability of the underlying soil or rock.

Landfills that meet all three criteria (numbers 1-3 above) must apply cover on active units once a week to reduce infiltration of precipitation.

After a grace period, new units that are built at landfills that have all three characteristics must meet additional design criteria and must pump contact water out of the landfill.

Landfills that have all three characteristics and have 50,000 or more tons of waste in place must install a gas monitoring system and conduct semi-annual gas monitoring.

Each landfill that is required to conduct water management or gas monitoring after the landfill closes must obtain financial assurance.

28-29-331. Control of hazardous and explosive gases at C&D landfills; documentation of conditions used to determine applicability. Owners and operators of C&D landfills in the eastern half of the state must submit documentation to KDHE that shows whether or not their landfill meets the other applicability criteria defined in K.A.R. 28-29-330. This proposed new regulation describes when this documentation must be submitted, and establishes a process for submission.

28-29-332. Control of hazardous and explosive gases at C&D landfills; additional design requirements. This proposed new regulation contains design standards, including the installation of a drainage layer and pumps, which must be met for new units built at landfills that meet the applicability criteria. These design standards will help reduce the amount of water standing in the landfill.

28-29-333. Control of hazardous and explosive gases at C&D landfills; additional operating requirements. This proposed new regulation requires that cover be applied at least once every week that waste is disposed at all landfills that meet the applicability criteria. This will reduce the amount of precipitation that enters the landfill.

This regulation also contains pumping and sampling requirements for new units in landfills that meet the applicability criteria. The pumping will help reduce the amount of water in the landfill and the sampling results will be used to determine how the contact water should be managed after it has been pumped out of the landfill.

28-29-334. Control of hazardous and explosive gases at C&D landfills; monitoring system design and design plan. This proposed new regulation describes the minimum standards for the placement and design of gas monitoring probes at those landfills that are required to install a gas monitoring system. Probes will be placed along the facility boundary. The regulation also describes what information must be included in the system design plan.

28-29-335. Control of hazardous and explosive gases at C&D landfills; monitoring and monitoring plan. This proposed new regulation describes the minimum standards for gas sampling and reporting for those landfills that are required to conduct gas monitoring. Samples will be taken every 6 months. The regulation also describes what information must be included in the gas monitoring operations plan.

28-29-336. Control of hazardous and explosive gases at C&D landfills; response, assessment monitoring, and corrective action. This proposed new regulation describes the steps that must be taken if landfill gas is detected above the specified action levels. This regulation will apply to all C&D landfills in Kansas, whether or not any other of these proposed gas control standards apply. Although gas is most likely to be produced in the landfills that will be required to install monitoring systems, it is possible that gas could become a problem at a landfill that does not have a monitoring system installed.

If landfill gas is detected above action levels, the owner or operator must assess the danger, take the steps necessary to protect human health and safety, and notify the local government. The owner or operator must then take samples on a daily basis to determine if the gas concentration level is persistent and if corrective action is required.

Environmental Benefit Statement

1) Need for proposed amendments and environmental benefit likely to accrue.

a. Need. Construction and demolition (C&D) landfills that are not designed and managed to prevent waste from becoming saturated with water can emit hazardous and explosive gases, endangering the health and safety of persons working at or living near the landfill.

b. Environmental benefit. C&D landfills that are constructed in accordance with these regulations will minimize the potential for waste saturation and the associated breakdown of organic materials that create toxic and/or explosive landfill gases that could affect the health and safety of the public.

2) When applicable, a summary of the research or data indicating the level of risk to the public health or the environment being removed or controlled by the proposed regulations or amendments. Landfill gases can migrate away from the landfill either through the air or through the ground. The two most dangerous gases produced by C&D landfills are hydrogen sulfide and methane.

Hydrogen sulfide (H₂S) is a colorless, toxic, and flammable/explosive gas that produces a rotten egg odor. It often results from the breakdown of matter that contains sulfur in the absence of oxygen, for example when gypsum (drywall/sheetrock/wallboard) is submerged in water. A water-saturated C&D landfill in Kansas has produced hydrogen sulfide gas at levels of up to 120 parts-per-million (ppm), with an average of 54 ppm. Levels up to 86,000 ppm have been measured in a Minnesota C&D landfill.* Hydrogen sulfide is heavier than air and can remain low to the ground once it reaches the surface of the landfill. The gas can travel laterally away from the landfill and onto neighboring properties. Hydrogen sulfide gas remains in the atmosphere for an average of 18 hours.

Methane (CH₄) is an odorless, colorless, flammable/explosive gas. Landfill methane is produced when organic materials (such as wood, cardboard, and vegetation) are decomposed by bacteria in the absence of oxygen. Methane has been detected at levels of 36% in a C&D landfill in Kansas. Levels up to 60% have been measured in a Minnesota C&D landfill.*

* Minnesota data from Ian Vagle, Veit USA, PowerPoint presentation.

3) If specific contaminants are to be controlled by the proposed regulation or amendment, a description indicating the level at which the contaminants are considered harmful according to current available research.

Hydrogen sulfide (H₂S)

Symptoms of exposure to H₂S in the air include eye and respiratory irritation, dizziness, headaches, fatigue, insomnia, gastrointestinal disturbance, and at high concentrations may result in loss of consciousness, coma, and death. Exposure to H₂S may result in lasting negative effects on attention span, memory, and motor function. The following table summarizes the risks associated with different concentrations of H₂S and exposure times.

Risk Based on Level of Exposure to H₂S

| Concentration (ppm) | Risk & Exposure Limits | Source |
|----------------------------|---|---------------|
| 0.0005 - 0.3 | Odor detection threshold | ATSDR |
| 0.0014 | Daily exposure likely to be without risk (RfC) | EPA |
| 0.02 | 15-364 days of exposure with minimal risk (MRL) | ATSDR |
| 0.07 | 14 days or less of exposure with minimal risk (MRL) | ATSDR |
| 10 | 10-minute exposure limit | NIOSH |
| 20 | Ceiling limit | OSHA |
| 50 | Peak 10-min exposure limit | OSHA |
| 100 | Immediately dangerous to life or health (IDLH) | NIOSH |
| 40,000 – 440,000 | Explosive (lower and upper limits) | NIOSH |

ATSDR: Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services

EPA: U.S. Environmental Protection Agency

RfC: Inhalation Reference Concentration – an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious, noncancer effects during a lifetime.

MRL: Minimal Risk Level – an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncarcinogenic) over a specified duration of exposure.

NIOSH: National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention

OSHA: Occupational Safety and Health Administration, U.S. Department of Labor

Methane (CH₄)

Methane gas is highly explosive when it is present in the air at levels of 5% to 15% by volume. In order for an explosion to occur, there must also be oxygen in the air and an ignition source. Methane usually will not cause an explosion within the landfill itself, because the concentration is over 15% and there is no oxygen. If methane escapes the landfill into the open air, it will usually be diluted to levels below 5%. The greatest danger of explosion occurs when methane migrates away from the landfill through soil or utility trenches and collects in buildings.

Economic Impact Statement

1) Are the proposed regulations or amendments mandated by federal law as a requirement for participating in or implementing a federally subsidized or assisted program? No

2) Do the proposed regulations or amendments exceed the requirements of applicable federal law? No, there are no Federal regulations addressing hazardous and explosive gases at C&D landfills.

3) Description of costs to agencies, to the general public and to persons who are affected by, or are subject to, the regulations:

a. Capital and annual costs of compliance with the proposed regulations or amendments and the persons who will bear those costs.

K.A.R. 28-29-300. Definitions. There are no capital or annual costs to associated with this regulation.

28-29-330. Control of hazardous and explosive gases at C&D landfills; applicability of additional requirements. This proposed new regulation defines which landfills will be subject to the additional operational and/or design and/or monitoring standards of K.A.R. 28-29-332 through 28-29-335. Costs which will be incurred as a result of the requirements will be described under the regulations that set forth the specifics of the requirements.

28-29-331. Control of hazardous and explosive gases at C&D landfills; documentation of conditions used to determine applicability. Owners and operators of C&D landfills in the eastern half of the state must submit documentation to KDHE that shows whether or not their landfill meets the other applicability criteria defined in K.A.R. 28-29-330.

KDHE estimates that 70-75 landfills will have to submit facility capacity data to the department. This information can be obtained at little or no expense.

Approximately 60 landfills will have to submit the following data to the department. Many landfills already have some or all of this information, so they will incur none or only some of these costs.

- Location relative to the 100-year floodplain. This determination will cost about \$200.
- Highest predicted groundwater elevation below the landfill. This determination will be approximately \$1500; if it requires installation of wells, the cost would be about \$3000 per well.
- Permeability of the base of the landfill and/or potential for water to drain by gravity out of the landfill. This determination will cost about \$2000.

Approximately 15 landfills will have to determine the tons of waste disposed since July 1, 1998. This information is available at no cost from the department.

28-29-332. Control of hazardous and explosive gases at C&D landfills; additional design requirements. This proposed new regulation contains design standards, including the

installation of a drainage layer and pumps, which must be met for new units built at landfills which meet the applicability criteria.

It is assumed that new landfills will be located and constructed so as not to be subject to this regulation. It is difficult to predict how many of approximately 10 existing landfills subject to the criteria of this regulation will submit plans for a new unit in any given year, but KDHE estimates that approximately 1 landfill each year would need to comply with these additional design requirements in order to construct a new unit.

New units at C&D landfills are typically 1-10 acres in size. Assuming an average new unit size of 5 acres, and an additional 12” added to the final cover, the following additional estimated costs would apply:

| | |
|--------------------------------------|-----------------|
| Drainage layer: | \$100,000 |
| Contact water monitoring system: | \$7,500 |
| Collection system and pumping plant: | \$20,000 |
| Final cover: | <u>\$14,500</u> |
| Total estimated additional costs: | \$142,000 |

The cost of constructing a 5-acre C&D landfill cell without these additional requirements is approximately \$250,000.

28-29-333. Control of hazardous and explosive gases at C&D landfills; additional operating requirements. This proposed new regulation requires that cover be applied at least once a week at all landfills that meet the applicability criteria.

Approximately 10 C&D landfills will be subject to this requirement. Landfills are currently required to apply cover over every 2,000 tons of waste disposed or at least every 120 days. The additional annual cost for each landfill will depend on the additional cover events (0 to 49) per year and the size of the area requiring cover. The cost of additional cover is estimated to range from \$0 to \$75,000 per year, with a total of an additional \$400,000 per year for the regulated community as a whole.

This regulation also contains pumping and sampling requirements for new units in landfills (approximately 10) which meet the applicability criteria. The pumping will cost about \$500 per year for a 5-acre site. Sampling of the contact water will cost approximately \$1000 per event and may occur as few as two times over the life of the unit.

28-29-334. Control of hazardous and explosive gases at C&D landfills; monitoring system design and design plan. It is estimated that 11 landfills will have to install gas monitoring systems. The cost of designing a system is estimated to range from \$12,000 to \$22,000 dollars. Landfills will typically need from 5 to 15 probes, at a cost of approximately \$2,500 per probe. The total cost for designing and installing the monitoring system may range from \$25,000 to \$60,000, with a total capital cost to the regulated community of approximately \$390,000. New cells at these landfills would also need gas monitoring systems; the design and installation of the gas monitoring system for a 5-acre cell would cost approximately \$7500.

28-29-335. Control of hazardous and explosive gases at C&D landfills; monitoring and monitoring plan. It is estimated that 11 landfills will have to monitor gas levels. Depending on the number of probes, buildings, and workers, landfills will typically have to collect between 20 and 120 samples per year. The cost to analyze each sample is approximately \$100, resulting in an annual cost of \$2000 to \$12,000 per year, and a total annual cost to the regulated community of approximately \$36,000.

28-29-336. Control of hazardous and explosive gases at C&D landfills; response, assessment monitoring, and corrective action. This proposed new regulation describes the steps that must be taken if landfill gas is detected above the specified action levels. The costs that would be incurred if gas is detected above action levels are too site- and incident-specific to be estimated, but could exceed \$1,000,000 if a major liquids and gas problem occurs.

b. Initial and annual costs of implementing and enforcing the proposed regulations or amendments, including the estimated amount of paperwork, and the state agencies, other governmental agencies or other persons or entities who will bear the costs. Documentation of applicability, plans, and sampling data will be reviewed by existing KDHE staff. No other state or federal agencies will be required to bear any additional costs due to these regulations.

c. Costs which would likely accrue if the proposed regulations or amendments are not adopted, the persons who will bear the costs and those who will be affected by the failure to adopt the regulations. Conducting corrective actions activities at a site where generation of gas threatens human health or safety could cost the C&D landfill owner or operator over \$1,000,000 if a major liquids and gas problem occurs.

d. A detailed statement of the data and methodology used in estimating the costs used in the statement. The number of facilities that might be subject to each of these regulations was estimated by KDHE staff based on their knowledge of the landfills in Kansas.

The costs to comply with the regulations come from the following sources:

- Kansas Department of Health and Environment, Bureau of Waste Management, Closure Cost Estimate Worksheet for Construction/Demolition Landfill, Revised May 11, 2004
- Kansas Department of Health and Environment, Bureau of Waste Management, Policy 10-02 Construction and Demolition Waste: Volume to Weight Conversion Factor, April 20, 2010.
- Bolton, Neal, P.E., The Handbook of Landfill Operations, Blue Ridge Solid Waste Consulting, Bozeman, MT., 1995
- Naval Facilities Engineering Command, Soil Mechanics Design Manual, 1982, (Fig) Extreme Frost Penetration (in Inches) Based Upon State Averages.
- State of California Department of Health Services Water Distribution Operator Certification Program, Conversion Sheet
- Tetra Tech EM, Inc., USEPA Financial Assurance Workshop for Closure & Post-Closure Care November 19, 2002, CostPro Estimating Software, Example CI-5
- Pumps and Pumping Costs, Internet Source – Author not identified
- <http://www.wateright.org/site2/advisories/energy.asp>

e. Description of any less costly or less intrusive methods that were considered by the agency and why such methods were rejected in favor of the proposed regulations.

There were no less intrusive or less costly methods available for consideration by KDHE to achieve the purposes of the proposed new regulations.

f. Consultation with League of Kansas Municipalities, Kansas Association of Counties, and Kansas Association of School Boards. Cities or counties that operate construction and demolition landfills may be impacted by this regulation. The department does not anticipate that school boards will incur costs as a result of the regulatory changes. A copy of this Regulatory Impact Statement was sent to each of these organizations on February 14, 2012.

John Heim, Executive Director
Kansas Assoc. of School Boards
1420 SW Arrowhead Road
Topeka, KS 66604-4024

Randy Allen, Executive Director
Kansas Association of Counties
300 SW 8th, 3rd Floor
Topeka, KS 66603

Don Moler, Executive Director
League of Kansas Municipalities
300 SW 8th Avenue
Topeka, KS 66603