

401 KAR 48:300. Surface and groundwater monitoring and corrective action.

RELATES TO: KRS 224.01, 224.10, 224.40, 224.43, 224.70, 40 C.F.R. Parts 257, 258, 302.4 Appendix A

STATUTORY AUTHORITY: KRS 224.10-100, 224.40-305, 224.43-340

CERTIFICATION STATEMENT:

NECESSITY, FUNCTION, AND CONFORMITY: KRS Chapter 224 requires the cabinet to promulgate administrative regulations for the treatment, management, processing or disposal of wastes. KRS 224.40-305 requires that persons engaging in the management, processing or disposal of waste obtain a permit. This chapter establishes the minimum technical standards for solid waste sites or facilities. This administrative regulation sets forth the standards for groundwater monitoring and corrective action.

Section 1. Applicability. The requirements of this administrative regulation apply to owners and operators of contained, construction/demolition, and residual landfills, Class II and Class III landfarming facilities, other solid waste sites or facilities at which the cabinet determines groundwater monitoring shall be required and solid waste sites or facilities required to accomplish corrective action as a result of documented groundwater contamination. Sections 1 through 7 of this administrative regulation do not apply to landfarming facilities permitted pursuant to 401 KAR 48:200. Landfarming facilities required to accomplish corrective action shall comply with Section 8 of this administrative regulation. The owner or operator shall satisfy the requirements of this administrative regulation for all wastes (or constituents thereof) contained in waste management units at the facility regardless of the time at which waste was placed in such unit. Designs, reports, and plans constituting the public practice of geology, as defined at KRS 322A.010, shall be developed by a person registered pursuant to KRS Chapter 322A, except as provided for by KRS 322A.080.

Section 2. Surface Water Monitoring Plan. A surface water monitoring plan as required in Section 5 of 401 KAR 47:190 shall include:

- (1) Documentation that the applicant currently holds or has applied for a KPDES permit for all structures that shall be used to control storm water run-off and all point source discharges.
- (2) The location of surface water monitoring points identified on the engineering plans. The surface water monitoring points shall be located such that the sampling shall characterize the quality of water unaffected by the landfills and shall be located such that the sampling shall determine if water leaving the landfill in surface drainage is contaminated with leachate. Sampling protocol shall measure surface water under base flow conditions that continues to drain after storm-induced surface run-off has ceased.
- (3) A schedule and list of analytical parameters for the quarterly surface water sampling program. The parameters to be analyzed for the water samples shall include at a minimum: chlorides, sulfate, iron, sodium, total organic carbon or biochemical oxygen demand, chemical oxygen demand, specific conductance, total suspended solids, total dissolved solids, total solids and pH.
- (4) A form to record the results of the surface water sample analyses.
- (5) Prior to the disturbance of any areas proposed for development in a landfill permit application, the owner shall analyze samples of the surface water points and submit the results to the cabinet. The sampling shall include a minimum of two (2) samples collected at no less than thirty (30) day intervals and shall be sufficient to characterize the existing surface water quality.

Section 3. Groundwater Quality Characterization. A groundwater characterization as required in 401 KAR 47:180 shall contain the chemical characteristics of the upper most

aquifer down to and including the lowest aquifer that may be affected by the site or facility. This description shall include results of analysis of at least two (2) samples of groundwater from the site before waste placement for the parameters listed in Section 10 of this administrative regulation. The number of samples collected for the groundwater quality characterization shall be consistent with the statistical method for groundwater analysis to be performed in Section 9 of this administrative regulation.

(1) For facilities permitted before May 8, 1990, the data required by this section shall be taken beginning with the first anniversary date of the issuance of the permit after May 8, 1990, and shall be for the parameters listed in Section 11 of this administrative regulation.

(2) Monitoring wells under this section shall be designed, constructed and maintained according to Section 6 of this administrative regulation. Sampling and analysis shall be conducted in accordance with a plan approved by the cabinet in accordance with the requirements of Section 7 of this administrative regulation.

Section 4. Groundwater Monitoring Plan. A groundwater monitoring plan as required in 401 KAR 47:190 or 401 KAR 48:200 shall include:

- (1) The number, location and depth of proposed monitoring points;
- (2) Preoperational data showing existing groundwater quality, as required in the groundwater quality characterization in Section 3 of this administrative regulation;
- (3) A groundwater sampling and analysis plan. The procedures, methods and techniques shall be approved by the cabinet. The plan shall include:
 - (a) Procedures and techniques designed to accurately measure groundwater quality upgradient, and downgradient of the proposed waste disposal area;
 - (b) Cabinet approved sampling methods including procedures and techniques for sample collection, sample preservation and sample shipment;
 - (c) Cabinet approved analytical procedures; and
 - (d) Chain of custody control, field and laboratory quality assurance and quality control.The procedures and methods shall be approved by the cabinet.
- (4) For solid waste sites or facilities located in karst regions the following additional hydrogeologic information shall be required:
 - (a) The nature and extent of karst drainage beneath the solid waste site or facility; and
 - (b) A description of a proposed groundwater monitoring system capable of completely and accurately monitoring groundwater contamination.

Section 5. Design Requirements for Groundwater Monitoring Systems. The groundwater quality monitoring system to be utilized in the groundwater monitoring plan shall accurately analyze groundwater quality and characterize local groundwater flow and flow systems. The system shall consist, at a minimum, of the following:

- (1) At least one (1) reference or background well at a point hydraulically upgradient from the disposal area in the direction of increasing static head that is capable of providing data representative of groundwater not affected by the solid waste site or facility. When the solid waste site or facility occupies the most upgradient position in the flow system, sufficient downgradient or side gradient monitoring wells shall be placed to accurately characterize the groundwater quality and regional and local groundwater flow and flow systems. Reference wells shall be located so that they shall not be affected by groundwater contamination from the disposal area; and
- (2) At least three (3) monitoring wells at points hydraulically connected in the direction of decreasing static head from the area in which solid waste has been or shall be disposed. In addition to three (3) downgradient wells, the cabinet may allow one (1) or more springs for monitoring points if the springs are hydraulically downgradient from the area in which solid waste has been or shall be disposed, if the springs are sampled in a manner approved by the cabinet, and if the springs otherwise meet the requirements of

the cabinet. Downgradient monitoring wells shall be located so that they shall provide early detection of groundwater contamination and progressive monitoring of the phases and units of the site or facility.

Section 6. Requirements for Monitoring Well Construction.

(1) Precautions shall be taken during drilling and construction of monitoring wells to avoid introducing contaminants into a borehole. Only potable water shall be used in drilling monitoring wells unless otherwise approved by the cabinet. Drilling muds shall not be used except with prior approval of the cabinet. Air systems and drilling lubricants shall not introduce contaminants into the boreholes.

(2) Decontamination of all equipment to be placed into the boring shall be performed before use at the site and between boreholes. Where possible, upgradient wells shall be drilled first.

(3) Monitoring wells shall be cased as follows:

- (a) To maintain the integrity of the monitoring well borehole by isolating water bearing units which are sampled by each well;
- (b) With a minimum casing diameter of four (4) inches unless otherwise approved by the cabinet in writing;
- (c) With screens and appropriate gravel or sand packing where necessary, to enable collection of samples at depths where appropriate aquifer flow zones exist;
- (d) To allow the casing to protrude at least one (1) foot above ground;
- (e) To provide a drill hole diameter that is a minimum of four (4) inches larger than the outside diameter of the well casing;
- (f) To produce an annular space above the sampling depth that is sealed to prevent contamination of samples and the groundwater; and
- (g) If plastic casing is used, it shall be threaded and gasket sealed to preclude potential sample contamination from solvent welded joints, unless otherwise provided by the cabinet in the permit.

(4) Monitoring well casings shall be enclosed in a protective cover that shall:

- (a) Be sufficient to reliably protect the well from damage. This shall include a protective barrier around the well;
- (b) Be installed into firm rock unless otherwise approved by the cabinet in writing;
- (c) Be grouted and placed with a cement collar below the frost line to hold it firmly in position unless otherwise approved by the cabinet;
- (d) Be numbered and painted in a highly visible color;
- (e) Protrude at least one (1) inch higher above grade than the monitoring well casing;
- (f) Have a locked cap; and
- (g) Be made of steel or any other material of equivalent strength.

(5) Each monitoring well shall have a concrete pad extending two (2) feet around the well and sloped away from the well.

Section 7. Sampling and Analysis.

(1) Parameters Listing. Owners or operators of solid waste sites or facilities that require groundwater monitoring shall conduct sampling and analysis from each monitoring well for the parameters listed in Section 11 of this administrative regulation.

(2) Reporting of analysis results. Analyses of data required by this section shall be submitted to the cabinet on a form provided by the cabinet within sixty (60) days of sampling or fifteen (15) days after completing the statistical analysis required by Section 9 of this administrative regulation, whichever is sooner, unless the cabinet approves another time period in the permit. Frequency of sampling shall be as indicated in Section 11 of this administrative regulation.

(3) If analysis of the sample results indicates contamination as specified in Section 8(1) of this administrative regulation, the owner or operator shall notify the cabinet within

forty-eight (48) hours of receiving the statistical analysis results required by Section 9 of this administrative regulation and shall arrange for the cabinet to split a sample no later than ten (10) days from the receipt of the results.

Section 8. Groundwater Contamination Assessment and Corrective Action.

(1) The operator of a solid waste site or facility shall be required to prepare and submit a groundwater assessment plan if laboratory analyses of one (1) or more monitoring wells at the site or facility shows the presence of one (1) or more parameters listed in 40 CFR 302.4, Appendix A as of October 1988, above the maximum containment level (MCL) as specified in 401 KAR 47:030 or significant increase over naturally occurring background levels for parameters that have no MCL. For parameters that have no maximum contaminant levels a significant increase over background shall be determined using a statistical test as specified in Section 9 of this administrative regulation.

(2) Confirmation sampling. The owner or operator of a solid waste site or facility shall not be required to submit an assessment plan if the following conditions are met:

(a) Within ten (10) days after receipt of sample results showing groundwater contamination the owner or operator resamples the affected wells; and

(b) Analysis from resampling shows to the cabinet's satisfaction that groundwater contamination has not occurred.

(3) The owner or operator of a solid waste site or facility shall be required to provide alternate water supplies to affected parties within twenty-four (24) hours of notification of the cabinet that sample results indicate contamination of a drinking water supply if it has been determined that the landfill is the probable source of contamination.

(4) The assessment plan shall be submitted to the cabinet within thirty (30) days of the occurrence of the conditions described in subsection (1) of this section. The assessment plan shall specify the manner in which the owner or operator shall determine the existence, quality, quantity, areal extent and depth of groundwater degradation, and the rate and direction of migration of contaminants in the groundwater. The assessment plan shall be prepared by a qualified professional and shall be implemented upon approval by the cabinet in accordance with the approved implementation schedule. The assessment plan shall be implemented within sixty (60) days after approval by the cabinet. The plan shall contain, at a minimum all of the following information:

(a) The number, location, size, casing type and depth of wells, lysimeters, borings, pits, piezometers and other assessment structures or devices to be used;

(b) Sampling and analytical methods for the parameters to be evaluated;

(c) Analyses of all parameters listed in Section 10(3) of this administrative regulation and any other parameter determined by the cabinet; and

(d) Evaluation procedures, including the use of previously gathered groundwater quality information, to determine the concentration, rate and extent of groundwater degradation or pollution from the facility.

(5) For public or private water supplies which may be adversely affected by the facility, the owner or operator shall submit a detailed hydrogeologic study addressing the potential effect of the site or facility on said water supply.

(6) If the cabinet determines that the assessment plan is inadequate, it may modify the plan and approve the plan as modified.

(7) Within ninety (90) days after the implementation of the groundwater assessment plan, the operator shall submit a groundwater assessment report containing the new data collected, analysis of the data and recommendations on the necessity for abatement.

(8) The cabinet may require abatement measures prior to approval of the groundwater assessment plan in the event that a determination has been made that there is an immediate threat to human health or the environment.

(9) Within 120 days of the cabinet approval of the groundwater assessment report, but in no event later than one (1) year from the event specified in subsection (1) of this section, the owner or operator shall submit a remedial action plan to include the following:

- (a) The specific methods or techniques to be used to abate groundwater contamination from the facility;
- (b) The specific methods or techniques to be used to prevent further groundwater contamination from the facility; and
- (c) A description of the means used to restore or replace public or private water supplies affected by contamination from the solid waste facility.

(10) Within fifteen (15) days of approval of the groundwater assessment report, the cabinet shall prepare and the owner or operator shall publish a public notice in accordance with 401 KAR 47:140, Section 7(1)(a) through (f), (3), and (4). The public notice shall contain a brief statement summarizing the contents of the groundwater assessment report, shall provide for a thirty (30) day public comment period, and shall set forth a proposed public hearing date. If no request for a public hearing is received during the thirty (30) day comment period, the public hearing may be cancelled.

(11) The owner or operator shall, within 120 days of approval of the groundwater corrective action plan under subsection (9) of this section, post the financial assurance required under 401 KAR 48:310.

(12) The owner or operator of a solid waste site or facility shall take any other steps deemed necessary by the cabinet to ensure protection of human health and the environment.

(13) Corrective action measures under this administrative regulation shall be initiated and completed within a period of time as specified by the cabinet considering the extent of contamination.

(14) Corrective action measures under this administrative regulation may be terminated upon approval of the cabinet when the owner or operator demonstrates that concentrations have been reduced to levels below the maximum contaminant level or naturally occurring background.

Section 9. Statistical Methods for Groundwater Analysis.

(1) The owner or operator shall specify in the permit application one (1) of the following statistical methods to be used in evaluating groundwater monitoring data for each parameter in Section 11 of this administrative regulation. The statistical test chosen shall be conducted separately for each parameter in Section 11 of this administrative regulation in each well for each monitoring event, and the results shall be maintained as part of the facility record throughout the operating and postclosure life of the facility.

(a) A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(b) An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(c) A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(d) A control chart approach that gives control limits for each constituent.

(e) Another statistical method approved by the cabinet based on justification included in the permit application that the method meets the requirements of subsection (2) of

this section.

(2) Any statistical method chosen under subsection (1) of this section shall comply with the following performance standards, as appropriate:

(a) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or hazardous constituents. If the distribution of the chemical parameters or hazardous constituents is shown by the owner or operator to be inappropriate for a normal theory test, then the data shall be transformed or a distribution-free theory test shall be used. If the distributions for the constituents differ, more than one (1) statistical method may be needed.

(b) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level of no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons shall be maintained. This performance standard shall not apply to tolerance intervals, prediction intervals, or control charts.

(c) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern.

(d) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern.

(e) The statistical method shall account for data below the limit of detection with one (1) or more statistical procedures that are protective of human health and the environment. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

(f) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

(3) The owner or operator shall determine whether or not there is a statistically significant increase over background values for each parameter or constituent required in the particular groundwater monitoring program that applies to the solid waste site or facility.

(a) In determining whether a statistically significant increase has occurred, the owner or operator shall compare the groundwater quality of each parameter or constituent at each monitoring well to the background value of that constituent, according to the statistical procedures and performance standards specified under subsections (1) and (2) of this section.

(b) Within thirty (30) days after receiving sampling results, the owner or operator shall determine whether there has been a statistically significant increase over background at each monitoring well.

Section 10. Groundwater Quality Characterization Parameters. For solid waste sites or facilities that require groundwater monitoring, the following parameters are to be analyzed for groundwater quality characterization as required in Section 2 of this administrative regulation:

(1) For all Class II and III landfarming facilities required to monitor groundwater, the characterization shall be based on the following parameters:

(a) Specific conductance, chemical oxygen demand, total organic carbon, chloride, iron, manganese, sodium, total nitrogen, nitrate nitrogen, chromium, cadmium, coliform bacteria, pH, calcium, magnesium, potassium, sulfate, bicarbonate, carbonate.

(b) Groundwater elevation in monitoring wells recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a United States Geological Survey (USGS) datum.

(2) For residual and construction/demolition debris landfills, the characterization shall be based on the following parameters:

(a) Chloride, chemical oxygen demand, total dissolved solids, specific conductance, pH, iron, sodium, arsenic, barium, cadmium, lead, mercury, nitrate, selenium, silver, pH, calcium, magnesium, potassium, sulfate, bicarbonate, carbonate.

(b) Groundwater elevations recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a United States Geological Survey (USGS) datum.

(3) For contained landfills, the characterization shall be based on the following parameters:

(a) Indicators: Specific conductance, chemical oxygen demand, total dissolved solids, total organic carbon, pH, chloride, iron, manganese, sodium, bicarbonate, calcium, sulfate, magnesium, potassium, carbonate.

(b) Hazardous Constituents.

Systematic Name	CAS RN	Common Name
Acenaphthylene	208-96-8	Acenaphthylene
Acenaphthylene, 1,2-dihydro-	83-32-9	Acenaphthene
Acetamide, N-(4-ethoxyphenyl)-H	62-44-2	Phenacetin
Acetamide, N-9H-fluoren-2-yl	53-96-3	2-Acetylaminofluorene; 2-AAF
Acetic acid ethenyl ester	108-05-4	Vinyl acetate
Acetic acid (2,4,5-trichlorophenoxy)-	93-76-5	2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid
Acetic acid (2,4-dichlorophenoxy)-	94-75-7	2,4-Dichlorophenoxy-acetic acid
Acetonitrile	75-05-8	Acetonitrile; Methyl cyanide
Aluminum	7429-90-5	Aluminum (total)
Anthracene	120-12-7	Anthracene
Antimony	7440-36-0	Antimony (total)
Aroclor 1016	12674-11-2	Aroclor 1016

Aroclor 1221	11104-28-2	Aroclor 1221
Aroclor 1232	11141-16-5	Aroclor 1232
Aroclor 1242	53469-21-9	Aroclor 1242
Aroclor 1248	12672-29-6	Aroclor 1248
Aroclor 1254	11097-69-1	Aroclor 1254
Aroclor 1260	11096-82-5	Aroclor 1260
Arsenic	7440-38-2	Arsenic (total)
Barium	7440-39-3	Barium (total)
Benz(a)anthracene, 7,12,-dimethyl	57-97-6	7,12-Dimethylbenz(a)-anthracene
Benz(j)aceanthrylene, 1,2-dihydro-3-Methyl	56-49-5	3-Methylcholanthrene
Benz(e)acephenanthrylene	205-99-2	Benzo(b)fluoranthene
Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-	23950-58-5	Pronamide
Benz(a)anthracene	56-55-3	Benzo(a)anthracene; Benanthracene
Benzenamine, 2 methyl-	95-53-4	o-Toluidine
Benzenamine, 2-methyl-5-nitro	99-55-8	5-Nitro-o-toluidine
Benzenamine, 2-nitro	88-74-4	2-Nitroaniline; o-Nitroaniline
Benzenamine, 3-nitro	99-09-2	3-Nitroaniline; m-Nitroaniline
Benzenamine, 4-chloro	106-47-8	p-Chloroaniline
Benzenamine, 4-nitro-	100-01-6	4-Nitroaniline; p-nitroaniline
Benzenamine, N-nitroso-N-phenyl	86-30-6	N-Nitrosodiphenylamine
Benzenamine, N-phenyl-	122-39-4	Diphenylamine
Benzenamine, N,N-dimethyl-	60-11-7	p-Dimethylamino-4-(phenylazo)-azobenzene
Benzene	71-43-2	Benzene

Benzene, 1-bromo-4-phenoxy-	101-55-3	4-Bromophenyl phenyl ether
Benzene, 1-chloro-4-phenoxy-	7005-72-3	4-Chlorophenyl phenyl ether
Benzene, 1-methyl-2, 4-dinitro	121-14-2	2,4-Dinitrotoluene-
Benzene, 1,1'-(2,2,2-trichloroethylidene)bis(4-chloro-	50-29-3	DDT; 4,4'-DDT
Benzene, 1,1'-(2,2,2-trichloroethylidene)bis(4-methoxy-	72-43-5	Methoxychlor
Benzene 1,1'-(2,2-dichloroethylidene)bis(4-chloro-	72-54-8	DDD; 4,4'-DDD
Benzene 1,1'-(2,2-dichloroethenylidene)bis(4-chloro-	72-55-9	DDE; 4,4'-DDE
Benzene 1,2-dichloro	95-50-1	o-Dichlorobenzene
Benzene 1,2,4-trichloro	120-82-1	1,2,4-trichlorobenzene
Benzene 1,2,4,5-tetrachloro	95-94-3	1,2,4,5-Tetrachlorobenzene
Benzene 1,3-dichloro-	541-73-1	M-Dichlorobenzene
Benzene, 1, 3-dintro	99-65-0	m-Dinitrobenzene
Benzene, 1,3,5-trinitro-	99-35-4	Sym-Trinitrobenze
Benzene 1,4-dichloro-	106-46-7	p-Dichlorobenzene
Benzene, 2-methyl-1,3-dinitro	606-20-2	2,6-Dinitrotoluene
Benzene, chloro-	108-90-7	Chlorobenzene
Benzene, dimethyl-	*	Xylene (total)
Benzene, ethenyl-	100-42-5	Styrene
Benzene, ethyl-	100-41-4	Ethyl benzene
Benzene, hexachloro	118-74-1	Hexachlorobenzene
Benzene, methyl	108-88-3	Toluene
Benzene, nitro	98-95-3	Nitrobenzene
Benzene, pentachloro-	606-93-5	Pentachlorobenzene

Benzene, pentachloronitro-	82-68-8	Pentachloronitrobenzene
Benzeneacetic acid, 4-chloro-a-(4-chlorophenyl)-a-hydroxy-, ethyl ester	510-15-6	Chlorobenzilate
1,4-Benzenediamine	106-50-3	p-Phenylene-dianine
1,2-Benzenedicarboxylic acid, bis-(2-ethylhexyl)ester	117-81-7	Bis(2-ethylhexyl) phthalate
1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester	85-68-7	Butyl benzyl phthalate; Benzyl butyl phthalate
1,2-Benzenedicarboxylic acid, dibutyl ester	84-74-2	Di-n-butyl phthalate
1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	Diethyl phthalate
1,2-Benzenedicarboxylic acid, dimethyl ester	131-11-3	Dimethyl phthalate
1,2-Benzenedicarboxylic acid, dioctyl ester	117-84-0	Di-n-octyl phthalate
Benzenemethanol	100-51-6	Benzyl alcohol
1,3-Benodioxole, 5-(1-propenyl)-	120-58-1	Isosafrole
1,3-Benzodioxole, 5-(2-propenyl)-	94-59-7	Safrole
Benzo(k)fluoranthene	207-08-9	Benzo(k)fluoranthene
Benzo(ghi)perylene	191-24-2	Benzo(ghi)perylene
Benzo(a)pyrene	50-32-8	Benzo(a)pyrene
Beryllium	7440-41-7	Beryllium (total)
1,1-Biphenyl-4,4'-diamine, 3,3'-dichloro-	91-94-1	3,3'-Dichloroenzidine
1,1'-Biphenyl-4,4'-diamine, 3,3'-dimethyl-	119-93-7	3,3'-Dimethylbenzidine
(1,1'-Biphenyl)-4-amine	92-67-1	4-Aminobiphenyl
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	87-68-3	Hexachlorobutadiene
1,3-Butadiene, 2-chloro-	126-99-8	2-Chloro-1,3-butadiene; chloropene
1-Butanamine, N-butyl-N-nitroso-	924-16-3	N-Nitrosodi-n-Butylamine
2-Butanone	78-93-3	Methyl ethyl ketone; MEK; 2-Butanone

2-Butene, 1,4-di-chloro-, (E)-	110-57-6	trans-1,4-Di-chloro-2-butene
Cadmium (total)	7440-43-9	Cadmium
Carbamothioic acid, bis (1-methylethyl)-, S-(2,3-dichloro-2-propenyl ester	2303-16-4	Diallate
Carbon disulfide	75-15-0	Carbon disulfide
Chromium	7440-47-3	Chromium (total)
Chrysene	218-01-9	Chrysene
Cobalt	7440-48-4	Cobalt (total)
Copper	7440-50-8	Copper (total)
Cyanide	57-12-5	Cyanide
Cyclohexane, 1,2,3,4, 5,6-hexachloro- (1a,2a,3B,4a,5B,6B)-	319-84-6	alpha-BHC
Cyclohexane, 1,2,3,4, 5,6-hexachloro-2B,3a,4B,5a,6B)-	319-85-7	beta-BHC
Cyclohexane, 1,2,3,4,5,6-hexachloro- (1a,2a,3a,4B,5a,6B)-	319-86-8	delta-BHC
Cyclohexane, 1,2,3,4,5,6-hexachloro- (1a,2a,3B,4a,5a,6B)-	58-89-9	gamma-BHC; lindane
2-Cyclohexene-1-one,3,5,5-trimethyl	78-59-1	Isophorone
1,3-Cyclopentadiene,1,2,3,4,5, 5-hexachloro-	77-47-4	Hexachlorocyclopentadiene
Dibenz(a,h)anthracene	53-70-3	Dibenz(a,h)anthracene
Dibenzofuran	132-64-9	Dibenzofuran, hexachlorodibenzofurans; penta-chlorodibenzo-furans; tetrachlorodibenzofurans.
2,7:3,6-Dimethanon-aphth (2,3-b)oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a, 7,7a-octahydro,1aa,2B,2aa,3B,6B,6aa,7B,7aa)-	60-57-1	Dieldrin
2,7:3,6-Dimethanon-aphth (2,3-b)oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a, 7,7a-octahydro,1aa,2B,2aB,3a,6a,6aB,7B,7aa)-	72-20-8	Endrin

1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro 1,4,4a,5,8,8a-hexa-hydro-,1aa, 4a,4aB,5a,8a,8aB)-	309- 00-2	Aldrin
1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro 1,4,4a,5,8,8a-hexa-hydro-,1aa, 4a,4aB,5B,8B,8aB)-	465- 73-6	Isodrin
1,4-Dioxane	123- 91-1	1,4-Dioxane
Ethanamine, N-ethyl-N-nitroso	55-18- 5	N-Nitrosodiethylamine
Ethanamine, N-methyl-N-nitroso	10595- 95-6	N-Nitrosomethylethyl amine
Ethane, 1,1-dichloro-	75-34- 3	1,1-Dichloroethane; ethyldidene chloride
Ethane, 1,1'-(methylenebis(oxy)) bis(2-chloro-	111- 91-1	Bis(2-chloroethoxy) methane
Ethane, 1,1'-oxybis (2-chloro-	111- 44-4	Bis(2-chloroethyl) ether
Ethane, 1,1,1-trichloro-	71-55- 6	1,1,1-Trichloroethane; Methyl chloroform
Ethane, 1,1,1,2-tetrachloro-	630- 20-6	1,1,1,2-Tetrachloroethane
Ethane, 1,1,2-trichloro-	79-00- 5	1,1,2-Trichloroethane
Ethane, 1,1,2,2-tetrachloro-	79-34- 5	1,1,2,2-Tetrachloro ethane
Ethane, 1,2-dibromo	106- 93-4	1,2-Dibromoethane; Ethylene dibromide; EDB
Ethane, 1,2-dichloro	107- 06-2	1,2-Dichloroethane; Ethylene dichloride
Ethane, chloro-	75-00- 3	Chloroethane; Ethyl chloride
Ethane, hexachloro-	67-72- 1	Hexachloroethane
Ethane, pentachloro-	76-01- 7	Pentachloroethane
1,2-Ethanediamine,N,N-dimethyl-N'- '2-pyridinyl-n'-(2-thienylmethyl)-	91-80- 5	Methapyrilene
Ethanone, 1-phenyl-	98-86- 2	Acetophenone
Ethene, 1,1-dichloro-	75-35- 4	1,1-Dichloroethylene; Vinylidene chloride; 1,1- Dichloroethene
Ethene, 1,2-dichloro-(e)-	156- 60-5	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene

Ethene, 1,2-dichloro(z)-	156-59-2	cis-1,2-Dichloroethylene; cis-1,2-Dichloro-ethene
Ethene, chloro-	75-01-4	Vinyl chloride; Chloroethene
Ethene, tetrachloro-	127-18-4	Tetrachloroethene; Tetrachloroethylene; Perchloroethylene
Ethene, trichloro-	79-01-6	Trichloroethene; Trichloroethylene
Fluoranthene	206-44-0	Fluoranthene
9H-Fluorene	86-73-7	Fluorene
2-Hexanone	591-78-6	2-Hexanone; Methyl butyl ketone
Indeno(1,2,3-cd) pyrene	193-39-5	Indeno(1,2,3-cd) pyrene
Lead	7439-92-1	Lead (total)
Magnesium	7439-94-4	Magnesium (total)
Manganese	7439-96-5	Manganese (total)
Mercury	7439-97-6	Mercury (total)
Methanamine, N-methyl-N-nitroso	62-75-9	N-Nitrosodimethylamine
Methane, bromo-	74-83-9	Bromomethane
Methane, bromochloro-	74-97-5	Bromochloromethane; Chlorobromomethane
Methane, bromodichloro-	75-27-4	Bromodichloromethane; Dibromochloromethane
Methane, chloro	74-87-3	Chloromethane; Methyl chloride
Methane, dibromo-	75-09-2	Dibromomethane; methylene bromide
Methane, dibromo-chloro-	124-48-1	Chlorodibromomethane
Methane, dichloro-	75-09-2	Dichloromethane, Methylene Chloride
Methane, Dichlorodifluoro-	75-71-8	Dichlorodifluoromethane; CFC-12
Methane, iodo	74-88-4	Iodomethane; Methyl iodide
Methane, tetrachloro-	56-23-5	Carbon Tetrachloride

Methane, tribromo-	75-25-2	Tribromomethane; Bromoform
Methane, trichloro-	67-66-3	Chloroform
Methane, trichlorofluoro-	75-69-4	Trichloromonofluoromethane; CFC-11
Methanesulfonic acid, ethyl ester	62-50-0	Ethyl methanesulfonate
Methanesulfonic acid, methyl ester	66-27-3	Methyl methane-sulfonate
4,7-Methano-1H-indene-1,2,4,5,6,7,8,8-octachloro-2,3, 3a,4,7,7a-hexahydro	**	Chlordane
4,7-Methano-1H-indene-1,4,5,6,7,8,8-heptachloro-3a, 4,7,7a-tetrahydro-	76-44-8	Heptachlor
2,5-Methano-2H-indeno(1,2-b)oxirene,2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6, 6a-hexahydro-, (1aa,1bB,2a, 5a,5aB,6B,6aa)	1024-57-3	Heptachlor epoxide
6,9-Methano-2,4,3-benzodioxathiepin,6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-,3-oxide, (3a,5aB,6a,9a,9aB)	959-96-8	Endosulfan I
6,9-Methano-2,4,3-6,7,8,9, benzo-dioxathiepin, 10,10-hexachloro-1,5,5a, 6,9,9a-hexahydro-,3-oxide, (3a,5aa,6B,9B,9aa)	33213-65-9	Endosulfan II
6,9-Methano-2,4,3-benzodioxathiepin,6,7,8,9, 10,10-hexachloro-1,5,5a,6,9, 9a-hexahydro-3,3-dioxide	1031-07-8	Endosulfan sulfate
1,3,4-Methano-2H-cyclobutal (cd)pentalen-2-one,1,1a,3,3a,4,5,5,5a,5b,6-decachloro-octahydro-	143-50-0	Kepone
1,2,4-Methanocyclopenta(cd)pentalene-5-carboxaldehyde, 2,2a,3,3,4,7-hexachlorodecahydro-, (1a,2B,2aB,4B,4aB,5B,6aB,6aB,7R*)	7421-93-4	Endrin aldehyde
1-Naphthalenamine	134-31-7	1-Naphthylamine
2-Naphthalenamine	91-59-8	2-Naphthylamine
Naphthalene	91-20-3	Naphthalene
Naphthalene, 2-chloro-	91-58-7	2-chloronaphthalene

Naphthalene, 2-methyl-	91-57-6	2-Methylnaphthalene
1,4-Naphthalenedione	130-15-4	1,4-Naphthoquinone
Nickel	7440-02-0	Nickel (total)
2-Pentanone, 4-methyl-	108-10-1	4-Methyl-2-pentanone; Methyl isobutyl ketone
Phenanthrene	85-01-8	Phenanthrene
Phenol	108-95-2	Phenol
Phenol, 2-(1-methyl-propyl)-4, 6-dinitro	88-85-7	2-sec-Butyl-4,6-dinitrophenol; Dinoseb; DNBP
Phenol, 2-chloro-	95-57-8	2-Chlorophenol
Phenol, 2-methyl-	95-48-7	ortho-Cresol; 2-methylphenol
Phenol, 2-methyl-4,6-dinitro-	34-52-1	4,6-Dinitro-o-cresol; 4,6-Dinitro-2 methylphenol
Phenol, 2-nitro	88-75-5	2-Nitrophenol; o-Nitrophenol
Phenol, 2,3,4,6-tetrachloro-	58-90-2	2,3,4,6-Tetrachlorophenol
Phenol, 2,4-dichloro	120-83-2	2,4-Dichlorophenol
Phenol, 2,4-dimethyl-	105-67-9	2,4-Dimethylphenol; m-Xylenol
Phenol, 2,4-dinitro-	51-28-5	2,4-Dinitrophenol
Phenol, 2,4,5-trichloro	95-95-4	2,4,5-Trichlorophenol
Phenol, 2,4,6-trichloro-	88-06-2	2,4,6-Trichlorophenol
Phenol, 2,6-dichloro-	87-65-0	2,6-Dichlorophenol
Phenol, 3 methyl-	108-39-4	m-Cresol; 3-methylphenol
Phenol, 4-chloro-3-methyl-	59-50-7	p-Chloro-m-cresol; 4-Chloro-3-methylphenol
Phenol, 4-methyl-	106-44-5	para-Cresol; 4-methylphenol
Phenol, 4-nitro	100-02-7	4-Nitrophenol; p-Nitrophenol
Phenol, pentachloro-	87-86-5	Pentachlorophenol

Phosphorodithioic acid, 0,0-diethyl S-((ethylthio) methyl) ester	298-02-2	Phorate
Phosphorodithioic acid, 0,0-diethyl S-(2-(ethylthio) ethyl) ester	298-04-4	Disulfoton
Phosphorothioic acid, 0-(4-((dimethyl-amino)sulfonyl) phenyl)0,0-dimethyl ester	52-85-7	Famphur
Phosphorothioic acid, 0,0-diethyl 0-(4-nitrophenyl ester	56-38-2	Parathion
Phosphorothioic acid, 0,0-diethyl 0-pyrazinyl ester	297-97-2	0,0-Diethyl 0,2-pyrazinyl phosphorothioate; thionazin
Phosphorothioic acid, 0,0-dimethyl 0-(4-nitrophenyl) ester	298-00-0	Methyl parathion; Parathion methyl
Phosphorodithioic acid, 0,0-dimethyl S-(2-(methylamino)-2-oxoethyl ester	60-51-5	Dimethoate
Phosphorothioic acid, 0,0,0-triethyl ester	126-68-1	0,0,0-Triethyl phosphorothioate
Piperidine, 1-nitroso-	100-75-4	N-Nitrosopiperidine
1-Propanamine, N-nitroso-N-propyl-	621-64-7	Di-n-propylnitrosamine; N-nitrosodipropylamine, N-nitroso-N-dipropylamine
Propane, 1,2-dibromo-3-chloro	96-12-8	1,2-Dibromo-3-chloropropane; DBCP
Propane, 1,2-dichloro-	78-87-5	1,2-Dichloropropane; Propylene dichloride
Propane, 1,3-dichloro-	142-28-9	1,3-Dichloropropane; Trimethylene dichloride
Propane, 1,2,3-trichloro-	96-18-4	1,2,3-Trichloropropane
Propane, 2,2-dichloro-	594-20-7	2,2-Dichloropropane; Isopropylidene chloride
Propane, 2,2'-oxybis (1-chloro-	108-60-1	Bis(2-chloroisopropyl) ether; Bis-(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodisopropyl ether; DCIP
Propanenitrile	107-12-0	Ethyl cyanide; Propionitrile
Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	93-72-1	Silvex; 2,4,5-TP
1-Propanol, 2-methyl-	78-83-1	Isobutyl alcohol
2-Propanone	67-64-1	Acetone
2-Propenal	107-02-8	Acrolein

1-Propene, 1,1-dichloro-	563-58-6	1,1-Dichloropropene
1-Propene, 1,1,2,3,3, 3,-hexachloro-	1888-71-7	Hexachloropropene
1-Propene, 1,3-dichloro-, (E)-	10061-02-6	trans-1,3-Di-chloropropene
1-Propene, 1,3-dichloro-, (Z)-	10061-01-5	cis-1,3-Dichloropropene
1-Propene, 3-chloro-	107-05-1	3-Chloropropene; Allyl chloride
2-Propenenitrile,2-methyl	126-98-7	Methacrylonitrile
2-Propenenitrile	107-13-1	Acrylonitrile
2-Propenoic acid, 2-methyl-, methyl ester	80-62-6	Methyl methacrylate
Pyrene	129-00-0	Pyrene
Pyrrolidine, 1-nitroso-	930-55-2	N-nitrosopyrrolidine
Selenium	7782-49-2	Selenium (total)
Silver	7440-22-4	Silver (total)
Sulfide	18496-25-8	Sulfide
Thallium	7440-28-0	Thallium (total)
Tin	7440-31-5	Tin (total)
Toxaphene	8001-35-2	Toxaphene
Vanadium	7440-62-2	Vanadium (total)
Zinc	7440-66-6	Zinc (total)

*Xylene(total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).

**Chlordane: This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-chlordane (CAS RN 5103-74-2), gamma chlordane (CAS RN 5566-34-7), and constituents of chlordane (CAS RN 57-74-9 and CAS RN 12789-03-06).

(c) Groundwater elevations in monitoring wells recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a United States Geological Survey datum.

- (4) For residual landfills this characterization shall include parameters approved by the cabinet based upon the chemical analysis of the waste.
- (5) For other sites or facilities the characterization shall be for parameters determined by the cabinet.

Section 11. Groundwater Monitoring Parameters.

- (1)
- (a) Operators of Class II and Class III landfarming facilities requiring groundwater monitoring shall monitor for the following parameters on a semiannual basis: temperature, chemical oxygen demand, total organic carbon, total nitrogen, nitrate nitrogen, lead, chromium, cadmium, coliform bacteria;
 - (b) Groundwater elevations in monitoring wells recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a USGS datum; and
 - (c) Other parameters as approved by the cabinet based on the waste analysis.
- (2) Operators of residual and construction/demolition debris landfills shall monitor semiannually for the following:
- (a) Temperature, chloride, chemical oxygen demand, total dissolved solids, total organic carbon, specific conductance, pH, iron, sodium;
 - (b) Arsenic, barium, cadmium, chromium, lead, mercury, nitrate, selenium;
 - (c) Groundwater elevations in monitoring wells recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a USGS datum;
 - (d) Other parameters as approved by the cabinet based on the waste analysis; and
 - (e) If after four (4) consecutive quarterly monitoring periods, analysis for the parameters in paragraphs (a) through (d) of this subsection indicates no exceedances above levels specified in Section 8(1) of this administrative regulation, the owner or operator may, upon request, be granted permission from the cabinet to reduce the monitoring parameters to those listed in paragraph (a) of this subsection.
- (3) Operators of contained landfills shall be required to monitor quarterly for the following parameters:
- (a) Temperature, chloride, chemical oxygen demand, total dissolved solids, total organic carbon, specific conductance, pH, total organic halides, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, nitrate, selenium, silver, sodium, thallium, vanadium, and zinc;
 - (b) Acetone; acrolein; acrylonitrile; benzene; bromochloromethane; bromodichloromethane; bromoform (tribromomethane); bromomethane (methyl bromide); 2-butanone (methyl ethyl ketone); carbon disulfide; carbon tetrachloride; chlorobenzene; chlorodibromomethane (dibromochloromethane); chloroethane (ethyl chloride); 2-chloroethyl vinyl ether; chloroform (trichloromethane); chloromethane (methyl chloride); dibromomethane (methylene bromide); 1,2-dibromo-3-chloropropane (DBCP); 1,2-dibromoethane (ethylene dibromide, EDB); 1,2-dichlorobenzene (o-dichlorobenzene); 1,4-dichlorobenzene (p-dichlorobenzene); trans-1,4-dichloro-2-butene; dichlorodifluoromethane; 1,1-dichloroethane (ethylidene chloride); 1,2-dichloroethane (ethylene dichloride); cis-1,3-dichloropropene; trans-1,3-dichloropropene; ethanol; ethylbenzene; ethyl methacrylate; 2-hexanone (methyl butyl ketone); iodomethane (methyl iodide); methylene chloride (dichloromethane); 4-methyl-2-pentanone (methyl isobutyl ketone); 1,1-dichloroethene (1,1-dichloroethylene, vinylidene chloride); cis-1,2-dichloroethene (cis-1,2-dichloroethylene); trans-1,2-dichloroethene (trans-1,2-dichloroethylene); 1,2-dichloropropane (propylene dichloride); styrene; 1,1,1,2-tetrachloroethane; 1,1,2,2-tetrachloroethane; tetrachloroethylene (tetrachloroethene, perchloroethylene); toluene; 1,1,1-trichloroethane (methyl chloroform); 1,1,2-trichloroethane; trichloroethene

(trichloroethylene); trichlorofluoromethane (CFC-11); 1,2,3-trichloropropane; vinyl acetate; vinyl chloride; xylene;

(c) Groundwater elevations recorded as a distance from the elevation at the wellhead referenced to mean sea level based on a United States Geologic Survey datum;

(d) Determine the rate and direction of groundwater flow each time groundwater is sampled;

(e) Other parameters as approved by the cabinet based on the waste analysis; and

(f) If after four (4) consecutive quarterly monitoring periods, analysis for the parameters in paragraphs (a) and (b) of this subsection indicates no exceedances above the levels specified in Section 8(1) of this administrative regulation, the owner or operator may obtain permission from the cabinet to reduce the sampling program to annual sampling for parameters in paragraphs (a) and (b) of this subsection while sampling quarterly for the following:

1. Temperature;
2. Chloride;
3. Chemical oxygen demand;
4. Total dissolved solids;
5. Total organic carbon;
6. Specific conductance;
7. pH;
8. Iron;
9. Sodium; and
10. Total organic halides.

(4) Operators of residual landfills shall monitor quarterly for parameters to be determined by the cabinet based upon chemical analysis of the waste to be disposed.

(5) Other solid waste sites or facilities shall monitor for parameters and at a frequency determined by the cabinet.

(401 KAR 048:300. 16 Ky.R. 1798; 2229; 2391; eff. 5-8-1990; 21 Ky.R. 506; 1104; eff. 11-7-1994; Crt eff. 8-13-2018; TAm eff. 10-15-2018; Crt eff. 7-22-2025.)