R315. Environmental Quality, Waste Management and Radiation Control, Waste Management.

R315-308. Ground Water Monitoring Requirements.

R315-308-1. Applicability.

(1) Each existing landfill, pile, or land treatment disposal facility that is required to perform ground water monitoring shall comply with the ground water monitoring requirements according to the compliance schedule as established by the Director during the permitting or the permit renewal process.

(2) Prior to the acceptance of waste, each new landfill, pile, or land treatment disposal facility that is required to perform ground water monitoring shall have:

(a) a site specific ground water monitoring plan approved by the Director; and

(b) the ground water monitoring system complete and operational.

(3) Ground water monitoring requirements may be waived by the Director if the owner or operator of a solid waste disposal facility can demonstrate that there is no potential for migration of hazardous constituents from the facility to the ground water during the active life of the facility and the post-closure care period. This demonstration must be certified by a qualified ground-water scientist and approved by the Director, and must be based upon:

(a) site-specific field collected measurements, sampling, and analysis of physical, chemical, and biological processes affecting contaminant fate and transport; and

(b) contaminant fate and transport predictions that maximize contaminant migration and consider impacts on human health and the environment.

(4) Once a ground water monitoring system and program has been established at a disposal facility, ground water monitoring shall continue to be conducted throughout the active life, closure, and post-closure care periods as specified by the Director.

(5) A facility that has a ground water monitoring alternative approved under Subsection R315-302-1(2)(e)(vi) is subject to the standards specified in Subsection R315-303-2(1) and the approved alternative shall be revoked by the Director if the operation of the facility impacts groundwater.

R315-308-2. Ground Water Monitoring Requirements.

(1) Each facility owner or operator that is required to conduct ground water monitoring shall formulate a ground water monitoring plan that addresses the requirements of Section R315-308-2.

(2) The ground water monitoring system must consist of at

least one background or upgradient well and two downgradient wells, installed at appropriate locations and depths to yield ground water samples from the uppermost aquifer and all hydraulically connected aquifers below the facility, cell, or unit. The downgradient wells shall be designated as the point of compliance and must be installed at the closest practicable distance hydraulically down gradient from the unit boundary not to exceed 150 meters (500 feet) and must also be on the property of the owner or operator:

(a) the upgradient well must represent the quality of background water that has not been affected by leakage from the active area; and

(b) the downgradient wells must represent the quality of ground water passing the point of compliance. Additional wells may be required by the Director in complicated hydrogeological settings or to define the extent of contamination detected.

(3) All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must allow collection of representative ground water samples. Wells must be constructed in such a manner as to prevent contamination of the samples, the sampled strata, and between aquifers and water-bearing strata. All monitoring wells and all other devices and equipment used in the monitoring program must be operated and maintained so that they perform to design specifications throughout the life of the monitoring program.

(4) The ground water monitoring program must include at a minimum, procedures and techniques for:

(a) well construction and completion;

(b) decontamination of drilling and sampling equipment;

(c) sample collection;

(d) sample preservation and shipment;

(e) analytical procedures and quality assurance;

(f) chain of custody control or sample tracking, as approved by the Director; and

(g) procedures to ensure employee health and safety during well installation and monitoring.

(5) Each facility shall utilize a laboratory, that is certified by the state for the test methods used, to complete tests, using methods with appropriate detection levels, on samples for the following:

(a) during the first year of facility operation after wells are installed or an alternative schedule as approved by the Director, a minimum of eight independent samples from the upgradient and four independent samples from each downgradient well for all parameters listed in Section R315-308-4 to establish background concentrations;

(b) after background levels have been established, a minimum

of one sample, semiannually, from each well, background and downgradient, for all parameters listed in Section R315-308-4 as a detection monitoring program;

(i) In the detection monitoring program, the owner or operator must determine ground water quality at each monitoring well on a semiannual basis during the life of an active area, including the closure period, and the post-closure care period.

(ii) The owner or operator must express the ground water quality at each monitoring well in a form appropriate for the determination of statistically significant changes;

(c) field-measured pH, water temperature, and water conductivity must accompany each sample collected;

(d) analysis for the heavy metals and the organic constituents from Section R315-308-4 shall be completed on unfiltered samples; and

(e) the Director may specify additional or fewer constituents depending upon the nature of the ground water or the waste on a site specific basis considering:

(i) the types, quantities, and concentrations of constituents in wastes managed at the landfill;

(ii) the mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the landfill;

(iii) the detectability of indicator parameters, waste constituents, and reaction products in the ground water; and

(iv) the background concentration or values and coefficients of variation of monitoring parameters or constituents in the ground water.

(f) The following information shall be placed in the facility's operating record and a copy submitted to the Director as the ground water monitoring results to be included in the annual report required by Subsection R315-302-2(4):

(i) a report on the procedures, including the quality control/quality assurance, followed during the collection of the ground water samples;

(ii) the results of the field measured parameters required by Subsections R315-308-2(5)(c) and R315-308-2(7);

(iii) a report of the chain of custody and quality control/quality assurance procedures of the laboratory;

(iv) the results of the laboratory analysis of the constituents specified in Section R315-308-4 or an alternative list of constituents approved by the Director:

(A) the results of the laboratory analysis shall list the constituents by name and CAS number; and

(B) a list of the detection limits and the test methods used; and

(v) the statistical analysis of the results of the ground

water monitoring as required by Subsection R315-308-2(8).

(vi) The results of the ground water monitoring may be submitted in electronic format.

(6) After background constituent levels have been established, a ground water quality protection standard shall be set by the Director which shall become part of the ground water monitoring plan. The ground water quality protection standard will be set as follows.

(a) For constituents with background levels below the standards listed in Section R315-308-4 or as listed in Section R315-308-5, which presents the ground water protection standards that are available for the constituents listed as Appendix II in 40 CFR 258, the ground water quality standards of Sections R315-308-4 and R315-308-5 shall be the ground water quality protection standard.

(b) If a constituent is detected and a background level is established but the ground water quality standard for the constituent is not included in Section R315-308-4 or Section R315-308-5 the ground water quality protection standard for that constituent shall be set according to health risk standards.

(c) If a constituent is detected and a background level is established and the established background level is higher than the value listed in Section R315-308-4, R315-308-5 or the level established according to Subsection R315-308-2(6)(b), the ground water quality protection standard shall be the background concentration.

(7) The ground water monitoring program must include a determination of the ground water surface elevation each time ground water is sampled.

(8) The owner or operator shall use a statistical method for determining whether a significant change has occurred as compared to background. The Director will approve such a method as part of the ground water monitoring plan. Possible statistical methods include:

(a) a parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must 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 must 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; or

(e) another statistical test method approved by the Director.

(9) For both detection monitoring, as described in Subsection R315-308-2(5), and assessment monitoring, as described in Subsection R315-308-2(12), the Director may specify additional or fewer sampling and analysis events, no less than annually, depending upon the nature of the ground water or the waste on a site-specific basis considering:

(a) lithology of the aquifer and unsaturated zone;

(b) hydraulic conductivity of the aquifer and unsaturated zone;

(c) ground water flow rates;

(d) minimum distance between upgradient edge of the landfill unit and downgradient monitoring well screen (minimum distance of travel); and

(e) resource value of the aquifer.

(10) The owner or operator must determine and report the ground water flow rate and direction in the upper most aquifer each time the ground water is sampled.

(11) If the owner or operator determines that there is a statistically significant increase over background in any parameter or constituent at any monitoring well at the compliance point, the owner or operator must:

(a) within 14 days of the completion of the statistical analysis of the sample results and within 30 days of the receipt of the sample results, enter the information in the operating record and notify the Director of this finding in writing. The notification must indicate what parameters or constituents have shown statistically significant changes; and

(b) immediately resample the ground water in all monitoring wells, both background and downgradient, or in a subset of wells specified by the Director, and determine:

(i) the concentration of all constituents listed in Section R315-308-4, including additional constituents that may have been identified in the approved ground water monitoring plan;

(ii) if there is a statistically significant increase over background of any parameter or constituent in any monitoring well at the compliance point; and

(iii) notify the Director in writing within seven days of the completion of the statistical analysis of the sample results.

(c) The owner or operator may demonstrate that a source other than the solid waste disposal facility caused the

contamination or that the statistically significant change resulted from error in sampling, analysis, statistical evaluation, or natural variation in ground water quality. A report documenting this demonstration must be certified by a qualified ground-water scientist and approved by the Director and entered in the operating record. If a successful demonstration is made and documented, the owner or operator may continue monitoring as specified in Subsection R315-308-2(5)(b).

(12) If, after 90 days, a successful demonstration as stipulated in Subsection R315-308-2(11)(c) is not made, the owner or operator must initiate the assessment monitoring program required as follows:

(a) within 14 days of the determination that a successful demonstration is not made, take one sample from each downgradient well and analyze for all constituents listed as Appendix II in 40 CFR Part 258, 2001 ed., which is adopted and incorporated by reference.

(b) for any constituent detected from Appendix II, 40 CFR Part 258, in the downgradient wells a minimum of four independent samples from the upgradient and four independent samples from each downgradient well must be collected, analyzed, and statistically evaluated to establish background concentration levels for the constituents; and

(c) within 14 days of the completion of the statistical analysis of the sample results and within 30 days of the receipt of the sample results, place a notice in the operation record and notify the Director in writing identifying the Appendix II, 40 CFR Part 258, constituents and their concentrations that have been detected as well as background levels. The Director shall establish a ground water quality protection standard pursuant to Subsection R315-308-2(6) for any Appendix II, 40 CFR Part 258, constituent detected in the downgradient wells.

(d) The owner or operator shall thereafter resample:

(i) at a minimum, all downgradient wells on a quarterly basis for all constituents in Section R315-308-4, or the alternative list that may have been approved as part of the permit, and for those constituents detected from Appendix II, 40 CFR Part 258;

(ii) the downgradient wells on an annual basis for all constituents in Appendix II, 40 CFR Part 258; and

(iii) statistically analyze the results of all ground water monitoring samples.

(e) The Director may specify additional or fewer constituents depending upon the nature of the ground water or the waste on a site specific basis considering:

(i) the types, quantities, and concentrations of constituents in wastes managed at the landfill;

(ii) the mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the landfill;

(iii) the detectability of indicator parameters, waste constituents, and reaction products in the ground water; and

(iv) the background concentration or values and coefficients of variation of monitoring parameters or constituents in the ground water.

(f) If after two consecutive sampling events, the concentrations of all constituents being analyzed in Subsection R315-308-2(12)(d)(i) are shown to be at or below established background values, the owner or operator must notify the Director of this finding and may, upon the approval of the Director, return to the monitoring schedule and constituents as specified in Subsection R315-308-2(5)(b).

(13) If one or more constituents from Section R315-308-4 or the approved alternative list, or from those detected from Appendix II, 40 CFR Part 258, are detected at statistically significant levels above the ground water quality protection standard as established pursuant to Subsection R315-308-2(6) in any sampling event, the owner or operator must:

(a) within 14 days of the receipt of this finding, place a notice in the operating record identifying the constituents and concentrations that have exceeded the ground water quality standard. Within the same time period, the owner or operator must also notify the Director and all appropriate local governmental and local health officials that the ground water quality standard has been exceeded;

(b) characterize the nature and extent of the release by installing additional monitoring wells as necessary;

(c) install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well and analyze the sample for the constituents in Section R315-308-4 or the approved alternative list and the detected constituents from Appendix II, 40 CFR Part 258; and

(d) notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site as indicated by sampling of wells in accordance with Subsections R315-308-2(13)(b) and (13)(c).

(e) The owner or operator may demonstrate that a source other than the solid waste disposal facility caused the contamination or that the statistically significant change resulted from error in sampling, analysis, statistical evaluation, or natural variation in ground water quality. A report documenting this demonstration must be certified by a qualified ground-water scientist and approved by the Director and entered in

the operating record. If a successful demonstration is made, documented and approved, the owner or operator may continue monitoring as specified in Subsection R315-308-2(12)(d) or Subsection R315-308-2(12)(e) when applicable.

R315-308-3. Corrective Action Program.

(1) If, within 90 days, a successful demonstration as stated in Subsection R315-308-2(13)(e) is not made, the owner or operator must:

(a) continue to monitor as required in Subsection R315-308-2(12)(d).

(b) take any interim measures as required by the Director or as necessary to ensure the protection of human health and the environment; and

(c) assess possible corrective action measures for the current conditions and circumstances of the disposal facility, addressing at least the following:

(i) the performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control exposure to any residual contamination;

(ii) time required to begin and complete the remedy;

(iii) the costs of remedy implementation;

(iv) public health or environmental requirements that may substantially affect implementation of the remedy; and

(v) prior to the selection of a remedy, discuss the results of the corrective measures assessment in a public meeting with interested and affected parties.

(d) Based on the results of the corrective measures assessment conducted and the comments received in the public meeting, the owner or operator must select a remedy which shall be submitted to the Director.

(i) The corrective action remedy must:

(A) be protective of human health and the environment;

(B) use permanent solutions that are within the capability of best available technology;

(C) attain the established ground water quality standard;

(D) control the sources of release so as to reduce or eliminate, to the maximum extent practicable, further releases of contaminants into the environment that may pose a threat to human health or the environment; and

(E) be approved by the Director.

(ii) Within 14 days after the selection of the remedy the owner or operator must:

(A) amend the corrective action program required by Subsection R315-302-2(2)(e) if necessary and send a report to the Director for approval describing the selected remedy and

amendments, along with a schedule of implementation and estimated time of completion; and

(B) put in place the financial assurance mechanism as required by Rule R315-309 for corrective action and notify the Director of the financial assurance mechanism and its effective date.

(2) Upon approval of the selected corrective action remedy, the Director will notify the owner or operator of such approval and will require that the corrective action plan proceed according to the approved schedule.

(a) The Director may also require facility closure if the ground water quality standard is exceeded and, in addition, may revoke any permit and require reapplication.

(b) The Director or the owner or operator may determine, based on information developed after implementation of the corrective action plan, that compliance with the requirements of Subsection R315-308-3(1)(d)(i) of this section are not being achieved through the remedy selected. In such a case, the owner or operator must implement other methods or techniques, upon approval by the Director, that could practicably achieve compliance with the requirements.

(c) Upon completion of the remedy, the owner or operator shall notify the Director. The notification shall contain certification signed by the owner or operator and a qualified ground-water scientist that the concentration of contaminant constituents have been reduced to levels below the specified limits of the ground water quality standard for a period of three years or an alternative length of time specified by the Director. Upon approval of the Director the owner or operator shall:

(i) terminate corrective action measures;

(ii) continue detection monitoring as required in Subsection R315-308-2(5)(b); and

(iii) be released from the requirements of financial assurance for corrective action.

R315-308-4. Constituents for Detection Monitoring.

The table lists the constituents for detection monitoring as specified by Subsection R315-308-2(5), the CAS number for the constituents, and the ground water quality standard for the constituents for any facility that is required to monitor ground water under Rule R315-308.

TABLE

Constituents for Detection Monitoring

		Ground Water

Inorganic Constituents	CAS	Protection Standard (mg/l)
Ammonia (as N)	7664-41-7	
Carbonate/Bicarbonate		
Calcium		
Chemical Oxygen Demand (COD)		
Chloride		
Iron	7439-89-6	
Magnesium		
Manganese	7439-96-5	
Nitrate (as N		
pH		
Potassium		
Sodium		
Sulfate		
Total Dissolved Solids (TDS)		
Total Organic Carbon (TOC)		
Heavy Metals		
Antimony	7440-36-0	0.006
Arsenic	7440-38-2	0.01
Barium	7440-39-3	2
Beryllium	7440-41-7	0.004
Cadmium	7440-43-9	0.005
Chromium		0.1
Cobalt	7440-48-4	2
Copper	7440-50-8	1.3
Lead		0.015
Mercury	7439-97-6	0.002
Nickel	7440-02-0	0.1
Selenium	7782-49-2	0.05
Silver	7440-22-4	0.1
Thallium		0.002
Vanadium	7440-62-2	0.3
Zinc	7440-66-6	5
Organic Constituents		
Acetone	67-64-1	4
Acrylonitrile	107-13-1	0.1
Benzene	71-43-2	0.005
Bromochloromethane	74-97-5	0.01
Bromodichloromethane[1]	75-27-4	0.1
Bromoform[1]	75-25-2	0.1
Carbon disulfide	75-15-0	4
Carbon tetrachloride	56-23-5	0.005
Chlorobenzene	108-90-7	0.1
Chloroethane	75-00-3	15

Chloroform[1]	67-66-3	0.1
Dibromochloromethane[1]	124-48-1	0.1
1,2-Dibromo-3-chloropropane	96-12-8	0.0002
1,2-Dibromoethane	106-93-4	0.00005
1,2-Dichlorobenzene (ortho)	95-50-1	0.6
1,4-Dichlorobenzene (para)	106-46-7	0.075
trans-1,4-Dichloro-2-butene	110-57-6	
1,1-Dichloroethane	75-34-3	4
1,2-Dichloroethane	107-06-2	0.005
1,1-Dichloroethylene	75-35-4	0.007
cis-1,2-Dichloroethylene	156-59-2	0.07
trans-1,2-Dichloroethylene	156-60-5	0.1
1,2-Dichloropropane	78-87-5	0.005
cis-1,3-Dichloropropene	10061-01-5	0.002
trans-1,3-Dichloropropene	10061-02-6	0.002
Ethylbenzene	100-41-4	0.7
2-Hexanone	591-78-6	1.5
Methyl bromide	74-83-9	0.01
Methyl chloride	74-87-3	0.003
Methylene bromide	74-95-3	0.4
Methylene chloride	75-09-2	0.005
Methyl ethyl ketone	78-93-3	0.17
Methyl iodide	74-88-4	
4-Methyl-2-pentanone	108-10-1	3
Styrene	100-42-5	0.1
1,1,1,2-Tetrachloroethane	630-20-6	0.07
1,1,2,2-Tetrachloroethane	79-34-5	0.005
Tetrachloroethylene	127-18-4	0.005
Toluene	108-88-3	1
1,1,1-Trichloroethane	71-55-6	0.2
1,1,2-Trichloroethane	79-00-5	0.005
Trichloroethylene	79-01-6	0.005
Trichlorofluoromethane	75-69-4	10
1,2,3-Trichloropropane	96-18-4	0.04
Vinyl acetate	108-05-4	37
Vinyl Chloride	75-01-4	0.002
Xylenes	1330-20-7	10

[1]The ground water protection standard of 0.1 mg/l is for the total of Bromodichloromethane, Bromoform, Chloroform, and Dibromochloromethane.

R315-308-5. Solid Waste Ground Water Quality Protection Standards for 40 CFR 258 Appendix II Constituents.

The table lists the CAS number for each constituent and the ground water quality protection standards which are currently available for the 40 CFR 258 Appendix II constituents required for

assessment monitoring of ground water at a solid waste facility as specified by Subsection R315-308-2(12).

TABLE

Appendix II Protection Standards

Appendix II Constituent	CAS	Ground Water Protection Standard (mg/l)
2,4-D	94-75-7	0.07
2,4,5-T	93-76-5	0.37
2,4,5-TP	93-72-1	0.05
Anthracene	120-12-7	10
Benzo(a)pyrene	50-32-8	0.0002
bis(2-Ethylhexy)phthalate	117-81-7	0.006
Chlordane	57-74-9	0.002
Cyanide	57-12-5	0.2
Dinoseb	88-85-7	0.007
Endrin	72-20-8	0.002
Heptachlor	76-44-8	0.0004
Heptachlor epoxide	1024-57-3	0.0002
Hexachlorobenzene	118-74-1	0.001
Hexachlorocyclopentadiene	77-47-4	0.05
Lindane	58-89-9	0.0002
Methoxychlor	72-43-5	0.04
Pentachlorophenol	87-86-5	0.001
Polychlorinated biphenyls(PCBs)	1336-36-3	0.0005
Tin	7440-31-5	21.9
Toxaphene	8001-35-2	0.003
1,2,4-Trichlorobenzene	120-82-1	0.07

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