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

**R315-308. Groundwater Monitoring Requirements.**

**R315-308-1. Applicability.**

(1) Each existing solid waste management facility that is required to perform groundwater monitoring shall comply with the groundwater monitoring requirements according to the compliance schedule as established by the director during the permitting or the permit renewal process.

(2) Before the acceptance of waste, each new solid waste management facility that is required to perform groundwater monitoring shall have:

(a) a site specific groundwater monitoring plan approved by the director; and

(b) the groundwater monitoring system complete and operational.

(3) Groundwater 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 groundwater during the active life of the facility and the post-closure care period. This demonstration shall be certified by a qualified groundwater scientist and approved by the director, and shall 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 groundwater monitoring system and program has been established at a disposal facility, groundwater 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 groundwater 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. Groundwater Monitoring Requirements.**

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

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

(a) the upgradient well shall represent the background concentration that has not been affected by leakage from the active area; and

(b) the downgradient wells shall represent the quality of groundwater 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) Each monitoring well shall be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing shall allow collection of representative groundwater samples. Wells shall be constructed in a manner that prevents contamination of the samples, the sampled strata, and between aquifers and water-bearing strata. Each monitoring well and any other devices and equipment used in the monitoring program shall be operated and maintained so that they perform to design specifications throughout the life of the monitoring program.

(4) The groundwater monitoring program shall 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 finish 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 each parameter 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 each parameter listed in Section R315-308-4 as a detection monitoring program. In the detection monitoring program:

(i) the owner or operator shall determine groundwater 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; and

(ii) the owner or operator shall express the groundwater 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 shall 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.

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

(i) the types, quantities, and concentrations of constituents in wastes managed at the solid waste management unit;

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

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

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

(f) The following information shall be placed in the facility's operating record and a copy submitted to the director as the groundwater 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 and quality assurance, followed during the collection of the groundwater 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 and quality assurance procedures of the laboratory;

(iv) the results of the laboratory analysis, including a list of the detection limits and test methods used, of the constituents listed by name and CAS number specified in Section R315-308-4 or an alternative list of constituents by name and CAS number approved by the director; and

(v) the statistical analysis of the results of the groundwater monitoring as required by Subsection R315-308-2(8).

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

(6) After background constituent levels have been established, a groundwater quality protection standard shall be set by the director that shall become part of the groundwater monitoring plan. The groundwater 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 groundwater protection standards that are available for the constituents listed as Appendix II in 40 CFR 258, the groundwater quality standards of Sections R315-308-4 and R315-308-5 shall be the groundwater quality protection standard.

(b) If a constituent is detected and a background level is established but the groundwater quality standard for the constituent is not included in Section R315-308-4 or Section R315-308-5 the groundwater 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 groundwater quality protection standard shall be the background concentration.

(7) The groundwater monitoring program shall include a determination of the groundwater surface elevation each time groundwater 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 the method as part of the groundwater 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 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 that has an interval for each constituent 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 groundwater 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) groundwater flow rates;

(d) minimum distance between upgradient edge of the solid waste management unit and downgradient monitoring well screen, minimum distance of travel; and

(e) resource value of the aquifer.

(10) The owner or operator shall determine and report the groundwater flow rate and direction in the upper most aquifer each time the groundwater 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 shall:

(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 shall indicate what parameters or constituents have shown statistically significant changes; and

(b) immediately resample the groundwater in each monitoring well, both background and downgradient, or in a subset of wells specified by the director, and determine:

(i) the concentration of the constituents listed in Section R315-308-4, including additional constituents that may have been identified in the approved groundwater 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 groundwater quality. A report documenting this demonstration shall be certified by a qualified groundwater 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 shall 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 the constituents listed as Appendix II in 40 CFR Part 258, 2001 ed., which is 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 shall be collected, analyzed, and statistically evaluated to establish background concentration levels for the constituents.

(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 groundwater 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, each downgradient well on a quarterly basis for the 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 the constituents in Appendix II, 40 CFR Part 258; and

(iii) statistically analyze the results of the groundwater monitoring samples.

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

(i) the types, quantities, and concentrations of constituents in wastes managed at the solid waste management unit;

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

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

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

(f) If after two consecutive sampling events, the concentrations of the 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 shall 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 groundwater quality protection standard as established pursuant to Subsection R315-308-2(6) in any sampling event, the owner or operator shall:

(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 groundwater quality standard. Within that period, the owner or operator shall also notify the director and the appropriate local governmental and local health officials that the groundwater 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 each person who owns the land or resides 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 groundwater quality. A report documenting this demonstration shall be certified by a qualified groundwater 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) if 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

Protection Standard

Inorganic Constituents CAS (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

Bromodichloromethane1 75-27-4 0.1

Bromoform1 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

Chloroform1 67-66-3 0.1

Dibromochloromethane1 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

1The ground water protection standard of 0.1 mg/l is for

the total of Bromodichloromethane, Bromoform, Chloroform, and

Dibromochloromethane.

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

The table lists the CAS number for each constituent and the groundwater quality protection standards which are currently available for the 40 CFR 258 Appendix II constituents required for assessment monitoring of groundwater at a solid waste facility as specified by Subsection R315-308-2(12).

|  |  |  |
| --- | --- | --- |
| Table | | |
| Appendix II Constituent | CAS | Groundwater 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 |

**KEY: solid waste management, waste disposal**

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