Chapter NR 635

GROUNDWATER AND LEACHATE MONITORING STANDARDS AND CORRECTIVE ACTION REQUIREMENTS

NR 635.01 Purpose. The purpose of this chapter is to specify groundwater and leachate monitoring requirements and corrective action requirements that result from a monitoring program.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.02 Applicability. Except as provided in s. NR 635.04, the requirements of s. NR 635.16 apply to all hazardous waste landfills and surface impoundments that accepted hazardous waste after November 19, 1980 but not after July 26, 1982 and the requirements of ss. NR 635.05 to 635.15 apply to all hazardous waste landfills, surface impoundments and waste piles that accepted hazardous waste after July 26, 1982. In addition, s. NR 635.17 applies to any hazardous waste treatment, storage or disposal facility that had or should have had an interim license. This chapter does not apply to solid waste facilities that manage only non-hazardous solid waste, metallic mining wastes resulting from a mining operation as defined in s. 144.81 (5), Stats., or polychlorinated biphenyls (PCBs), except where portions of this chapter are referenced in ch. NR 157.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.03 Definitions. The definitions in s. NR 600.03 apply to this chapter.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.04 Exemptions. The requirements of this chapter do not apply to the following:

(1) Solid waste disposal facilities licensed under chs. NR 500 to 522 provided that:

(a) The solid waste disposal facility has been approved under s. NR 506.15 to accept hazardous waste only from very small quantity generators; and

(b) The solid waste disposal facility does not meet the definition of a solid waste management unit.

(2) Only non-hazardous solid waste facilities that do not meet the definition of solid waste management unit.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.05 General. (1) The owner or operator shall satisfy the following requirements for all wastes, or constituents thereof, contained in solid waste management units at the facility, regardless of the time at which waste was placed in the units:

(a) All solid waste management units shall comply with the requirements in s. NR 635.17;

(b) A surface impoundment, waste pile or landfill that receives hazardous waste after July 26, 1982 or proposes to accept hazardous waste is a regulated unit and shall comply with the requirements of ss. NR 635.05 to 635.15 in lieu of s. NR 635.16 for purposes of detecting, characterizing and responding to releases to any underlying aquifer. The financial responsibility requirements of s. NR 635.17 apply to regulated units;

(c) A surface impoundment or landfill which accepted hazardous waste after November 19, 1980 but not after July 26, 1982 is an existing unit and shall comply with the requirements of s. NR 635.16 and the financial responsibility requirements of s. NR 635.17; and

(d) The requirements of par. (b) may apply to miscellaneous units when necessary to comply with ch. NR 670.

(2) The requirements of this chapter apply during the active life of the regulated unit, including the closure period. After closure of the regulated unit, the requirements of this chapter:

(a) Do not apply if all waste, waste residues, contaminated containment system components and contaminated subsoils are removed or decontaminated at closure;

(b) Apply during the long-term care period under s. NR 685.06 if the owner or operator is conducting a detection monitoring program under s. NR 635.13; or

(c) Apply during the compliance period under s. NR 635.11 if the owner or operator is conducting a compliance monitoring program under s. NR 635.14 or a corrective action program under s. NR 635.17.

(3) The department may require the installation of a groundwater and leachate monitoring wells, suction lysimeters, moisture probes, collection basin lysimeters and similar water quality monitoring devices, and the implementation of a water quality sampling and analysis program to detect the effects of leachate on groundwater. The location of monitoring devices and the water quality monitoring program shall be approved in writing by the department.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91; am. (1) (b) and (2) (intro.), Register, August, 1992, No. 440, eff. 9-1-92.

NR 635.06 Required programs. Owners and operators subject to s. NR 635.05 (1) (b) shall conduct a monitoring and response program as follows:

(1) Except as provided in s. NR 635.13 (9), whenever hazardous constituents specified under s. NR 635.08 from a regulated unit are detected

at or beyond the design management zone under s. NR 635.10, the owner or operator shall institute a compliance monitoring program under s. NR 635.14;

(2) Except as provided in s. NR 635.14 (10), whenever the groundwater protection standard under s. NR 635.07 is exceeded, the owner or operator shall institute a corrective action program under s. NR 635.15;

(3) Except as provided in s. NR 635.14 (10), whenever hazardous constituents under s. NR 635.08 from a regulated unit exceed concentration limits under s. NR 635.09 in groundwater between the design management zone under s. NR 635.10 and the downgradient facility property boundary, the owner or operator shall institute a corrective action program under s. NR 635.15; or

(4) In all other cases, the owner or operator shall institute a detection monitoring program under s. NR 635.13.

(5) The department shall specify the specific elements of the monitoring and response program, which may include one or more of the programs identified in subs. (1) to (4) as may be necessary to protect human health and the environment. In deciding whether to require the owner or operator to be prepared to institute a particular program, the department shall consider the potential adverse effects on human health and the environment that might occur before final administrative action on a plan modification application to incorporate the program could be taken. The department shall specify the circumstances under which each of the programs shall be required.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.07 Groundwater protection standard. The owner or operator subject to the provisions of s. NR 635.05 (1) (b) shall comply with conditions specified by the department that are designed to ensure that hazardous constituents under s. NR 635.08 detected in the groundwater from a regulated unit do not exceed the concentration limits under s. NR 635.09 in any aquifer at or beyond the point of standards application under s. NR 635.10 during the compliance period under s. NR 635.11. The department shall establish this groundwater protection standard when hazardous constituents have been detected in the groundwater from a regulated unit. In no case shall a standard established under this chapter be lessstringent than an enforcement standard established under ch. NR 140.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.08 Hazardous constituents. (1) For facilities subject to s. NR 635.05 (1) (b), the department shall specify the hazardous constituents to which the groundwater protection standard of s. NR 635.07 applies. Hazardous constituents are constituents identified in appendix I of ch. NR 635, that have been detected in groundwater in any aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless the department has excluded them under sub (2).

(2) The department may exclude an appendix I constituent from the list of hazardous constituents specified in sub. (1) if it finds that the constituent is not capable of posing a substantial present or potential hazard

to human health or the environment. In deciding whether to exclude a constituent, the department shall consider the following:

(a) Potential adverse effects on groundwater quality, considering:

1. The physical and chemical characteristics of the waste in the regulated unit, including its potential for migration;

2. The hydrogeological characteristics of the facility and surrounding land;

3. The quantity of groundwater and the direction of groundwater flow;

4. The proximity and withdrawal rates of groundwater users;

5. The current and future uses of groundwater in the area;

6. The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality;

7. The potential for health risks caused by human exposure to waste constituents;

8. The potential damage to wildlife, crops, vegetation and physical structures caused by exposure to waste constituents;

9. The persistence and permanence of the potential adverse effects; and

(b) Potential adverse effects on hydraulically connected surface water quality, considering:

1. The volume and physical and chemical characteristics of the waste in the regulated unit;

2. The hydrogeological characteristics of the facility and surrounding lands;

3. The quantity and quality of groundwater, and the direction of groundwater flow;

4. The patterns of rainfall in the region;

5. The proximity of the regulated unit to surface waters;

6. The current and future uses of surface waters in the area and any water quality standards established for those surface waters;

7. The existing quality of surface water, including other sources of contamination and the cumulative impact on surface water quality;

8. The potential for health risks caused by human exposure to waste constituents;

9. The potential damage to wildlife, crops, vegetation and physical structures caused by exposure to waste constituents; and

10. The persistence and permanence of potential adverse effects.

(c) Except as provided by s. NR 140.28, no other exemption may be granted to allow a violation of ch. NR 140 enforcement standards.

(3) In making any determination under sub. (2) about the use of groundwater in the area around the facility, the department may consider the uses and potential uses of any aquifers which could be impacted

and the maintenance of the quality of the aquifers so those uses or potential uses are not threatened.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.09 Concentration limits. (1) For facilities subject to s. NR 635.05 (1) (b), the department shall specify concentration limits in the groundwater for the hazardous constituents identified under s. NR 635.08. The concentration that is specified for a hazardous constituent:

(a) May not exceed the background level of the constituent in the groundwater at the time that limit is specified in the department approval;

(b) For any of the constituents listed in table I, may not exceed the respective value given in that table if the background level of the constituent is below the value given in table I; or

(c) May not exceed an alternate concentration limit established by the department under sub. (2); and

(d) Except as provided by s. NR 140.28, may not exceed the enforcement standards established under ch. NR 140.

Table I

MAXIMUM CONCENTRATION OF CONSTITUENTS FOR GROUNDWATER PROTECTION

Arsenic	0.05 mg/l
Barium	1.0 mg/l
Benzene	0.005 mg/l
Cadmium	0.01 mg/l
Carbon Tetrachloride	0.005 mg/l
Chromium	0.05 mg/l
1,2 Dichloroethane	0.005 mg/l
1,1 Dichloroethylene	0.007 mg/l
para-Dichlorobenzene	0.075 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
1,1,1 Trichloroethane	0.20 mg/l
Trichlorethylene	0.005 mg/l
Vinyl Chloride	0.002 mg/l
Endrin (1,2,3,4,10, 10-hexachloro1,7-epoxy-1,4,4a,5,6,7,8,9a-octahydro-1, 4-endo, endo-5,8,-dimethano naphthalene)	0.0002 mg/l
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004 mg/l
Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenylethane)	0.1 mg/l

Toxaphene (C10H10C6, Technical chlorinated camphene, 67-69 percent chlorine)	0.005 mg/l
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.1 mg/l
2,4,5-TP Silvex (2,4,5-Trichlorophenoxy propionic acid)	0.01 mg/l

(2) The department may establish an alternate concentration limit for a hazardous constituent if the department finds that the constituent may not pose a substantial present or potential hazard to human health or the environment if the alternate concentration limit is not exceeded. In establishing alternate concentration limits, the department shall consider the factors listed under s. NR 635.08 (2). In no case may an alternate concentration limit be established which is inconsistent with ch. NR 140.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.10 Point of standards application. The point of standards application for facilities subject to regulation under this chapter is specified in s. NR 140.22 (2) and (3).

(1) DESIGN MANAGEMENT ZONE. The design management zone and waste boundary are defined in s. NR 140.22 (5) (a). The design management zone extends horizontally 0 feet beyond the waste boundary for facilities subject to the requirements of ss. NR 635.05 to 635.15, and 300 feet beyond the waste boundary for facilities subject to the requirements of s. NR 635.16.

(2) CHANGES TO THE DESIGN MANAGEMENT ZONE. The department may consider an expansion or reduction of the design management zone for facilities subject to the requirements of s. NR 635.16 in accordance with s. NR 140.22 (5) (b). The factors that shall be considered by the department are listed in s. NR 140.22 (5) (c) and (d). An owner or operator of a facility may submit a written request for approval of an expansion or reduction of the design management zone. the request shall include an evaluation of the factors listed in s. NR 140.22 (5) (c) and (d).

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.11 Compliance period. (1) For facilities subject to s. NR 635.05 (1) (b), the department shall specify the compliance period during which the groundwater protection standard of s. NR 635.07 applies. The compliance period is the number of years equal to the active life of the facility, including any waste management activity prior to permitting and the closure period. The compliance period begins when the owner or operator initiates a compliance monitoring program which meet the requirements of s. NR 635.14.

(2) If the owner or operator is engaged in a corrective action program at the end of the compliance period specified in sub. (1), the compliance period is extended until the owner or operator can demonstrate that the groundwater protection standard of s. NR 635.07 has not been exceeded for a period of 3 consecutive years.

(3) If the compliance period ends before the long-term care period is completed, the owner or operator shall return to detection monitoring as outlined in s. NR 635.13.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.12 General groundwater monitoring requirements. The following monitoring requirements apply to all hazardous waste landfills, surface impoundments, waste piles that accepted hazardous waste after July 26, 1982 and to other facilities where required under s. NR 600.07, 635.13 to 635.15, 640.14, 645.12, 655.11 or 670.09.

(1) The number of required wells and other sampling devices shall be approved by the department based on the site size, waste type, site design and the hydrogeologic and geologic setting of the site and shall be capable of yielding groundwater samples for analysis. At a minimum, the system shall consist of:

(a) Two or more upgradient monitoring points at locations and depths sufficient to yield groundwater samples that are representative of background water quality in the uppermost aquifer near the facility and not affected by the facility.

(b) Four or more downgradient monitoring points at locations and depths to ensure immediate detection of any statistically significant amounts of hazardous wastes or leached constituents from the facility in the uppermost aquifer. These monitoring points shall be located between the hazardous waste boundary and the property boundary as close as practical to the design management zone and shall include 2 monitoring points in a well nest configuration.

(2) The department may require 2 or more pore water sampling devices located vertically below the hazardous waste where monitoring of the unsaturated zone would aid in detecting the migration of contaminants into groundwater, and will not compromise the facility's containment capabilities.

(3) If a facility contains more than one regulated unit, separate groundwater monitoring systems are not required for each regulated unit if:

(a) The provisions for sampling groundwater in the uppermost aquifer will enable detection and measurement at the point of standards application of hazardous constituents from the regulated units that have entered the groundwater in the uppermost aquifer, and

(b) The sampling plan is approved in writing by the department.

(4) All groundwater wells and other groundwater sampling devices shall be properly developed in accordance with s. NR 660.09 (3) (j).

(5) A leachate monitoring system shall be installed, when required, within the fill area to provide accurate measurements of leachate levels and a means of obtaining representative samples of leachate quality, and shall be located and protected to minimize accidental damage during the operation.

(6) All groundwater and leachate monitoring wells and other sampling devices shall:

(a) Be constructed of suitable inert and non-contaminating material;

(b) Be constructed to prevent vertical movement of liquid along the well pipe;

(c) Be properly protected, secured and properly labeled;

(d) Have a minimum 2-inch diameter;

(e) Be cased in a manner that maintains the integrity of the monitoring well bore hole;

(f) Have a casing that is screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples, and

(g) Have the space between the bore hole and well casing above the sampling depth sealed to prevent contamination of samples and the groundwater.

(7) Elevation of the groundwater surface at each monitoring well shall be determined at least quarterly and each time a sample is obtained. Leachate level elevations for any leachate monitoring system shall, at a minimum, be measured monthly and each time a sample is obtained.

(8) The department may require the operator to attempt to sample public or private wells as part of a regular monitoring program or to determine the extent of groundwater contamination.

(9) If for any reason a monitoring well or other monitoring device is destroyed or otherwise fails to properly function, the owner or operator of the facility shall immediately notify the department in writing. All devices shall be properly abandoned in accordance with s. NR 660.13 (24) and replaced, weather permitting, with another sampling device in accordance with this section within 60 days of notification to the department unless the operator is notified otherwise in writing by the department.

(10) The owner or operator shall obtain and analyze samples from the installed groundwater monitoring system. The owner or operator shall develop and follow a groundwater sampling and analysis plan and shall keep this plan at the facility. The plan shall be approved by the department. At a minimum, the plan shall include procedures and techniques for:

(a) Sample collection;

(b) Sample preservation and shipment;

(c) Analytical procedures in accordance with standard methods for the examination of water and wastewater or other methods approved in writing by the department; and

(d) Chain of custody control.

(11) The groundwater monitoring program shall include measurement, sampling and analytical methods that are appropriate for groundwater sampling and that accurately assess groundwater quality and provide early detection of hazardous constituents entering the groundwater. The methods shall be documented in the operating record and include quality assurance and quality control procedures.

(12) An owner or operator who performs groundwater monitoring in accordance with this chapter satisfies the requirements of ch. NR 140, and is not required to evaluate groundwater monitoring through ch. NR 140, except as follows:

(a) If the background concentration established under s. NR 635.12 (13) or 635.16 (3), for a substance in table 1 or 2 of ch. NR 140, exceeds the ch. NR 140 preventive action limit or enforcement standards, the facility may apply for an exemption under s. NR 140.28.

(b) If a parameter identified under s. NR 635.13 (1) or 635.16 (2) is included in Table 1 or 2 of ch. NR 140, the notice required under ss. NR 635.13 (8) (a) and 635.16 (8) shall include a determination of whether or not the concentration exceeds the preventive action limit or the enforcement standard.

(13) Where appropriate, the groundwater monitoring program shall establish background groundwater quality for each of the hazardous constituents or monitoring parameters or constituents specified in the plan approval or license.

(a) In the detection monitoring program under s. NR 635.13, background groundwater quality for a monitoring parameter or constituent shall be based on data from quarterly sampling of all wells required under this chapter for one year prior to accepting waste.

(b) In the compliance monitoring program under s. NR 635.14, background groundwater quality for a hazardous constituent shall be based on data from upgradient wells that:

1. Is available before the plan approval or license is issued;

2. Accounts for measurement errors in sampling and analysis; and

3. Accounts, to the extent feasible, for seasonal fluctuations in background groundwater quality if the fluctuations are expected to affect the concentration of the hazardous constituent.

(c) Background quality may be based on sampling of wells that are not upgradient from the waste boundary where:

1. Hydrogeologic conditions do not allow the owner or operator to determine what wells are upgradient; or

2. Sampling at other wells shall provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells.

(d) In developing the data base used to determine a background value for each parameter or constituent, the owner or operator shall take a minimum of one sample from each well and a minimum of 4 samples from the entire system used to determine background groundwater quality, each time the system is sampled.

(14) For facilities subject to s. NR 635.05 (1) (b), the owner or operator shall use the following statistical procedure in determining whether background values or concentration limits have been exceeded:

(a) If, in a detection monitoring program, the level of a constituent at or beyond the boundary of the design management zone is to be compared to the constituent's background value and that background value has a sample coefficient of variation less than 1.00:

1. The owner or operator shall take at least 4 portions from a sample at each well at or beyond the design management zone and determine whether the difference between the mean of the constituent at each well,

using all portions taken, and the background value for the constituent is significant at the 0.05 level using Cochran's approximation to the Behrens-Fisher student's t-test, 40 CFR 264, Appendix IV, July 1, 1986. If the test indicates that the difference is significant, the owner or operator shall repeat the same procedure, with at least the same number of portions as used in the first test, with a fresh sample from the monitoring well. If this second round of analyses indicates that the difference is significant, the owner or operator shall conclude that a statistically significant change has occurred; or

Note: Cochran's approximation to the Behrens-Fisher student's t-test can be found in 40 CFR. This publication may be obtained from:

The Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

This publication is available for inspection at the offices of the department, the secretary of state, and the revisor of statutes.

2. The owner or operator may use an equivalent statistical procedure for determining whether a statistically significant change has occurred. The department shall specify a procedure if it finds that the alternative procedure reasonably balances the probability of falsely identifying a noncontaminating regulated unit and the probability of failing to identify a contaminating regulated unit in a manner that is comparable to that of the statistical procedure described in subd. 1.

(b) In all other situations in a detection monitoring program and in a compliance monitoring program, the owner or operator shall use a statistical procedure providing reasonable confidence that the migration of hazardous constituents from a regulated unit into and through the aquifer shall be indicated. The department shall specify a statistical procedure that it finds:

1. Is appropriate for the distribution of the data used to establish background values or concentrations limits; and

2. Provides a reasonable balance between the probability of falsely identifying a noncontaminating regulated unit and the probability of failing to identify a contaminating regulated unit.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91; am. (14) (a) 1., Register, August, 1992, No. 440, eff. 9-1-92; correction in (4) made under s. 13.93 (2m) (b) 7, Stats., Register, August, 1992, No. 440.

NR 635.13 Detection monitoring program. The owner or operator of a facility subject to s. NR 635.05 (1) (b) shall establish a detection monitoring program which shall comply with the following requirements:

(1) The owner or operator shall monitor for indicator parameters, such as specific conductance, total organic carbon or total organic halogen, for waste constituents, or reaction products, such as products produced by reactions between waste types and between leachate and soil, that provide a reliable indication of the presence of hazardous constituents in groundwater. The department shall specify the parameters or constituents to be monitored after considering the following factors:

(a) The types, quantities and concentrations of constituents in wastes managed at the regulated unit;

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

(c) The detectability of indicator parameters, waste constituents and reaction products in groundwater; and

(d) The concentrations or values and coefficients of variation of proposed monitoring parameters or constituents in the groundwater background.

(2) The owner or operator shall install a groundwater monitoring system at the design management zone as specified under s. NR 635.10. The groundwater monitoring system shall comply with s. NR 635.12 (1) to (11).

(3) The owner or operator shall establish a background value for each monitoring parameter or constituent required under sub (1). The owner or operator shall submit the background values to the department for approval.

(a) The owner or operator shall comply with s. NR 635.12 (13) in developing the data base used to determine background values.

(b) The owner or operator shall tabulate background values for the determination of statistically significant increases under s. NR 635.12 (14).

(c) In taking samples used in the determination of background values, the owner or operator shall use a groundwater monitoring system that complies with s. NR 635.12 (1) to (11).

(4) The owner or operator shall determine groundwater quality at each monitoring well at least quarterly during the active life of a regulated unit, including the closure period and the long-term care period. The owner or operator shall tabulate the groundwater quality at each monitoring well for the determination of statistically significant increases under s. NR 635.12 (14).

(5) The owner or operator shall determine the groundwater flow rate and direction in the uppermost aquifer at least annually.

(6) The owner or operator shall use procedures and methods for sampling and analysis that meet the requirements of s. NR 635.12 (10).

(7) The owner or operator shall determine whether there is a statistically significant change in pH or increase over background values for any parameter or constituent specified in the plan of operation approval each time the owner or operator determines groundwater quality under sub. (4).

(a) In determining whether a statistically significant change in pH or increase over background values has occurred, the owner or operator shall compare the groundwater quality at each monitoring well for each parameter or constituent to the background value for that parameter or constituent, according to the statistical procedure specified under s. NR 635.12 (14).

(b) The owner or operator shall determine whether there has been a statistically significant change in pH or increase over background values

at each monitoring well at the design management zone within 60 days after completion of sampling. The department may specify a different time period after considering the complexity of the statistical test and the availability of laboratory facilities to perform the analysis of groundwater samples.

(8) If the owner or operator determines, pursuant to sub. (7), that there is a statistically significant increase for parameters or constituents specified pursuant to sub. (1) at any monitoring well, the owner or operator shall:

(a) Notify the department of this finding in writing within 7 days. The notification shall indicate what parameters or constituents have shown statistically significant increases;

(b) Immediately sample the groundwater in all monitoring wells and determine the concentration of all constituents identified in appendix I that are present in groundwater;

(c) Establish a background value for each appendix I constituent that has been detected under par. (b) as follows:

1. The owner or operator shall comply with s. NR 635.12 (13) in developing the data base used to determine background values;

2. The owner or operator shall tabulate background values for the determination of statistically significant increases under s. NR 635.12 (14); and

3. The owner or operator shall use a groundwater monitoring system that complies with s. NR 635.12 (1) to (11) in taking samples used in the determination of background values;

(d) Within 90 days, submit to the department an application for a plan modification to establish a compliance monitoring program meeting the requirements of s. NR 635.14. The application shall include the following information:

1. An identification of the concentration of any appendix I constituents found in the groundwater at each monitoring well;

2. Any proposed changes to the groundwater monitoring system at the facility necessary to meet the requirements of s. NR 635.14, including wells, monitoring frequency, sampling and analysis procedures or methods, or statistical procedures;

3. For each hazardous constituent found in groundwater, a proposed concentration limit required under s. NR 635.09 (1) (a) or (b) or a notice of intent to seek an alternative concentration limit under s. NR 635.09 (2); and

(e) Within 180 days, submit to the department all data necessary to justify an alternative concentration limit sought under s. NR 635.09 (2) and an engineering feasibility plan for a corrective action program necessary to meet the requirements of s. NR 635.15 unless:

1. Hazardous constituents identified under par. (b) are listed in table I and their concentrations do not exceed the respective values given in that table; or

2. The owner or operator has sought an alternative concentration limit under s. NR 635.09 (2) for every hazardous constituent identified under par. (b).

(9) If the owner or operator determines, pursuant to sub. (7), that there is a statistically significant change in pH or increase in the concentration of other parameters or constituents specified pursuant to sub. (1) at any monitoring well at the design management zone, the owner or operator may demonstrate that a source other than a regulated unit caused the increase or that the increase resulted from error in sampling, analysis, evaluation or natural variation in groundwater. While the owner or operator may make a demonstration under this subsection in addition to, or instead of, fulfilling the requirements under sub. (8) (d), the owner or operator is not relieved of the requirement to submit a plan modification application within the time specified in sub. (8) (d) unless the demonstration made under this subsection successfully shows that a source other than a regulated unit caused the increase or that the increase resulted from error in sampling, analysis or evaluation. In the event that the demonstration is unsuccessful, the owner or operator shall comply with sub. (8) (b) and (c). In making a demonstration under this subsection, the owner or operator shall:

(a) Notify the department in writing that the owner or operator intends to make a demonstration under this subsection, within 7 days after determining that a statistically significant increase of parameters or constituents occurred at a monitoring well;

(b) Submit, within 90 days, a report to the department which demonstrates that a source other than a regulated unit caused the increase, or that the increase resulted from the error in sampling, analysis or evaluation;

(c) Submit, within 90 days, to the department an application for a plan modification to make any appropriate changes to the detection monitoring program at the facility; and

(d) Continue to monitor in accordance with the detection monitoring program established under this section.

(10) If the owner or operator determines that the detection monitoring program no longer satisfies the requirements of this section, the owner or operator shall, within 90 days, submit an application for a plan modification to make any appropriate changes to the program.

(11) The owner or operator shall assure that monitoring and corrective action measures necessary to achieve compliance with the groundwater protection standard under s. NR 635.07 are taken during the term of any plan approval.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91; am. (8) (e) 1., Register, August, 1992, No. 440, eff. 9-1-92.

NR 635.14 Compliance monitoring program. For facilities subject to s. NR 635.05 (1) (b), an owner or operator required to establish a compliance monitoring program under s. NR 635.13 shall, at a minimum, have the following responsibilities:

(1) The owner or operator shall monitor the groundwater to determine whether regulated units are in compliance with the groundwater protec-

tion standard under s. NR 635.07. The department shall specify the groundwater protection standard including:

(a) A list of the hazardous constituents under s. NR 635.08;

(b) Concentration limits under s. NR 635.09 for each of those hazardous constituents;

(c) The point of standards application under s. NR 635.10; and

(d) The compliance period under s. NR 635.11.

(2) The owner or operator shall install a groundwater monitoring system at the point of standards application as specified under s. NR 635.10. The groundwater monitoring system shall comply with s. NR 635.12 (1) to (11).

(3) Where a concentration limit established under par. (b) is based on background groundwater quality, the department shall specify the concentration limit as follows:

(a) If there is a high temporal correlation between upgradient and downgradient concentrations of the hazardous constituents, the owner or operator may establish the concentration limit through sampling at upgradient wells each time groundwater is sampled. The department shall specify the procedures used for determining the concentration limit in this manner. In all other cases, the concentration of the hazardous constituents shall be the mean of the pooled data on the concentration of the hazardous constituent.

(b) If a hazardous constituent is identified in appendix I and the difference between the concentration limit and the background value of that constituent under s. NR 635.12 (13) is not statistically significant, the owner or operator shall use the background value of the constituent as the concentration limit. In determining whether this difference is statistically significant, the owner or operator shall use a statistical procedure providing reasonable confidence that a real difference shall be indicated. The statistical procedure shall:

1. Be appropriate for the distribution of the data used to establish background values; and

2. Provide a reasonable balance between the probability of falsely identifying a significant difference and the probability of failing to identify a significant difference.

(c) The owner or operator shall:

1. Comply with s. NR 635.12 (13) in developing the data base used to determine background values;

2. Tabulate background values for the determination of statistically significant increases under s. NR 635.12 (14); and

3. Use a groundwater monitoring system that complies with s. NR 635.12 (1) to (11).

(4) The owner or operator shall determine the concentration of hazardous constituents in groundwater at each monitoring well at least quarterly during the compliance period. The owner or operator shall tabulate

the concentration at each monitoring well for the determination of statistically significant increases under s. NR 635.12 (14).

(5) The owner or operator shall determine the groundwater velocity and direction using new water level measurements in the uppermost aquifer at least annually.

(6) The owner or operator shall analyze samples from all monitoring wells for all constituents contained in appendix I of ch. NR 635 as specified by the department at least annually to determine whether additional hazardous constituents are present in the uppermost aquifer. If the owner or operator finds appendix I constituents in the groundwater that are not identified in the plan approval or license as hazardous constituents, the owner or operator shall report the concentrations of these additional constituents to the department within 7 days after completion of the analysis.

(7) The owner or operator shall use procedures and methods for sampling and analysis that meet the requirements of s. NR 635.12 (10).

(8) The owner or operator shall determine whether there is a statistically significant increase over the concentration limits for any hazardous constituent specified under sub. (1) each time the owner or operator determines the concentration of hazardous constituents in groundwater.

(a) In determining whether a statistically significant increase has occurred, the owner or operator shall compare the groundwater quality at each monitoring well for each hazardous constituent to the concentration limit for that constituent according to the statistical procedures specified in the plan approval or license under s. NR 635.12 (14).

(b) The owner or operator shall determine whether there has been a statistically significant increase at each monitoring well within 60 days after the completion of sampling. The department may specify a different time period after considering the complexity of the statistically test and the availability of laboratory facilities to perform the analysis of groundwater samples.

(9) If the owner or operator determines, pursuant to sub. (8), that the groundwater protection standard is being exceeded at any monitoring well, the owner or operator shall:

(a) Notify the department of this finding in writing within 7 days. The notification shall indicate what concentration limits have been exceeded.

(b) Submit to the department an application for a plan modification to establish a corrective action program meeting the requirements of s. NR 635.15 within 180 days, or within 90 days if an engineering feasibility study has been previously submitted to the department under s. NR 635.13 (8) (e). The application shall at a minimum include the following information:

1. A detailed description of corrective actions that will achieve compliance with the groundwater protection standard specified under sub. (1); and

2. A plan for a groundwater monitoring program that demonstrates the effectiveness of the corrective action. A groundwater monitoring program may be based on a compliance monitoring program developed to meet the requirements of this section.

(10) If the owner or operator determines, pursuant to sub. (8), that the groundwater protection standard is being exceeded at any monitoring well, the owner or operator may demonstrate that a source other than a regulated unit caused the increase or that the increase resulted from error in sampling, analysis or evaluation. While the owner or operator may make a demonstration under this subsection in addition to, or in lieu of, submitting a plan modification application under sub. (9) (b), the owner or operator is not relieved of the requirement to submit a plan modification application within the time specified in sub. (9) (b), unless the department finds that the demonstration made under this subsection successfully shows that a source other than a regulated unit caused the increase or that the increase resulted from error in sampling, analysis or evaluation. In making a demonstration under this subsection, the owner or operator shall:

(a) Notify the department in writing that the owner or operator intends to make a demonstration under this subsection within 7 days after determining that the groundwater protection standard is being exceeded;

(b) Submit, within 90 days, a report to the department which demonstrates that a source other than a regulated unit caused the standard to be exceeded or that the apparent noncompliance with the standards resulted from error in sampling, analysis or evaluation;

(c) Submit, within 90 days, an application to the department for a plan modification to make any appropriate changes to the compliance monitoring program at the facility; and

(d) Continue to monitor in accordance with the compliance monitoring program established under this section.

(11) If the owner or operator determines that the compliance monitoring program no longer satisfies the requirements of this section, the owner or operator shall, within 90 days, submit an application for a plan modification to make any appropriate changes to the program.

(12) The owner or operator shall assure that monitoring and corrective action measures necessary to achieve compliance with the groundwater protection standard under s. NR 635.07 are taken during the term of the department approval or term of the license.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.15 Corrective action program for hazardous waste units. An owner or operator required to establish a corrective action program under s. NR 635.14 shall comply with the following requirements:

(1) The owner or operator shall take corrective action to ensure that regulated units are in compliance with the groundwater protection standard under s. NR 635.07. The department shall specify the groundwater protection standard including:

(a) The list of the hazardous constituents identified under s. NR 635.08;

(b) The concentration limits under s. NR 635.09 for each of those hazardous constituents;

(c) The point of standards application under s. NR 635.10; and

(d) The compliance period under s. NR 635.11.

(2) The owner or operator shall implement a corrective action program that prevents hazardous constituents from exceeding their respective concentration limits at or beyond the design management zone by removing the hazardous waste constituents or treating them in place. The department may approve, conditionally approve or deny an owner or operator's corrective action plan. In a conditional approval or denial, the department may specify the corrective action measures to be taken.

(3) The owner or operator shall begin corrective action within a reasonable time period after the groundwater protection standard is exceeded. The department may specify that time period. If a department approval includes a corrective action program in addition to a compliance monitoring program, the department shall specify when the corrective action program shall begin.

(4) In conjunction with a corrective action program, the owner or operator shall establish and implement a groundwater monitoring program to demonstrate the effectiveness of the corrective action program. A monitoring program may be based on the requirements for a compliance monitoring program under s. NR 635.14 and shall be as effective as that program in determining compliance with the groundwater protection standard under s. NR 635.07 and in determining the success of a corrective action program under sub. (5) where appropriate.

(5) In addition to the other requirements of this section, the owner or operator shall conduct a corrective action program to remove or treat in place any hazardous constituents under s. NR 635.08 that exceed concentration limits under s. NR 635.09 in groundwater. The department shall specify the measures to be taken at the following locations:

(a) At or beyond the boundary of the design management zone under s. NR 635.10; and

(b) Beyond the facility boundary, where necessary to protect human health and the environment, unless the owner or operator demonstrates to the department that, despite the owner's or operator's best efforts, the owner or operator was unable to obtain the necessary permission to undertake the action. The owner or operator is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. The owner or operator is still required to take on-site measures to address the releases. The on-site measures shall be determined by the department on a case-by-case basis.

(c) Corrective action measures under this section shall be initiated and completed within a reasonable period of time considering the extent of contamination.

(d) Corrective action measures under this section may be terminated once the concentration of hazardous constituents under s. NR 635.08 is reduced to levels below their respective concentration limits under s. NR 635.09.

(6) The owner or operator shall continue corrective action measures during the compliance period to the extent necessary to ensure that the groundwater protection standard is not exceeded. If the owner or operator is conducting corrective action at the end of the compliance period, the owner or operator shall continue that corrective action for as long as

necessary to achieve compliance with the groundwater protection standard. The owner or operator may terminate corrective action measures taken beyond the period equal to the active life of the facility, including the closure period, if the owner or operator can demonstrate, based on data from the groundwater monitoring program under sub. (4), that the groundwater protection standard of s. NR 635.07 has not been exceeded for a period of 3 consecutive years.

(7) The owner or operator shall report in writing to the department of the effectiveness of the corrective action program. The owner or operator shall submit these reports semi-annually.

(8) If the owner or operator determines that the corrective action program no longer satisfies the requirements of this section, the owner or operator shall, within 90 days, submit an application for a plan modification to make any appropriate changes to the program.

(9) The owner or operator shall establish proof of financial responsibility for corrective action in accordance with a department issued order or plan approval and the requirements of ch. NR 685 and s. NR 144.443, Stats.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.16 Existing unit monitoring requirements. The following monitoring requirements apply to all landfills and surface impoundments which accepted hazardous wastes after November 19, 1980, but not after July 26, 1982 and to other facilities where required under ss. NR 600.07, 640.15, 645.12, 655.11 and 670.09.

(1) The general monitoring requirements of s. NR 635.12 (1) to (12) apply to facilities under this section.

(2) At a minimum, the owner or operator shall determine the concentration or value of the following parameters in groundwater samples in accordance with subs. (3) and (4).

(a) Parameters characterizing the suitability of the groundwater as a drinking water supply, as specified in table II;

Table II

EPA Interim Primary Drinking Water Standards

Arsenic	0.05 mg/l
Barium	1.0 mg/l
Benzene	0.005 mg/l
Cadmium	0.01 mg/l
Carbon Tetrachloride	0.005 mg/l
Chromium	0.05 mg/l
1,2 Dichloroethane	0.005 mg/l
1,1 Dichloroethylene	0.007 mg/l
para-Dichlorobenzene	0.075 mg/l
Endrin	0.0002 mg/l
Fluoride	1.4-2.4 mg/l
Lead	0.05 mg/l

Lindane	0.004 mg/l
Mercury	0.002 mg/l
Methoxychlor	0.1 mg/l
Nitrate (as N)	10.0 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Toxaphene	0.005 mg/l
1,1,1 Trichloroethane	0.20 mg/l
Trichloroethylene	0.005 mg/l
Vinyl Chloride	0.002 mg/l
2,4-D	0.1 mg/l
2,4,5-TP Silvex	0.01 mg/l
Radium	5 pCi/l
Gross Alpha	15 pCi/l
Gross Beta	4 millirem/yr
Coliform Bacteria	1/100 ml

(b) Parameters establishing groundwater quality including chloride, iron, manganese, phenols, sodium and sulfate.

(c) Parameters used as indicators of groundwater contamination, including pH, specific conductance, total organic carbon and total organic halogen.

(d) In all cases, the physical characteristics of the water sample including odor, color and turbidity shall be recorded.

(e) Any other parameters required by the department, based on the waste types accepted or other factors as appropriate.

(3) At a minimum, initial background water quality shall be established as follows:

(a) For all monitoring devices, the owner or operator shall establish initial background concentrations or values of all parameters specified in sub. (2). The owner or operator shall do this by sampling each device quarterly for one year and analyzing samples for all parameters.

(b) For each of the indicator parameters specified in sub. (2) (c) at least 4 replicate measurements shall be obtained from each quarterly sample. The initial background arithmetic mean and variance shall be determined for each indicator parameter by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from ungradient wells during the first year.

(4) After the first year, all monitoring wells and other sampling devices shall be sampled and the samples analyzed with the following minimum frequencies:

(a) Samples collected to establish groundwater quality shall be obtained and analyzed for the parameters specified in sub. (2) (b), (d) and (e) at least quarterly.

(b) Samples collected to indicate groundwater contamination shall be obtained and analyzed for the parameters specified in sub. (2) (c) and (e) at least quarterly.

(5) The owner or operator shall:

(a) Prepare an outline of a groundwater quality assessment program. The outline shall describe a comprehensive groundwater monitoring program capable of determining:

1. Whether hazardous waste or hazardous waste constituents have entered the groundwater;

2. The rate and extent of migration of hazardous waste or hazardous waste constituents in the groundwater; and

3. The concentrations of hazardous waste or hazardous waste constituents in the groundwater.

(b) For each indicator parameter specified in sub. (2) (c) or (e) calculate the arithmetic mean and variance, based on at least 4 replicate measurements on each sample, for each sampling device monitored in accordance with sub. (4) (b) and compare these results with the initial background arithmetic mean for that parameter. This comparison shall be performed in accordance with the following requirements:

1. The owner or operator shall use the student's t-test to determine statistically significant changes in the concentration or value of an indicator parameter in periodic groundwater samples when compared to the initial background concentration or value of that indicator parameter. The comparison shall consider individually each of the wells in the monitoring system. For 3 of the indicator parameters, specific conductance, total organic carbon and total organic halogen, a single-tailed student's t-test shall be used to test at the 0.01 level of significance for significant increases over background. The difference test for pH shall be a 2-tailed student's t-test at the overall 0.01 level of significance.

Note: A description of the student's t-tests, formulae for calculation of the t-statistic and tables for comparison can be found in most introductory statistics texts.

2. The department may require different statistical tests and levels of significance based on site specific hydrogeologic conditions, groundwater quality, waste characteristics and facility design and operation.

(6) At a minimum, the comparisons for the downgradient and upgradient wells made under sub. (5) (b) shall be submitted to the department by the owner or operator annually.

(7) If the comparisons for downgradient and for upgradient wells made under sub. (5) (b) show a statistically significant increase, or pH change, the owner or operator shall then immediately obtain additional groundwater samples from the downgradient wells where a significant difference was detected, split the samples in 2 or more portions, and obtain analyses of all additional samples to determine whether the significant difference was a result of laboratory error.

(8) If the analyses performed under sub. (7) confirm the statistically significant increase or pH change, the owner or operator shall provide written notice with appropriate documentation to the department

within 7 days of the date of a confirmation that the facility may be affecting groundwater quality.

(9) Within 15 days after the notification under sub. (8), the owner or operator shall develop and submit to the department a specific plan prepared under the direction of and signed by a qualified hydrogeologist, for a groundwater quality assessment program at the facility, based on determining: whether hazardous waste or hazardous waste constituents have entered the groundwater; the rate and extent of migration of hazardous waste or hazardous waste constituents in the groundwater; and the concentrations of hazardous waste or hazardous waste constituents in the groundwater.

(10) The plan to be submitted under sub. (9) shall specify the number, location and depth of wells; the number and analysis frequency of water quality parameters for those hazardous wastes or hazardous waste constituents in the facility; evaluation procedures and groundwater quality, sampling and analytical methods to be used for determining the source or cause of contamination, including use of any previously gathered groundwater quality information; facility design and construction reports, operating procedures and facility history; and a schedule of implementation.

(11) The owner or operator shall implement the groundwater quality assessment plan which satisfies the requirements of sub. (10) and department concerns and, at a minimum, determine: the source or cause of the contamination; the rate and extent of migration of the hazardous waste and hazardous waste constituents in the groundwater; the concentrations of the hazardous waste or hazardous waste constituents in the groundwater; and short and long-term potential impacts to drinking water supplies and the environment, and proposed conceptual solutions and action to bring under control and correct the environmental damage.

(12) The owner or operator shall make the determination under sub. (11) in accordance with the time schedule approved by the department; and, within 15 days after that determination, submit to the department a written report containing an assessment of the groundwater quality, cause and effect of contamination and conceptual solutions.

(13) If the owner or operator determines, based on the results of the determination under sub. (11), that no hazardous waste or hazardous waste constituents from the facility have entered the groundwater, then the owner may reinstate the indicator evaluation program described in subs. (4) and (5) (b) to (12). If the owner or operator reinstates the indicator evaluation program, the department shall be notified in the report submitted under sub. (12).

(14) If the owner or operator determines, based on the determination under sub. (11) that hazardous waste or hazardous waste constituents from the facility have entered the groundwater, then the owner or operator shall continue to make the determinations required under sub. (11) on a quarterly basis until the end of the long-term care period for the facility, or until the groundwater quality problems at the site have been corrected as provided for in the final plans; shall submit a final plan for solutions and corrective action to control and correct the environmental damage within 180 days after the department's review of submittals under sub. (12) and shall implement the final plans for solutions and corrective actions and other emergency procedures including department

review comments within 45 days after the department's review of the final plans.

(15) Any groundwater quality assessment to satisfy the requirements of sub. (11) shall be completed and reported in accordance with sub. (12).

(16) At least annually the owner or operator shall evaluate the data on groundwater surface elevations obtained under s. NR 635.12 (7) to determine whether the requirements under s. NR 635.12 (1) and (5) for locating the monitoring system continue to be satisfied. If the evaluation shows that s. NR 635.12 (1) and (5) are no longer satisfied, the owner or operator shall immediately notify the department and submit for department approval a plan to bring the monitoring system into compliance with this requirement.

(17) The owner or operator of the site or facility shall comply with the following reporting and record keeping requirements:

(a) The owner or operator shall report to the department the results of the sampling from each groundwater monitoring well required under s. NR 635.12 (1) quarterly.

(b) The owner or operator shall annually report to the department the results of the statistical evaluation required under sub. (6) and groundwater surface elevation required under sub. (16) and a description of the response, where applicable.

(c) The owner or operator implementing a groundwater quality assessment plan under sub. (11), shall annually report to the department the results of the groundwater quality assessment program which includes, but is not limited to, the rate of contaminant migration during the reporting period.

(d) An owner or operator of a site or facility shall retain, until the end of the long-term care period, all records of monitoring and analytical activities and data, including all original strip chart recordings and instrumentation, calibration and maintenance records. The owner or operator shall inform the department prior to discarding any groundwater information.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91.

NR 635.17 Corrective action for solid waste management units. (1) The owner or operator of a facility seeking a license for the treatment, storage or disposal of hazardous waste shall institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or hazardous waste constituents from any solid waste management unit at the facility, regardless of the time at which waste was placed in a unit. At a minimum, corrective action under this section shall restore contaminated soil in compliance with the requirements of ch. NR 720 and restore contaminated groundwater in compliance with the requirements of ch. NR 140.

(2) Corrective action shall be specified in the license. The license shall contain schedules of compliance for corrective action where corrective action cannot be completed prior to issuance of the license and assurances of financial responsibility for completing corrective action.

(3) The owner or operator shall implement corrective actions beyond the facility property boundary, where necessary to protect human health

and the environment, unless the owner or operator demonstrates to the satisfaction of the department that, despite the owner's or operator's best efforts, the owner or operator was unable to obtain the necessary permission to undertake actions. The owner or operator is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where offsite access is denied. On-site measures to address releases shall be determined by the department on a case-by-case basis. The owner or operator shall establish proof of financial responsibility for corrective action in accordance with a department issued order or plan approval and the requirements of ch. NR 685 and s. 144.443, Stats.

History: Cr. Register, February, 1991, No. 422, eff. 3-1-91; am. (1), Register, April, 1994, No. 460, eff. 5-1-94; am. (1), Register, March, 1995, No. 471, eff. 4-1-95.

APPENDIX I[1]

GROUNDWATER MONITORING LIST

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Acenaphthene	83-32-9	Acenaphthylene, 1,2-dihydro-	8100 8270
Acenaphthylene	208-96-8	Acenaphthylene	8100 8270
Acetone	67-64-1	2-Propanone	8240
Acetophenone	98-86-2	Ethanone, 1-phenyl-	8270
Acetonitrile; Methyl cyanide	75-05-8	Acetonitrile	8015
2-Acetylamino-fluorene; 2-AAF	53-96-3	Acetamide, N-9H-fluoren-2-yl-	8270
Acrolein	107-02-8	2-Propenal	8030 8240
Acrylonitrile	107-13-1	2-Propenenitrile	8030 8240
Aldrin	309-00-2	1,4:5,8-Dimethano-naphthalene, 1,2,3,4,10, 10-hexachloro- 1,4,4a,5, 8,8a-hexahydro- (1α,4a, 4ab,5a,8a,8ab)-	8080 8270
Allyl chloride	107-05-1	1-Propene, 3-chloro-	8010 8240
4-Aminobiphenyl	92-67-1	[1,1'-Biphenyl]-4-amine	8270
Aniline	62-53-3	Benzenamine	8270
Anthracene	120-12-7	Anthracene	8100 8270
Antimony	(Total)	Antimony	6010 7040 7041
Aramite	140-57-8	Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl) phenoxy]-1-methylethyl ester	8270
Arsenic	(Total)	Arsenic	6010 7060 7061
Barium	(Total)	Barium	6010 7080
Benzene	71-43-2	Benzene	8020 8240
Benzo[a]-anthracene; Benzanthracene	56-55-3	Benz[a]anthracene	8100 8270
Benzo[b]fluoran-thene	205-99-2	Benz[e]acephen-anthrylene	8100 8270

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Benzo[k]fluoranthene	207-08-9	Benzo[k]fluoranthene	8100 8270
Benzo[ghi]perylene	191-24-2	Benzo[ghi]perylene	8100 8270
Benzo[a]pyrene	50-32-8	Benzo[a]pyrene	8100 8270
Benzyl alcohol	100-51-6	Benzenemethanol	8270
Beryllium	(Total)	Beryllium	6010 7090 7091
alpha-BHC	319-84-6	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1a,2a,3b,4a,5b,6b)-	8080 8250
beta-BHC	319-85-7	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1a,2b,3a,4b,5a,6b)-	8080 8250
delta-BHC	319-86-8	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1a,2a,3a,4b,5a,6b)-	8080 8250
gamma-BHC; Lindane	58-89-9	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1a,2a,3b,4a,5a,6b)-	8080 8250
Bis(2-chloroethoxy)methane	111-91-1	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-	8270
Bis(2-chloroethyl)ether	111-44-4	Ethane, 1,1'-oxybis[2-chloro-	8270
Bis(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodiisopropyl ether	108-60-1	Propane, 2,2'-oxybis[1-chloro-	8010 8270
Bis(2-ethylhexyl) phthalate	117-81-7	'1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	8060 8270
Bromodichloromethane	75-27-4	Methane, bromodichloro-	8010 8240
Bromoform; Tribromomethane	75-25-2	Methane, tribromo-	8010 8240
4-Bromophenyl phenyl ether	101-55-3	Benzene, 1-bromo-4-phenoxy-	8270
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester	8060 8270
Cadmium	(Total)	Cadmium	6010 7130 7131
Carbon disulfide	75-15-0	Carbon disulfide	8240
Carbon tetrachloride	56-23-5	Methane, tetrachloro-	8010 8240
Chlordane	57-74-9	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	8080 8250
p-Chloroaniline	106-47-8	Benzenamine, 4-chloro-	8270

Appendix

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Chlorobenzene	108-90-7	Benzene, chloro-	8010 8020 8240
Chlorobenzilate	510-15-6	Benzeneacetic acid, 4-chloro-a-(4-chlorophenyl)-a-hydroxy-, ethyl ester	8270
p-Chloro-m-cresol	59-50-7	Phenol, 4-chloro-3-methyl-	8040 8270
Chloroethane; Ethyl chloride	75-00-3	Ethane, chloro-	8010 8240
Chloroform	67-66-3	Methane, trichloro-	8010 8240
2-Chloro-naphthalene	91-58-7	Naphthalene, 2-chloro-	8120 8270
2-Chlorophenol	95-57-8	Phenol, 2-chloro-	8040 8270
4-Chlorophenyl phenyl ether	7005-72-3	Benzene, 1-chloro-4-phenoxy-	8270
Chloroprene	126-99-8	1,3-Butadiene, 2-chloro-	8010 8240
Chromium	(Total)	Chromium	6010 7190 7191
Chrysene	218-01-9	Chrysene	8100 8270
Cobalt	(Total)	Cobalt	6010 7200 7201
Copper	(Total)	Copper	6010 7210
m-Cresol	108-39-4	Phenol, 3-methyl-	8270
o-Cresol	95-48-7	Phenol, 2-methyl-	8270
p-Cresol	106-44-5	Phenol, 4-methyl-	8270
Cyanide	57-12-5	Cyanide	9010
2,4-D; 2,4-Dichlorophenoxy-acetic acid	94-75-7	Acetic acid, (2,4-dichlorophenoxy)-	8150
4,4'-DDD	72-54-8	Benzene 1,1'-(2,2-dichloroethylidene)bis[4-chloro-	8080 8270
4,4'-DDE	72-55-9	Benzene, 1,1'-(dichloro-ethenylidene)bis[4-chloro-	8080 8270
4,4'-DDT	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene) bis[4-chloro-	8080 8270
Diallate	2303-16-4	Carbamothioic acid, bis(1-methylethyl)- , S-(2,3-dichloro-2-propenyl) ester	8270
Dibenz[a,h]-anthracene	53-70-3	Dibenz[a,h]anthracene	8100 8270
Dibenzofuran	132-64-9	Dibenzofuran	8270

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Dibromochloromethane; Chlorodibromomethane	124-48-1	Methane, dibromochloro-	8010 8240
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	Propane, 1,2-dibromo-3-chloro-	8010 8240 8270
1,2-Dibromoethane Ethylene dibromide	106-93-4	Ethane, 1,2-dibromo-	8010 8240
Di-n-butyl phthalate	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester	8060 8270
o-Dichlorobenzene	95-50-1	Benzene, 1,2-dichloro-	8010 8020 8120 8270
m-Dichlorobenzene	541-73-1	Benzene, 1,3-dichloro-	8010 8020 8120 8270
p-Dichlorobenzene	106-46-7	Benzene, 1,4-dichloro-	8010 8020 8120 8270
3,3'-Dichlorobenzidine	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-	8270
trans-1,4-Dichloro-2-butene	110-57-6	2-Butene, 1,4-dichloro-, (E)-	8240
Dichlorodifluoromethane	75-71-8	Methane, dichlorodifluoro-	8010 8240
1,1-Dichloroethane	75-34-3	Ethane, 1,1-dichloro-	8010 8240
1,2-Dichloroethane; Ethylene dichloride	107-06-2	Ethane, 1,2-dichloro-	8010 8240
1,1-Dichloroethylene; Vinylidene chloride	75-35-4	Ethene, 1,1-dichloro-	8010 8240
trans-1,2-Dichloroethylene	156-60-5	Ethene, 1,2-dichloro-, (E)-	8010 8240
2,4-Dichlorophenol	120-83-2	Phenol, 2,4-dichloro-	8040 8270
2,6-Dichlorophenol	87-65-0	Phenol, 2,6-dichloro-	8270
1,2-Dichloropropane	78-87-5	Propane, 1,2-dichloro-	8010 8240
cis-1,3-Dichloropropene	10061-01-5	1-Propene, 1,3-dichloro-, (Z)-	8010 8240
trans-1,3-Dichloropropene	10061-02-6	1-Propene, 1,3-dichloro-, (E)-	8010 8240
Dieldrin	60-57-1	2,7:3,6-Dimethanonaphth[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)-	8080 8270
Diethyl phthalate	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester	8060 8270

Appendix

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester	8270
Dimethoate	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2 (methylamino)-2-oxoethyl] ester	8270
p-(Dimethylamino) azobenzene	60-11-7	Benzenamine, N,N-dimethyl-4-(phenylazo)-	8270
7,12-Dimethylbenz[a]anthracene	57-97-6	Benz[a]anthracene, 7,12-dimethyl-	8270
3,3'-Dimethylbenzidine	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-	8270
alpha, alpha-Dimethylphenethylamine	122-09-8	Benzeneethanamine, a,a-dimethyl-	8270
2,4-Dimethylphenol	105-67-9	Phenol, 2,4-dimethyl-	8040 8270
Dimethyl phthalate	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester	8060 8270
m-Dinitrobenzene	99-65-0	Benzene, 1,3-dinitro-	8270
4,6-Dinitro-o-cresol	534-52-1	Phenol, 2-methyl-4,6-dinitro-	8040 8270
2,4-Dinitrophenol	51-28-5	Phenol, 2,4-dinitro-	8040 8270
2,4-Dinitrotoluene	121-14-2	Benzene, 1-methyl-2,4-dinitro-	8090 8270
2,6-Dinitrotoluene	606-20-2	Benzene, 2-methyl-1,3-dinitro-	8090 8270
Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-	8150 8270
Di-n-octyl phthalate	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester	8060 8270
1,4-Dioxane	123-91-1	1,4-Dioxane	8015
Diphenylamine	122-39-4	Benzenamine, N-phenyl-	8270
Disulfoton	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl]ester	8140 8270
Endosulfan I	959-98-8	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)	8080 8250
Endosulfan II	33213-65-9	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro- 1,5,5a,6,9 9a-hexahydro-, 3-oxide, (3a,5aa,6b,9b,9aa)-	8080

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Endosulfan sulfate	1031-07-8	6,9-Methano-2,4,3-benzo-dioxathiepin, 6,7,8,9,10, 10-hexachloro-1,5,5a,6,9, 9a-hexahydro-,3,3-dioxide	8080 8270
Endrin	72-20-8	2,7:3,6-Dimethanonaphth-[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)	8080 8250
Endrin aldehyde	7421-93-4	1,2,4-Metheno-cyclopenta-[cd]pentalene-5-carboxaldehyde, 2,2a,3,3,4,7-hexachlorodecahydro-, (1a,2b,2ab,4b,4ab,5b, 6ab,6bb,7R*)	8080 8270
Ethylbenzene	100-41-4	Benzene, ethyl-	8020 8240
Ethyl methacrylate	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester	8015 8240 8270
Ethyl methanesulfonate	62-50-0	Methanesulfonic acid, ethyl ester	8270
Famphur	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino) sulfonyl]phenyl]-O,O dimethyl ester	8270
Fluoranthene	206-44-0	Fluoranthene	8100 8270
Fluorene	86-73-7	9H-Fluorene	8100 8270
Heptachlor	76-44-8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro- 3a,4,7,7a-tetrahydro-	8080 8270
Heptachlor epoxide	1024-57-3	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)	8080 8270
Hexachlorobenzene	118-74-1	Benzene, hexachloro-	8120 8270
Hexachlorobutadiene	87-68-3	1,3-Butadiene, 1,1,2,3, 4,4-hexachloro-	8120 8270
Hexachlorocyclopentadiene	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-	8120 8270
Hexachloroethane	67-72-1	Ethane, hexachloro-	8120 8270
Hexachlorophene	70-30-4	Phenol, 2,2'-methylenebis[3,4,6 trichloro-	8270
Hexachloropropene	1888-71-7	1-Propene, 1,1,2,3,3,3-hexachloro-	8270
2-Hexanone	591-78-6	2-Hexanone	8240

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Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Indeno(1,2,3-cd)pyrene	193-39-5	Indeno[1,2,3-cd]pyrene	8100 8270
Isobutyl alcohol	78-83-1	1-Propanol, 2-methyl-	8015
Isodrin	465-73-6	1,4,5,8-Dimethano-naphthalene,1,2,3,4,10, 10-hexachloro-1,4,4a,5, 8,8a hexahydro-(1a,4a, 4ab,5b,8b,8ab)-	8270
Isophorone	78-59-1	2-Cyclohexen-1-one, 3,5,5-trimethyl-8270	8090
Isosafrole	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-	8270
Kepone	143-50-0	1,3,4-Metheno-2H-cyclobuta- [cd]pentalen 2-one, 1,1a,3,3a,4,5,5, 5a,5b,6-decachloroocta hydro	8270
Lead	(Total)	Lead	6010 7420 7421
Mercury	(Total)	Mercury	7470
Methacrylo-nitrile	126-98-7	2-Propenenitrile, 2-methyl-	8015 8240
Methapyrilene	91-80-5	1,2,Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-	8270
Methoxychlor	72-43-5	Benzene, 1,1'-(2,2,2,trichloroethyl-idene)bis[4-methoxy-	8080 8270
Methyl bromide; Bromomethane	74-83-9	Methane, bromo-	8010 8240
Methyl chloride; Chloromethane	74-87-3	Methane, chloro-	8010 8240
3-Methylchol-anthrene	56-49-5	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-	8270
Methylene bromide; Dibromomethane	74-95-3	Methane, dibromo-	8010 8240
Methylene chloride; Dichloromethane	75-09-2	Methane, dichloro-	8010 8240
Methyl ethyl ketone; MEK	78-93-3	2-Butanone	8015 8240
Methyl iodide; Iodomethane	74-88-4	Methane, iodo-	8010 8240
Methyl methacrylate	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester	8015 8240
Methyl methane-sulfonate	66-27-3	Methanesulfonic acid, methyl ester	8270
2-Methyl-naphthalene	91-57-6	Naphthalene, 2-methyl-	8270
Methyl parathion; Parathion methyl	298-00-0	Phosphorothioic acid, O,O-dimethyl O-(4-nitro-phenyl) ester	8140 8270
4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1	2-Pentanone, 4-methyl-	8015 8240

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Naphthalene	91-20-3	Naphthalene	8100 8270
1,4-Naphthoquinone	130-15-4	1,4-Naphthalenedione	8270
1-Naphthylamine	134-32-7	1-Naphthalenamine	8270
2-Naphthylamine	91-59-8	2-Naphthalenamine	8270
Nickel	(Total)	Nickel	6010 7520
o-Nitroaniline	88-74-4	Benzenamine, 2-nitro-	8270
m-Nitroaniline	99-09-2	Benzenamine, 3-nitro-	8270
p-Nitroaniline	100-01-6	Benzenamine, 4-nitro-	8270
Nitrobenzene	98-95-3	Benzene, nitro-	8090 8270
o-Nitrophenol	88-75-5	Phenol, 2-nitro-	8040 8270
p-Nitrophenol	100-02-7	Phenol, 4-nitro-	8040 8270
4-Nitroquinoline 1-oxide	56-57-5	Quinoline, 4-nitro-, 1-oxide	8270
N-Nitrosodi-n-butylamine	924-16-3	1-Butanamine, N-butyl-N-nitroso-	8270
N-Nitrosodiethylamine	55-18-5	Ethanamine, N-ethyl-N-nitroso-	8270
N-Nitrosodimethylamine	62-75-9	Methanamine, N-methyl-N-nitroso-	8270
N-Nitrosodiphenylamine	86-30-6	Benzenamine, N-nitroso-N-phenyl-	8270
N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	1-Propanamine, N-nitroso-N-propyl-	8270
N-Nitrosomethylethylamine	10595-95-6	Ethanamine, N-methyl-N-nitroso-	8270
N-Nitrosomorpholine	59-89-2	Morpholine, 4-nitroso-	8270
N-Nitrosopiperidine	100-75-4	Piperidine, 1-nitroso-	8270
N-Nitrosopyrrolidine	930-55-2	Pyrrolidine, 1-nitroso-	8270
5-Nitro-o-toluidine	99-55-8	Benzenamine, 2-methyl-5-nitro-	8270
Parathion	56-38-2	Phosphorothioic acid, O,O-diethyl-O (4-nitrophenyl) ester	8270
Polychlorinated biphenyls; PCBs	See 6	1,1'-Biphenyl, chloro derivatives	8080 8250
Polychlorinated dibenzo-p-dioxins; PCDDs	See 7	Dibenzo[b,e][1,4]dioxin, chloro derivatives	8280
Polychlorinated dibenzofurans; PCDFs	See 8	Dibenzofuran, chloro derivatives	8280

Appendix

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Pentachlorobenzene	608-93-5	Benzene, pentachloro-	8270
Pentachloroethane	76-01-7	Ethane, pentachloro-	8240 8270
Pentachloronitrobenzene	82-68-8	Benzene, pentachloronitro-	8270
Pentachlorophenol	87-86-5	Phenol, pentachloro-	8040 8270
Phenacetin	62-44-2	Acetamide, N-(4-ethoxyphenyl)	8270
Phenanthrene	85-01-8	Phenanthrene	8100 8270
Phenol	108-95-2	Phenol	8040 8270
p-Phenylenediamine	106-50-3	1,4-Benzenediamine	8270
Phorate	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester	8140 8270
2-Picoline	109-06-8	Pyridine, 2-methyl-	8240 8270
Pronamide	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2 propynyl)-	8270
Propionitrile; Ethyl cyanide	107-12-0	Propanenitrile	8015 8240
Pyrene	129-00-0	Pyrene	8100 8270
Pyridine	110-86-1	Pyridine	8240 8270
Safrole	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-	8270
Selenium	(Total)	Selenium	6010 7740 7741
Silver	(Total)	Silver	6010 7760
Silvex; 2,4,5-TP	93-72-1	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-	8150
Styrene	100-42-5	Benzene, ethenyl-	8020 8240
Sulfide	18496-25-8	Sulfide	9030
2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-	8150
2,3,7,8-TCDD; 2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-	8280
1,2,4,5-Tetrachlorobenzene	95-94-3	Benzene, 1,2,4,5-tetrachloro-	8270
1,1,1,2-Tetrachloroethane	630-20-6	Ethane, 1,1,1,2-tetrachloro-	8010 8240
1,1,2,2-Tetrachloroethane	79-34-5	Ethane, 1,1,2,2-tetrachloro-	8010 8240

Common name[2]	CAS RN[3]	Chemical abstracts service index name[4]	Suggested methods[5]
Tetrachloro-ethylene; Perchloroethylene; Tetrachloroethene	127-18-4	Ethene, tetrachloro-	8010 8240
2,3,4,6-Tetra-chlorophenol	58-90-2	Phenol, 2,3,4,6-tetra-chloro-	8270
Tetraethyl di-thiopyro-phosphate; Sulfotepp	3689-24-5	Thiodiphosphoric acid ([(HO)2P(S)]2O),tetra-ethyl ester	8270
Thallium	(Total)	Thallium	6010 7840 7841
Tin	(Total)	Tin	7870
Toluene	108-88-3	Benzene, methyl-	8020 8240
o-Toluidine	95-53-4	Benzenamine, 2-methyl-	8270
Toxaphene	8001-35-2	Toxaphene	8080 8250
1,2,4-Trichloro-benzene	120-82-1	Benzene, 1,2,4-trichloro-	8270
1,1,1-Trichloro-ethane; Methyl-chloroform	71-55-6	Ethane, 1,1,1-trichloro-	8240
1,1,2-Trichloro-ethane	79-00-5	Ethane, 1,1,2-trichloro-	8010 8240
Trichloro-ethylene; Trichloroethene	79-01-6	Ethene, trichloro-	8010 8240
Trichlorofluoro-methane	75-69-4	Methane, trichlorofluoro-	8010 8240
2,4,5-Trichloro-phenol	95-95-4	Phenol, 2,4,5-trichloro-	8270
2,4,6-Trichloro-phenol	88-06-2	Phenol, 2,4,6-trichloro-	8040 8270
1,2,3-Trichloro-propane	96-18-4	Propane, 1,2,3-trichloro-	8010 8240
O,O,O-Triethyl phosphorothioate	126-68-1	Phosphorothioic acid, O,O,O-triethyl ester	8270
sym-Trinitro-benzene	99-35-4	Benzene, 1,3,5-trinitro-	8270
Vanadium	(Total)	Vanadium	6010 7910 7911
Vinyl acetate	108-05-4	Acetic acid, ethenyl ester	8240
Vinyl chloride	75-01-4	Ethene, chloro-	8010 8240
Xylene (total)	1330-20-7	Benzene, dimethyl-	8020 8240
Zinc	(Total)	Zinc	6010 7950

[1]The regulatory requirements pertain only to the list of substances; the right hand column (Methods) is given for informational purposes only. See also footnote 5.

[2]Common names are those widely used in government regulations, scientific publications and commerce; synonyms exist for many chemicals.

[3]Chemical Abstracts Service registry number. Where "Total" is entered, all species in the groundwater that contain this element are included.

[4]CAS index names are those used in the 9th Cumulative Index.

[5]Suggested Methods refer to analytical procedure numbers used in EPA Report SW-846 "Test Methods for Evaluating Solid Waste", third edition, November 1986. Analytical details can be found in SW-846 and in documentation on file with EPA. CAUTION: The methods listed are representative SW-846 procedures and may not always be the most suitable method or methods for monitoring an analyte under the regulations. Note: The publication SW-846 may be obtained from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161

[6]Polychlorinated biphenyls (CAS RN 1336-36-3); this category contains congener chemicals, including constituents of Aroclor-1016 (CAS RN 12674-11-2), Aroclor-1221 (CAS RN 11104-28-2), Aroclor-1232 (CAS RN 11141-16-5), Aroclor-1242 (CAS RN 53469-21-9), Aroclor-1248 (CAS RN 12672-29-6), Aroclor-1254 (CAS RN 11097-69-1), and Aroclor-1260 (CAS RN 11096-82-5).

[7]This category contains congener chemicals, including tetrachlorodibenzo-p-dioxins (see also 2,3,7,8-TCDD), pentachlorodibenzo-p-dioxins, and hexachlorodibenzo-p-dioxins.

[8]This category contains congener chemicals, including tetrachlorodibenzofurans, pentachlorodibenzofurans and hexachlorodibenzofurans. The PQL shown is an average value for PCDF congeners.