EPA Region 10 Guidance For WQBELs

Below Analytical Detection/Quantitation Level

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Background

EPA is charged with issuing NPDES permits which assure compliance with water quality standards. In more and more situations, especially those that concern metals, water quality-based effluent limitations (WQBELs) are set below analytical detection limits.

Currently, a wide variety of approaches are used by EPA Regions and NPDES-authorized States to establish compliance with WQBELs, including the imposition of method detection limits (MDLs), practical quantification limits (PQLs), limits of detection (LODs), and/or setting levels as an unspecified non-detect. All these different approaches share the same basis, that is, the need to establish a concentration in the permit that can be measured for evaluating compliance.

EPA headquarters has offered guidance in the form of the *Final Guidance on Section 304(l): Listing and Permitting of Pulp and Paper Mills* (march 15, 1989); *Strategy for the Regulation of Discharges of PCDDs and PCDFs from Pulp and Papaer Mills to Waters of the United States* (May 21, 1990); and the March 1991 *Technical Support Document for Water Quality-based Toxics Control*. These guidance documents recommend that where calculated WQBELs are below detection levels, the calculated WQBEL should be included as a permit requirement and that the permit writer specify the minimum level (ML) as the compliance level in permits that limit dioxin. In addition, in March 1994, EPA headquarters proposed a draft *National Guidance for the Permitting, Monitoring, and Enforcement of Water Quality-based Effluent limitations Set Below Analytical Detection/Quantitation Levels*. EPA Headquarters has received a significant number of comments on the recommendations in their draft guidance. As of March 1996, the guidance has not been finalized. (See Attachment No. 1 for a discussion of MDLs, Mls, and interim Mls).

Issue

For Region 10, one of the troubling aspects of this suspended draft guidance is the recommendation to have the permittee report as “zero” on the discharge monitoring report (DMR) any value below the ML. Eight main questions arise out of the implementation and enforcement of WQBELs set below the analytical detection limits:

1. For water quality-impaired streams, should the compliance level be the MDL or the ML?

2. If WQBELs are set below detection limits, what other conditions should be included in the permit to help determine compliance with the WQBEL (e.g., sediment monitoring, bioaccumulation monitoring, etc.)?

3. How should the ML be rounded?

4. How will the calculation for receiving water concentration be conducted if the only available data is equal to or greater than the ML, instead of all data above the MDL, as is currently used? How will the loss of information be accounted for when "zeros" are recorded on the DMRs?

5. Should the ML be put into the permit? Or should Mls be used strictly as an enforcement discretion tool by compliance officers?

6. Because method detection levels (MDLs) are determined expermintally in the lab, how should interim Mls be used when each lab may have different MDLs and therefore different Mls? Should only published Mls be used?

7. How will PCS be used to track WQBEL's set below the analytical detection limit?

8. Should MDLs be specified when requireing ambient monitoring in a permit?

Permit writers and compliance officers, need to make informed decisions with a scientific basis. Informed decisions need to based, as much as possible, on actual data. Results reported as "zero" are not analytical results and do not constitute actual data. However, based on the definition of MDL, as given in 40 CFR 136, Appendix B, results less than the MDL should be used as "zero" in calculations.

Solution

To address these issues, the following procedures will be used:

1. Incorporate the calculated WQBEL into the permit.

2. Incorporate MDLs into the permit as the analytical level to be achieved; this will ensure that the laboratory is using the most sensitive analytical test method available. The fact sheet should discuss MDSs. Use analytical methods that have MDLs published for them (i.e., 200.7, 200.9). Under the Quality Assurance Project Plan section of the permit, have the permtitee specify the methods they will use to reach the required MDLs Note: Under Method 200.9, specify graphite furnace, i.e., Methods 239.2, 241.2, etc.

   The permit should state that actual analytical results should be reported on the DMR when the results are greater than the MDL; if the analytical results are less then the MDL then the permittee should report "less than <MDL number>" on the DMR.

3. Incorporate the Interim ML[1] (or published ML, if available) in the permit for EPA to use as a compliance evaluation level.

4. The ML or Interim ML wil be the "limit" entered into PCS as the level to determine compliance. Actual analytical results should be reported on the DMR when the results are greater than the MDL; if the analytical results are less than the MDL then the permittee should report "less than <MDL number>" on the DMR.

5. If the permit has WQBELs below the analytical detection level the permit writer should consider incorporating one or more (as appropriate) of the following into the permit:

   a. Include limits for internal wastestreams (See Appendix E of *National Guidance for the Permitting, Monitoring, and Enforcement of WQBELs Set Below Analytical Detection Level*).

   b. Include a mass loading limit as well as a concentration based limit. Mass-based limits are particularly important for control of bioconcentratable pollutants. Concentration-based limits will not adequately control discharges of these pollutants if the effluent concentrations are below detection levels. For these pollutants, controlling mass loadings to the receiving water is critical for preventing adverse environmental impacts.

      Mass-based effluent limits alone may not assure attainment of water quality standards in waters with low dilution. In these waters, the quantity of effluent discharged has a strong effect on the instream dilution and therefore upon the RWC. At the extreme case of a stream that is 100 percent effluent, it is the effluent concentration rather than the effluent mass discharge that dictates the instream concentration. Therefore, EPA recommends that permit limits on both mass and concentration be specified for effluents discharging into waters with less tha 100 fold dilution to ensure attainment of water quality standards (*TSD* pg. 100).

   c. Sediment Studies/Sediment Toxicity Tests. Sediment provides habitat for many aquatic organisms and is a major repository for many of the more persistent chemicals that are introduced into surface waters. Mounting evidence exists of environmental degration in areas where water quality criteria are not exceeded, yet organisms in or near sediments are adversely affected. Contaiminated sediments may be directly toxic to aquatic life or can be a source of contaminants for bioaccumulation in the food chain (*Puget Sound Estuary Program, Puget Sound Protocols*, EPA/910/9-86/157).

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[1]ML = MDL x 3.18

Laboratory tests have been developed which obtain a direct measure of sediment toxicity or bioaccumulation. The objective of the sediment test is to determine whether contaminants in sediment are harmful to or are bioaccumulated by benthic organisms (*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, EPA/600/R-94/024; *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods*, EPA/600/R-94/025).

d. Bioaccumulation Study. This would include fish tissue studies (*EPA Method 200.11, Determination of Metals in Fish Tissue by Inductively Coupled Plasma Atomic Emission Spectrometry*). While not appropriat ina ll cases, bioaccumulation studies can provide baseline data from which to help assess the validity of the effluent limitations. If there are no fish species which reside full-time in the vicinity of the discharge, caged mussel studies could be used.

6. The EPA headquarter Office of Water has described how the ML should be rounded: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, etc. However, due to the way metals are calibrated, in certain cases they may be rounded to the nearest whole number rather than to some multiple of 2-10.

7. When conducting reasonable potential calculations and water quality-based effluent limitations, all data reported as above the published MDL should be used in the calculations. Data which is reported as less than {MDL number} should be used as “zero” in calculations.

8. Some permittees may be unable to meet the specified MDLs due to matrix interferences. EPA believes that it is important to distiguish between instances when MDLs are not achieved due to poor laboratory technique and when matrix interferences do, in fact, occur. To make this determination, the permittee must follow the guidelines and procedures set forth in 40 CFR 136.

   If it is determined that there are matrix interferences which preclude the facility from achieving the MDL specified in the final permit, the permit may be reopened and the MDLs can be modified accordingly. Section IV.F. of the permit allows the permit to be reopened for cause.

   EPA has guidelines by which permittees may request discharge-specific MDLs. Information on how to determine matrix interference is contained in *Guidance on Evaluation, Resolution, and Documentation of Analytical Problems Associated with Compliance Monitoring*, June 1993 [EPA 821-B-93-001, Monitoring Guidance].

9. Where permit limits are above the MDL, the permit should specify the MDL which should be achieved. In this case, the MDL should be 5-10 times lower than the permit limit specified.

10. To ensure quality data, MDLs should also be specified for ambient monitoring requirements.

Philip G. Millam, Acting Director
Office of Water

Date

EXAMPLE PERMIT LANGUAGE

I. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND SPECIAL REQUIREMENTS.

A. Specific Limitations, monitoring Requirements and special Requirements.

1. During the period beginning on the effective date of this permit and lasting until the expiration date, discharges from Outfall 001 are authorized to _____ Creek in accordance with the following effluent limitations and monitoring requirements:

EFFLUENT PARAMETERS	EFFLUENT LIMITATIONS[1]		MONITORING REQUIREMENTS[2,3]	
	MONTHLY AVERAGE	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
Flow, CFS	---	---	Continuous Recording	
pH	6.5 to 9.5 Standard Units		Daily	Grab
Hardness as $CaCO_3$, mg/L	---	---	Weekly	Grab
Total Suspended solids, mg/L	20	30	Weekly	Grab
Temperature, EC	---	---	Daily	Grab
Aluminum (Al)[4], µg/L	71	143	Weekly	Grab
Arsenic (As)[4], µg/L	0.1	0.3	Weekly	Grab
Cadmium (Cd)[4], µg/L	13.8	27.6	Weekly	Grab
Mercury (Hg)[5], µg/L	0.01	0.02	Weekly	Grab
Zinc (Zn)[4], µg/L	27.4	55	Weekly	Grab

1. Effluent limitations shall be met prior to discharging to _____ Creek.
2. Samples for monitoring requirements shall be taken after the last treatment step and prior to being discharged to _____ Creek.
3. For additional monitoring and reporting requirements see Part I.A.2.
4. These parameters shall be analyzed as total recoverable.
5. Mercury shall be analyzed as total.

2. Additional Monitoring and Reporting Requirements:

a. For TSS, pH and hardness the permittee shall use the test methods approved in Methods for Chemical Analysis of Water and Wastes, (EPA-600/4-79/020).

b. The effluent limits for arsenic and mercury are not quantifiable using EPA approved analytical methods. EPA has determined that it will use the interim minimum level as the compliance evaluation

level for these parameters.

The permittee shall conduct analyses using methods approved in 40 CFR 136. The analytical method detection limit or range of analytical method detection limits outlined in the table below shall be achieved for each specified parameter.

Parameter[1,2]	Method Detection Limit (µg/L)	Interim Minimum Level
Aluminum	7.8 - 14	N/A
Arsenic	0.5	2
Cadmium	0.05 - 2	N/A
Mercury	0.2	0.5
Zinc	2 - 5	N/A

1. Mercury shall be analyzed as total. All other parameters shall be analyzed and reported as total recoverable.
2. See Section I.G.1.b., Quality Control Project Plan.

c. For purposes of reporting on the Discharge Monitoring Report (DMR), if a value is less than the method detection level, the permittee shall report "less than {numerical method detection level}" on the DMR. For example, if the laboratory reports "not detected" for a sample and states that the MDL is "5 µg/L" then the permittee shall report "less than 5 µg/L" on the DMR.

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G. Quality Assurance Project Plan: **(NOTE: This is example language only; the entire QAPP is not incorporated into this example; permit writers should include the most current language).**

1. The permittee shall develop Quality Assurance Project Plans (QAPPs). The purpose of the QAPPs shall be to assist in planning for the collection and analysis of environmental samples in support of the permit and in explaining data anomalies when they occur.

a. Throughout all sample collection and analysis activities, the permittee shall use the EPA-approved quality assurance, quality

control, and chain-of-custody procedures described in Interim Guidelines and Specifications For Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980. The permittee's QAPPs shall be prepared in the format which is specified in QAMS-005/80. The following two references may be helpful in preparing the QAPPs for this permit:

You and Quality Assurance in Region 10, EPA, Region 10, Quality and Data management Program, march 1988.

Example format and Critical Elements of Quality Assurance Plan, EPA, Region 10, Quality and Data Management Program.

b. The QAPPs shall include details on the number of samples, type of sample containers, preservation of samples and holding times for each target compound; the type and number of quality assurance field samples, precision and accuracy requirements, sample preparation requirements, sample shipping methods, and laboratory data delivery requirements.

The QAPPs shall identify the test methods that will be used to achieve the MDLs specified in part I.A.2.b. for each target compound.

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H. Definitions

1. Method Detection Limit (MDL) - The minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined by a specific laboratory method 940 CFR 136).

2. Minimum Level (ML) - the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes and processing steps have been followed.

3. Interim Minimum Level - The interim minimum level is calculated when a method specified ML does not exist. It is equal to 3.18 times the method specified MDL.

NOTE: If ambient monitoring is required, specify the method detection limits that should be achieved for each parameter.

EXAMPLE FACT SHEET LANGUAGE -
FOR WQBELS BELOW THE QUANTITATION LEVEL:

A. Effluent Monitoring

Water qualtiy-based effluent limits (WQBELs) have been incorporated into the permit to protect State water qualtiy standards. Some WQBELs fall below the capabilit of current analytical technology to detect and/or quantify the parameters. The major issues associated with these water quality based llimits are:

- How will the effluent be monitored to ensure that analytical methods used in effluent monitoring measure the lowest accurately quantifyable level possible;
- How will analytical results be reported when data fall below detection levels; and
- How will compliance be determined with effluent limits that fall below detection levels.

In March 1994 EPA Headquarters developed draft guidance to address these issues, and has received a significant number of comments on the recommendations in their guidance. As of March 1996, EPA Headquarters has not finalized the guidance. (NOTE: The permit writer should update this section as necessary).

In the interim, EPA Region 10 has developed internal guidance for permit writers and compliance officers to address the issues of implementing and enforcing effluent limits that are below the analytical quantitiation levels.

For WQBELs below the quantitiation level, the principle recommendations in Region 10's guidance are as follows:

1. WQBELs will be incorporated into the permit.

2. The interim ML or ML will be used as the complaince evaluation level.

3. The inability to measure to the necessary level of detection is addressed by establishing the minimum level (ML) as the quantification level for use in laboratory analysis.

   EPA believes that the use of the ML as an analytical chemistry performance standard provides an unambiguius and rational means to demonstrate that the best chemistry available at the time of permit issuance is being used.

The ML is defined as the lowest concentration that gives recognizable signals and an acceptable calibration point. It is the equivalent concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes and processing steps have been followed. MLs are analyte and method specific and are established during the development and validation of the method.

4. In the absence of promulgated MLs, Interim MLs should be used. EPA believes that Interim ML values can be derived most effectively as a multiple of the existing Method Detection Limit[1] (MDL) value for a given analyte. The Interim ML is calculated as 3.18 times the published MDL for the analyte for a specific analytical method approved under Section 304(h) or previously approved for use by the permitting authority.

5. The permit should require that actual analytical results be reported whenever the analytical results are greater than the MDL. When analytical results are less than the MDL the results should be reported as {less than MDL}.

6. In order to ensure that the laboratory is using the most sensitive analytical methods available to evaluate the effluent or ambient water sample, the permit should specify the MDLs that need to be achieved.

   The permit should also specify the MDL that should be achieved for those effluent limitations that are above the MDL. In these cases, the MDL should be 5-10 times lower than the effluent limitation.

7. Under the Quality Assurance Project Plan in the permit, the permittee should specify the 40 CFR 136 analytical test methods that will be used to achieve the required MDLs for each parameter.

8. If the permit has WQBELs below the analytical detection/quantitation level, the permit writer should consider incorporating one or more of the following into the permit: limits for internal wastestreams; mass loading limits; sediment studies/sediment toxicity tests; bioaccumulation study.

9. To ensure quality data from ambient monitoring, MDLs should be specified for ambient monitoring requirements.

The following table provides a summary of the parameters, the effluent Maximum Daily Limit, the effluent Average Monthly Limit, the method detection limits and Interim Minimum Level applicable to this permit based on the guidance above:

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[1]Method Detection Limit - the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined by a specific laboratory method (40 CFR 136).

Parameter	Average Monthly Limit, µg/L	Maximum Daily Limit, µg/L	Method Detection Limit to be achieved[1]	Interim Minimum Level
Aluminum	71	143	7.8 - 14	N/A
Arsenic	0.1	0.3	0.5	2
Cadmium	14	28	0.05 - 3	N/A
Mercury	0.01	0.02	0.2	0.5
Zinc	27	55	2 - 5	N/A

1. The permittee must use an approved 40 CFR 136 test method to achieve the method detection limit. In some cases, such as aluminum, the permittee is allowed a range that the method detection level should fall within.