DEPARTMENT OF HEALTH

How to Interpret Drinking Water Lab Results

When it comes to contaminants, water professionals want to provide the best quality water possible. Understanding the significance of the various types of limitations mentioned on laboratory reports enables operators to make informed decisions based on water quality data.

Knowing whether a contaminant is truly undetectable or simply not quantifiable can help operators have a better understanding of a result and what the limits on laboratory reports mean about what's in their samples.

The MDH public health lab (PHL) and private laboratories use the following terms for reporting water quality results:

Method Detection Limit (MDL), according to the US Environmental Protection Agency (EPA), is the lowest measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results. The MDL is a statistical calculation based on measured concentrations, most recently revised by EPA in 2016 (EPA 821-R-16-006).

Practical Quantitation Level (PQL) is the level above the detection limit where most laboratories can achieve quantitation with acceptable uncertainty.

Table 1. Regulatory Terminology with Explanations

Different regulations, analytical methods, and labs may use different terminology.

Type of limit	Explanation
	Dependent on Method
Method Detection Limit (MDL)	A statistical calculation that determines the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable.
Limit of Detection (LOD)	The lowest concentration that can be distinguished from zero.
Limit of Quantitation (LOQ)	The lowest concentration that can be determined with acceptable accuracy and precision, indicating a specified degree of confidence.
Practical Quantitation Limit (PQL)	The lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operation conditions-generally three times the lowest level standard.
	Dependent on How Data Will Be Used
Minimum Reporting Limit (MRL)	The lowest concentration that the laboratory must report for the method, which is usually determined by regulatory agency requirements. Generally, three times the PQL or two to five times the MDL.
Lowest Concentration Minimum Reporting Level (LCMRL)	The lowest true concentration for which the future recovery is predicted to fall, with high confidence (99%), between 50% and 150% recovery.
	Determined by Regulatory Agency
Regulatory Limit	The legal limit for a contaminant reflects the level that protects human health and that water systems can achieve using the best available technology.

Other Definitions

Definitions from the Environmental Laboratory Quality Assurance Manual

Reporting Limit

The lowest concentration that can be reported as a quantifiable value for a target analyte in a sample after analysis. Typically, this defined concentration cannot be lower than the concentration of the lowest calibration standard for that analyte, and it can only be utilized if the analyte's quality control standards are met. Reporting limit can and do change.

Examples: The lead concentration decreased from 5.0 µg/L to 0.5 µg/L.

Method Detection Level (MDL)

The Smallest amount of an analyte that the lab is 99% confident of "seeing", if it exists. For further information on how the MDL was determined, see [EPA: 40 CFR 136 App (PDF) (https://www.epa.gov/sites/default/files/2016-12/documents/mdl-procedure_rev2_12-13-2016.pdf)](https://www.epa.gov/sites/default/files/2016-12/documents/mdl-procedure_rev2_12-13-2016.pdf).

Note that the predicted MDL value has not been analytically verified.

Quality Assurance/Quality Control (QA/QC) Information

As shown on the Batch B710540 information for a nitrate sample, there are five sections. This is the information included with the result that is sent to systems.

Results were produced by Minnesota Department of Health, except where noted.

Batch B7I0540 - General Chemistry Prep

Blank (B7I0540-BLK1) — **Prepared: 09/28/17 08:51 Analyzed: 09/28/17 12:44**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Init.	Qualifiers
Nitrate + Nitrite Nitrogen, Total	<	0.05	mg/L							KAC	

LCS (B7I0540-BS1) — **Prepared: 09/28/17 08:51 Analyzed: 09/28/17 12:45**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Init.	Qualifiers
Nitrate + Nitrite Nitrogen, Total	5.0		mg/L	5		101	90-110			KAC	

Duplicate (B7I0540-DUP1) — Source: 17I1144-01 — **Prepared: 09/28/17 08:51 Analyzed: 09/28/17 12:47**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Init.	Qualifiers
Nitrate + Nitrite Nitrogen, Total	<	0.05	mg/L		<				10	KAC	

Duplicate (B7I0540-DUP2) — Source: 17I1145-01 — **Prepared: 09/28/17 08:51 Analyzed: 09/28/17 12:49**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Init.	Qualifiers
Nitrate + Nitrite Nitrogen, Total	<	0.05	mg/L		<				10	KAC	

Matrix Spike (B7I0540-MS1) — Source: 17I1146-01 — **Prepared: 09/28/17 08:51 Analyzed: 09/28/17 12:52**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Init.	Qualifiers
Nitrate + Nitrite Nitrogen, Total	5.1		mg/L	5		102	90-110			KAC	

Blank – This is a method blank. It is laboratory reagent water that goes through the same process as a sample. It is serves as a negative control, ensuring that our procedure does not show evidence of contamination or produce false positives. For the laboratory to say that there are no concerns, the blank must be less than the reporting level of 0.05 ng/L.

LCS – This is a blank spike, or laboratory control sample. It is laboratory reagent water fortified with a known amount of nitrate + nitrite standard and subjected to the same testing procedures as a sample. It is used as a positive control to guarantee that the approach works efficiently and accurately. To achieve acceptance standards, the recovery of the known addition must be between 90 and 110% of the true value.

Duplicate1, Duplicate2 – A duplicate is a laboratory replication of an environmental sample. It is used to measure the method's precision, ensuring that we can consistently deliver the same result within the 10% relative percent difference tolerance.

Matrix Spike – This is a positive control sample created from field samples that have gone through the full process. It is comparable to an LCS, where a known amount of standard is added, and a recovery is required.

Resources

Definition and Procedure for the Determination of the Method Detection Limit, Revision 2. US Environmental Protection Agency. 2016. EPA 821-R-16-006.

Sanders PF, Lippincott RL, Eaton A. Determining Quantitation Levels for Regulatory Purposes. 1996. Journal AWWA. 88 :3:104*. https://awwa.onlinelibrary.wiley.com/doi/10.1002/j.1551-8833.1996.tb06523.x*

Kimbrough DE, Cardenas M, Eaton A, et al. Setting IOC Reporting Limits for Drinking Water Compliance—The California Approach. 2004. Journal AWWA. 96:9:56. https://awwa.onlinelibrary.wiley.com/doi/10.1002/j.1551-8833.2004.tb10703.x

Oxenford JL, McGeorge LJ, Jenniss SW. Determination of Practical Quantitation Levels for Organic Compounds in Drinking Water. 1989. *Journal AWWA*. 81:4:149. https://awwa.onlinelibrary.wiley.com/doi/10.1002/j.1551-8833.1989.tb03193.x

Keith LH, Crummett W, Deegan J Jr,et al. Principles of Environmental Analysis. 1983. *Analytical Chemistry*. 55:14:2210. https://pubs.acs.org/doi/abs/10.1021/ac00264a003

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Updated: January 30, 2024

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