

METHOD DETECTION LIMIT (MDL)

The Method Detection Limit is a statistically derived value representing the minimum concentration of a substance, in a given matrix, that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

The MDL is a theoretical number and is determined by following EPA's 40 CFR Part 136 "Procedure for the Determination of the Method Detection Limit". The procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type.

A range may be provided for an MDL. This may be due to several reasons:

- 1) Several instruments may be used for the same method.

Example: VOAs (600 Series Test Codes) Method EPA 624 MDLs

Test Code	Constituent	Instrument and MDL (µg/L)		
		Varian Saturn 3	Varian 2200	LECO Pegasus IV
601	Methylene Chloride	0.15	0.13	0.12
602	Chloroform	0.13	0.16	0.12
604	Carbon Tetrachloride	0.20	0.18	0.15

Given this information, the Template shows a range for the MDLs as follows:

Test Code	Constituent	MDL (µg/L)
601	Methylene Chloride	0.12 – 0.15
602	Chloroform	0.12 – 0.16
604	Carbon Tetrachloride	0.15 – 0.20

- 2) The analysis may be assigned to one of several laboratories.

Example: Surfactants (MBAS) Test Code 315, Method SM5540C MDLs

Test Code	Laboratory	MDL (µg/L)
315	SJCAPL	0.014
315	Lancaster TPL	0.05
315	Weck Laboratories	0.023

Given this information, the Template shows a range for the MDLs as follows:

Test Code	Constituent	MDL (µg/L)
315	Surfactants (MBAS)	0.014 – 0.05

MINIMUM LEVEL (ML AKA MINIMUM LIMIT)

- 1) The Minimum Level represents the lowest concentration at which an analyte can be measured with a known level of confidence. For analysis procedures that utilize a calibration curve, the ML represents the lowest standard concentration in the calibration curve for a specific analytical technique after the application of appropriate method-specific factors.
- 2) The ML is determined either by the method, the State Implementation Plan [SIP, Appendix 4, SWRCB Minimum Levels in ppb ($\mu\text{g/L}$)], the permit, or the Quality Assurance Manager per a Method Validation study.
- 3) Commercial laboratories must be able to meet all required methodologies and MLs. When special MLs are requested or required, the Districts must pre-arrange with the commercial lab to meet any extraordinary requirements.
- 4) On the templates, the ML is often the same as the RL but does not change with changing circumstances, e.g., dilution factors and concentration factors.

REPORTING LIMIT (RL)

- 1) The RL is the lowest standard concentration in the calibration curve adjusted for sample dilution or concentration.
- 2) For tests without a calibration curve, the RL represents the lowest level that can be reliably achieved within limits of precision and accuracy during routine laboratory operating conditions.
- 3) The RL is determined by the method or the Quality Assurance Manager per a Method Validation study.
- 4) Generally, if the RL is different for samples and tests analyzed by the same laboratory and analysis method, it is due to a matrix problem that requires sample dilution, or there was insufficient sample available to use the typical aliquot size. For example, chloride will interfere with a metals analysis by ICP-MS. Samples collected from the San Gabriel River estuary station are brackish and must always be diluted due to the high concentration of chloride in the samples. Therefore, you will see a range for these RLs on QA's method detection limits template.
- 5) A different analysis method could also result in different RLs. For example, if our lab analyzed metals by ICP-MS for one sample, and ICP-OES for another sample, the RLs will be different. But both RLs must be within the regulatory requirements. This scenario typically only occurs if there is a problem with an instrument. In this case, one would see a range on QA's method detection limits template.
- 6) Two instruments can have different RLs. For example, perhaps a lab has two ICP-MS instruments, but has determined the titanium RL on one to be 2 ppb but 5 ppb on the other. If the regulatory limit is 50 ppb, the lab could use either instrument but the reported RLs would be different and one would see a range on QA's method detection limits template.

REFERENCES

Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California [State Implementation Plan (SIP)], State Water Resources Control Board, California EPA, Appendix 4, 2005, DM5 Document No. 715433.

Quality Assurance Program of the Sanitation Districts of Los Angeles County, Laboratories Section Quality Assurance, Version 08.1.0, May 2008, DM5 Document No. 975385. See sections 14.1.3, 14.1.4, 15.2, Appendix I, and Appendix J.