

# Updated Environmental Testing Criterion

In this white paper Element engaged expert, John Rigdon, will guide you through the new Method Detection Limit (MDL) performance criterion for chemical analysis as outlined in EPA 40 C.F.R. Part 136 published on August 8, 2017.

## What is the new Method Detection Limit (MDL)?

The new Method Detection Limit (MDL) went into effect September 27, 2017. Its definition has changed from “The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero...” to “The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.”

## What has changed?

The MDL now requires that the samples used to calculate the MDL are representative of laboratory performance throughout the year, rather than on a single date. A laboratory has the option to pool data from multiple instruments to calculate one MDL that represents multiple instruments.

## Why do we need it?

EPA considers this change important because as detector sensitivity improves, the background contamination of the laboratory, consumable supplies, and equipment can be more important in determining the detection limit than the sensitivity of the instrument. Methods of detection are only as valuable as their ability to analyze for each analyte. How do we determine how well a method analyzes for an analyte? One way is to look at the MDL. The concept of a detection limit has been a topic of debate for a long time in the environmental industry. Therefore, confusion arises when different detection limits, determined by different analysts on different instruments, are compared and sometimes interchanged. While the former and the new MDL procedure use the same statistical calculations, the new MDL better accounts for variability in prep and analysis over time. In addition, the new procedure safeguards against contributions from method blank analyses by adding a MDL blank determination to the procedure. So as stated above, the MDL is now defined as:

“The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.”

## Specifics of the New Procedure

The MDL value (MDLs) still is calculated from the analysis of a sample matrix spiked with a low concentration of target analyte (the sample matrix is typically a clean reference matrix, such as reagent water). With the new procedure, the initial MDLs preparation and/or analysis is carried out over time with at least two replicates per day over three days and a minimum of seven replicates total. The MDLs calculation has not changed from the original MDL calculation.

Method blank samples are used to calculate the new method blank MDL (MDLb) where the initial MDLb calculation is very similar to the MDLs calculation. For initial MDLb determination, historical data can be used as long as at least two blank values can be derived from three separate day's analyses.

For initial MDL determination, the MDL will be the greater of the determined MDLs and MDLb for each analyte.

To perform annual MDL verifications, analyze at least two MDLs and MDLb replicates per quarter per instrument with at least seven MDLs and MDLb samples analyzed per year. Recalculate MDLs and MDLb from the collected results. Alternatively MDLb can be calculated using the 99th percentile of all method blank results analyzed over a two year time period; at a minimum for the 99th percentile calculation, use method blank data from the previous six months or the most recent fifty results, whichever is greater.

To complete the annual verification, compare the higher of the calculated MDLs and MDLb values to the existing MDL value for each analyte. If the comparison is within a factor of 0.5 to 2.0 of the existing MDL, then the existing MDL is considered acceptable and may be left unchanged. For this method of determination to be acceptable, no more than three percent of the method blank results used in the determination can be above the existing MDL value.

## How does this affect you?

- It is now necessary to calculate two MDL values, MDLs and MDLb. The higher value becomes your actual MDL.
- MDL spike data now will be collected quarterly and method blank data will be accumulated year round.
- The MDL can be determined across multiple instruments for a given analyte under the same method as opposed to calculating a separate MDL for each instrument/method/analyte combination.

## Exceptions

The MDL procedure is not applicable to methods that do not produce results with a continuous distribution, such as, but not limited to, methods for whole effluent toxicity, presence/absence methods, and microbiological methods that involve counting colonies. The MDL procedure also is not applicable to measurements such as, but not limited to, biochemical oxygen demand, color, pH, specific conductance, many titration methods, and any method where low-level spiked samples cannot be prepared.

Except as described in the addendum, for the purposes of this procedure, “spiked samples” are prepared from a clean reference matrix, such as reagent water and spiked with a known and consistent quantity of the analyte. MDL determinations using spiked samples may not be appropriate for all gravimetric methods (e.g., residue or total suspended solids), but an MDL based on method blanks can be determined in such instances.

## Conclusion

In conclusion, the new MDL procedure is designed to take into account the variability of analyses over time and the effects of normal background using a combination of spiked and method blank data. While this paper provided an overview of the MDL process, please consult the full MDL procedure found in EPA 40 C.F.R. Part 136, Appendix B and any reference methods. If you have additional questions, consult your management staff and remember this is just one piece of your environmental quality program.