

Large Sample Volume Effect on Detection Levels

The EPA defines the MDL as the "minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Laboratories determine method detection limits by running 7 replicated analysis, at the low point of their initial calibration, using standard sample deviation. These analysis are matrix, analyst, instrument and method specific.

A one liter volume is usually used to determine the MDL for trace organics in water analysis methods. Once these values are determined they are inserted into the laboratory calculation formula spread sheets which apply factors to calculate the sample concentrations which are based on sample volume used, and extract volume concentrations. The MDL will be multiplied by a factor and will "float" up or down with the sample volumes or extract volumes used as well as dilutions to keep the extract solution concentration within the initial calibration range. Often laboratories will report RL reporting Limits, or PQL practical reporting limits. These values are usually 3 to 5 times the MDL, and represent a practical and routinely achievable quantitation limit with a high degree of certainty. These values will also float up or down proportional to the calculation factors determined by the volumes of the sample and extract volumes.

Below are three examples demonstrating MDL and PQL changing, based on a fixed extract solution concentration at 10ug/l with the extract volume of 1 ml, and the sample volumes varying from 100 mls to 100,000 mls.

Example #1 MDL base

Extract concentration = 10 ug/l

Sample volume = **1000 ml**

Extract volume = 1 ml

Sample concentration 0.01 ug/l

MDL 0.01 ug/l

PQL 0.03 ug/l

Example #2 Low sample volume

Extract concentration = 10 ug/l

Sample volume = **100 ml**

Extract volume = 1ml

Sample concentration 0.1 ug/l

MDL 0.10ug/l

PQL 0.30ug/l

Example #3 high sample volume

Extract concentration = 10 ug/l

Sample volume = **100,000 ml**

Extract volume = 1ml

Sample concentration 0.0001 ug/l

MDL 0.0001ug/l

PQL 0.0003ug/l