

Detection Limit/Quantitation Limit Summary Table

	DETECTION LIMIT (e.g., MDL, PLD, DL, LOD)	QUANTITATION LIMIT (e.g., ML, PLQ, MRL, LLOQ)	COMMENTS	UNCERTAINTY	REFERENCES
PROGRAM					
OST - Office of Water (Wastewater)	MDL(40 CFR Part 136)	ML (40 CFR Part 136)	As of 06-21-2010, OST is reevaluating Detection and Quantitation in CWA programs.		40 CFR Part 136
OGWDW - Office of Water (Drinking Water)	MDL (40 CFR Part 136)	MRL. - LCMRL values from individual laboratories are used to generate the MRL.	Note: Ongoing effort to reduce the use of DL.	MQOs as targets for method development and approval. Organic methods bias (recovery) should be $\pm 30\%$ for levels $> MRL$ and $\pm 50\%$ for levels $\leq MRL$. The method precision should be $\leq 20\%$ RSD. For inorganic analyses bias targets of $\pm 20\%$ are used.	40 CFR Part 136

OSWER - Solid Waste (SW-846 Methods)	No MDL procedure.	LLOQ - typically established as the lowest point of quantitation which, in most cases, is the lowest concentration in the calibration curve. A LLOQ verification is recommended for each project application to validate quantitation capability at low analyte concentration levels. This verification may be accomplished either with clean control material (e.g., reagent water, solvent blank, Ottawa sand) or a representative sample matrix (free of target compounds). Optimally, the LLOQ should be less than or equal to the desired action levels based on the stated project-specific requirements.	Remove suggested MDLs and MDL determination from SW-846 methods, and use only LLOQ.	The LLOQ check is carried through the same preparation procedures as the environmental samples and other QC. Recovery should be $\pm 50\%$ (or other such project-required acceptance limits for accuracy and precision) of the true value to verify the data reporting limits(s).	
OSWER - CLP	MDL(40 CFR Part 136)	CRQL : Minimum level of quantitation acceptable under the contract Statement of Work (SOW)	For inorganic SOW ILM05.4, ISM01.2, and organic SOM01.2		40 CFR Part 136; USEPA CLP SOW for Inorganic Analysis Multi-Media, Multi-Concentration, and Inorganic Superfund Methods, and Organics Analysis Multi-Media, Multi-Concentration

OEM - Office of Emergency Management, Env. Response Laboratory Network (ERLN)	MDL (40 CFR Part 136)	LOQ - Based on Lowest Calibration Standard.			
ORD - Water Methods	DL - Determination of a detection limit is optional and only required if results below the lowest concentration calibration standard are used. Laboratory fortified blanks (LFBs) are prepared at a concentration to give a S/N of 2/5. The samples are prepared and analyzed. The DL is the Student t value for the 99% confidence level at n-1 degrees of freedom, times the standard deviation of the replicate measurements.	MRL - is a concentration that is no lower than the lowest level calibration standard and is determined from analysis of seven replicate LFBs. The MRL is confirmed if the upper and lower limits of the half range of the prediction interval, calculated as the standard deviation of the replicate LFBs times 3.963, are within 50% of the mean result for the seven replicates.	For Methods 332.0, 521, and 535, the MDL or DL can be calculated from the minimum reporting level (MRL) confirmation data set. The MRL conc. is determined from the analysis of 7 replicate LFB's and is not lower than the lowest level calibration standard. For Method 528, 529, 556.1, the procedure described for the determination mirrors that given in Method 332.0 and Method 521, except that use of the MRL confirmation data set is not offered as an alternative to the preparation and analysis of seven LFBs over three days.		40 CFR Part 136
ORD - NERL	LOD - The LOD is calculated by multiplying the standard deviation of results from 10 injections of low concentration samples by 3.	LOQ - The LOQ is determined using water samples spiked at a low concentration to give a coefficient of variation of less than 15%. The quality control limit used for the coefficient of variation is 20%.		LOQ - The LOQ is determined using water samples spiked at a low concentration to give a coefficient of variation of less than 15%. The quality control limit used for the coefficient of variation is 20%.	

ORD - NHEERL Analytical Chemistry Core	MDL - DQFAC Single Laboratory DL-QL Procedure (ver. 2.4)(FACDQ10-13): 3 x std dev of 7 low concentration replicates analyzed over 3 days.	LOQ (LRL) - 10 x std dev obtained in MDL study		± 25% to ± 15% with 95% confidence	NHEERL Analytical Chemistry Core Operating Procedures
ORD - Marine Methods	MDL (40 CFR Part 136)		Performed during initial demonstration of proficiency using 40 CFR 136 Appendix B with replicates distributed through out a group of typical samples.		ORD Marine Methods
OPPTS - Office of Pesticide Programs BEAD/Analytical Chemistry Branch (ACB)	LOD - Samples fortified with analytes at "low" concentrations are prepared and analyzed. S/N is calculated and LOD is 3 x S/N	LOQ -Samples fortified with analytes at "low" concentrations are prepared and analyzed. S/N is calculated and LOQ is 10 x S/N	Alterantive LOD: The concentration of the lowest calibration standard is treated as the LOQ and the LOD is often assumed to be 1/3 of the LOQ. The lowest possible LOD and LOQ values are not critical in these cases. The rationale of this approach is that the expected analyte concentrations in the samples are high and above the lowest calibration concentration and knowledge of the actual LOD/LOQ is not necessary.		

	<p>LOD - The concentration of the lowest calibration standard is treated as the LOQ and the LOD is often assumed to be 1/3 of the LOQ. The lowest possible LOD and LOQ values are not critical in these cases. The rationale of this approach is that the expected analyte concentrations in the samples are high and above the lowest calibration concentration and knowledge of the actual LOD/LOQ is not necessary.</p>	<p>LOQ - The compound's calibration curve is applied to the noise response of a sample. The LOQ is 10 x N.</p>			
<p>OPPTS - Office of Pesticide Programs BEAD/ACB Pesticide Residue methods</p>		<p>LOQ - estimated as 6 to 10 x standard deviation of the noise, verified with analysis of 5 replicates at two fortification levels plus two control samples. Data should be generated for two fortification levels appropriate to the proposed LOQ and likely residue levels or 10 x LOQ.</p>			

OPPTS - Office of Pesticide Programs BEAD/ACB Pesticide Data Program	LOD - $3 \times N$; calculated by multiplying the response of the method noise by approx. 3 and converting to concentration.	LOQ - equals $10 \times$ noise. LOQ is calculated by multiplying the response of the method noise level by at least ten and then converting the total response to a concentration - or by multiplying LOD $\times 10/3$ if LOD is $3 \times$ noise. For mass spectrometry qualitative analysis, the LOQ shall be at least $3 \times S/N$. For MS Quantitation Analysis, the LOQ shall be			
OPPTS - Office of Pesticide Programs BEAD/ACB USDA IR-4 Project	LOD - 10% below the smallest concentration within the standard curve				
OAR - Stationary Source/Ambient Air	DL - $3 \times$ the standard deviation [S_0] of the blank level	LLOQ - Lower limit of quantitation defined as $10 \times$ the standard deviation (S_0) at the blank level	If estimated PLQ is $> 2 \times$ calculated PLQ, prepare two additional standards at lower concentrations than used in making the initial calculation. Sample and analyze these two standards seven times. Calculate S_0 for each concentration. Graph S_0 vs Conc. Determine best-fit straight line and extrapolate to zero concentration. PLQ is $10 \times S_0$ at zero concentration.		Method 301 (40 CFR 63, Appendix A), Reference Committee on Environmental Monitoring of the American Chemical Society Analytical Chemistry December 1980

<p>OECA - Office of Criminal Enforcement, Forensics, and Training/National Enforcement Investigations Center</p>	<p>LOD/MDL - A variety of methods are employed to calculate the LOD/MDL, depending on the technique, matrix, and data quality objectives. These may be applied for a technique, or for a set of analysis. Methods include, but are not limited to a.) Calculating the MDL by determined the standard deviation and multiplying this value by the Student-t value for a 95% confidence interval for n-1 samples. b) Using 40 CFR Part 136, Appendix B as guidance, but determine the MDL as applicable to procedure.</p>	<p>LOQ - Similar to the LOD/MDL, a variety of methods are employed for the determination of the quantitation limit, based on technique and sample matrix. Methods include, but are not limited to a) setting the LOQ to the calibration standard with the lowest concentration b) LOQ may be determined by basing the level of 10x the standard deviation of method blanks to compensate for the matrix effects.</p>	<p>LOD and LOQ are estimates for lowest concentration detected and reported for the analyses, however it is necessary to assess and interpret of the uncertainty at these limits to predict the quality of the value of these limits.</p>	<p>Uncertainty is based on an assessment of the contributions of all the sources of uncertainty for an analysis and presented as a data quality statement. Uncertainty based on control charting or statistical analysis of laboratory control samples are examples of the components of the overall uncertainty statement, however each component is weighed for each set of analysis to determine the overall uncertainty of the analysis.</p>	<p>40 CFR Part 136</p>
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