NJ DWQI Testing Subcommittee

Report on the Development of a Practical Quantitation Level (PQL) for Perfluorooctanesulfonic acid (PFOS) in Drinking Water

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PQL Report on Perfluorooctanesulfonic acid (PFOS)

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Definitions

- **Practical Quantitation Level** (PQL) is the minimum concentration for which an analyte can be reliably quantitated within an acceptable limit of uncertainty.
- **Method Detection Limit** (MDL) is a measurement used by a laboratory to determine specific minimum detection capabilities for a particular method.
- **Reporting Limit** (RL) is the minimum concentration by which an analyte is reliably quantitated by an individual laboratory.
- **Minimum Reporting Level** (MRL) is the minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis.
- **Lowest Concentration MRL** (LCMRL) is the lowest spiking concentration at which recovery of between 50 and 150% is expected 99% of the time by a single analyst.
- **Bootstrap Estimate of a Confidence Interval of the Mean** is an statistical technique that has been used most recently by the USEPA and is applied to generate a normal distribution and associated 95 % upper and lower confidence intervals from the skewed mean (not median) values for the inter-laboratory MDLs and RLs.

The Testing Subcommittee reviewed analytical information from laboratories performing PFOS analyses. In considering sources of PFOS data, the following criteria were established by the Testing Subcommittee:

1) Laboratories that analyzed water samples for PFOS for NJDEP PFC studies (2006 and 2009) and as requested by water systems;

2) Laboratories that are certified for the analysis of PFOS in drinking water by the NJDEP Office of Quality Assurance (OQA); and

3) National laboratories that obtained US Environmental Protection Agency (EPA) approval to analyze six PFASs under the Unregulated Contaminant Monitoring Rule 3 (UCMR3) program, that report PFOS lower than the required UCMR3 minimum reporting level (MRL) of 40 ng/L using either method EPA 537 or a proprietary method.

MDLs from Laboratories in Increasing Order

Laboratory	Analytical Method	MDL (ng/L)
SGS North American Inc.	EPA 537	0.2
Underwriters Laboratory	L400	0.35
Eurofins Eaton Analytical IN	EPA 537	0.5
Columbia Analytical Services	Modified EPA 537	0.60
GEL Laboratories, LLC.	EPA 537	0.66
Eurofins Eaton Analytical CA	EPA 537	0.717
Vista Analytical Laboratory	EPA 537	1.04
Test America-Denver	DV-LC-0012 Rev 14	1.12
Test America-Sacramento	Proprietary WS-LC-0025 Rev 1.2	**1.28**
Pace Analytical Services, Inc.	EPA 537	1.3
American Water Central Laboratory	EPA 537	1.4
SGS Accutest – Orlando	EPA 537	2
Eurofins Lancaster Laboratories Environmental	EPA 537	2
Test America-Denver	DV-LC-0012 Rev 4	2
Weck Laboratories	Modified EPA 537	2.33
Eurofins Eaton Analytical CA	EEA LCMS SOP 2434	3.66
Test America Sacramento	EPA 537	6.8
Median of the MDLs		**1.3**
Median of MDLs x 5		**6.5**

Mean and Median of Reporting Limits and Low Calibration Standards

Laboratory	State	Method	Reporting Limit (ng/L)	Low Calibration Standard (ng/L)
Advanced Water Quality Assurance Lab	CA	EPA 537	4	4
American Water Central Laboratory	IL	EPA 537	5	5
Columbia Analytical Service	WA	Modified EPA 537	2	2
Eurofins Eaton Analytical	CA	EEA LCMS-SOP2434	5	4.8
Eurofins Eaton Analytical	CA	EPA 537	2.5	2.4
Eurofins Eaton Analytical	IN	EPA 537	2	2
Eurofins Lancaster Laboratories Environmental	PA	EPA 537	5	4
GEL Laboratories, LLC	SC	EPA 537	2	2
Pace Analytical Services	FL	EPA 537	40	4
SGS Accutest - Orlando	FL	EPA 537	8	3.2
SGS North America	NC	EPA 537	2	2
State Hygienic Laboratory Coralville	IO	EPA 537	39	15.7
Test America-Denver	CO	DV-LC-0012 REV 4	10	4
Test America-Denver	CO	DV-LC-0012 REV 14	30	4
Test America- Sacramento	CA	EPA 537	40	4
Test America-Sacramento	CA	WS-LC-0025 Rev 1.2	2	2
Underwriters Laboratory	IN	L400	10	0.5
Vista Analytical Laboratory	CA	EPA 537	10	1
Weck Labs	CA	Modified 537	5	5
Mean			**11.8**	**3.8**
Median			**5**	**4**

Mean and Median of Minimum Reporting Levels and Low Calibration Standards Laboratories Using EPA 537

Laboratory	Method	MRL (ng/L)	Low Calibration Standard (ng/L)
Advanced Water Quality Assurance Laboratory	EPA 537	4	4
American Water Central Laboratory	EPA 537	5	5
Eurofins Eaton Analytical - CA	EPA 537	2.5	2.4
Eurofins Eaton Analytical - IN	EPA 537	2	2
Eurofins Lancaster Laboratories Environmental	EPA 537	5	4
SGS North American Inc.	EPA 537	2	2
Pace Analytical Services Inc. Florida	EPA 537	40	4
SGS Accutest - Orlando	EPA 537	8	3.2
State Hygienic Laboratory-Coralville	EPA 537	39	15.7
GEL Laboratories, LLC.	EPA 537	2	2
Test America- Sacramento	EPA 537	40	4
Vista Analytical Laboratory	EPA 537	10	1
Mean		**13.3**	**4.1**
Median		**5**	**4**

Bootstrap Estimate of a Confidence Interval of a Mean

generated using the inter-laboratory MDLs :

Lower Confidence Limit (ng/L)	Mean (ng/L)	Upper Confidence Limit (ng/L)	Confidence Level Range	Number of Randomly Selected Values
0.6	0.8	**1.1**	95%	2000

The upper confidence limit of the mean MDL x 5 =
1.1 ng/L x 5 = **5.5 ng/L**

Bootstrap Estimate of a Confidence Interval of a Mean

generated using the inter-laboratory Reporting Limits :

Lower Confidence Limit (ng/L)	Mean (ng/L)	Upper Confidence Limit (ng/L)	Confidence Level Range	Number of Randomly Selected Values
3.5	5.0	6.6	95%	2000

Bootstrap Estimate of a Confidence Interval of a Mean

generated using the inter-laboratory low calibration standards:

Lower Confidence Limit (ng/L)	Mean (ng/L)	Upper Confidence Limit (ng/L)	Confidence Level Range	Number of Randomly Selected Values
2.6	3.4	**4.2**	95%	2000

Summary of standard non parametric inter-laboratory approaches for determining a PFOS PQL

Approach	Value (ng/L)
Median MDL x 5	6.5
Mean of RLs	11.8
Median of RLs	5
Mean of low calibration standards	**3.8**
Median of low calibration standards	**4**
Mean of MRLs (RLs for EPA 537)	13.3
Median of MRLs (RLs for EPA 537)	5
Mean of low calibration standards (EPA 537)	4.1
Median of low calibration standards (EPA 537)	4

Summary of standard parametric inter-laboratory approaches for determining a PFOS PQL

Approach	Value (ng/L)
Upper Confidence Limit MDL x 5	5.5
Upper Confidence Limit of RLs	6.6
Upper Confidence Limit of low calibration standards	**4.2**
Upper confidence limit of MRLs (RLs for EPA 537)	6.3
Upper confidence limit of low calibration standards of labs using EPA 537	3.8

The Testing Subcommittee is recommending a PQL of **4.2 ng/L** based on the bootstrap analysis of the low calibration standards from laboratories currently performing PFOS analyses.

- The low calibration standards rather than reporting limits are more indicative of the ability of labs to quantitate at low levels;
- The UCL of the estimate of the mean using the bootstrap means that laboratories can meet the value 95% of the time.