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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Safe Drinking Water

Chapter 109 Pre-Draft Rulemaking: PFAS Maximum Contaminant Levels (MCLs)

Public Water System TAC Board Meeting

July 29, 2021

Tom Wolf, Governor

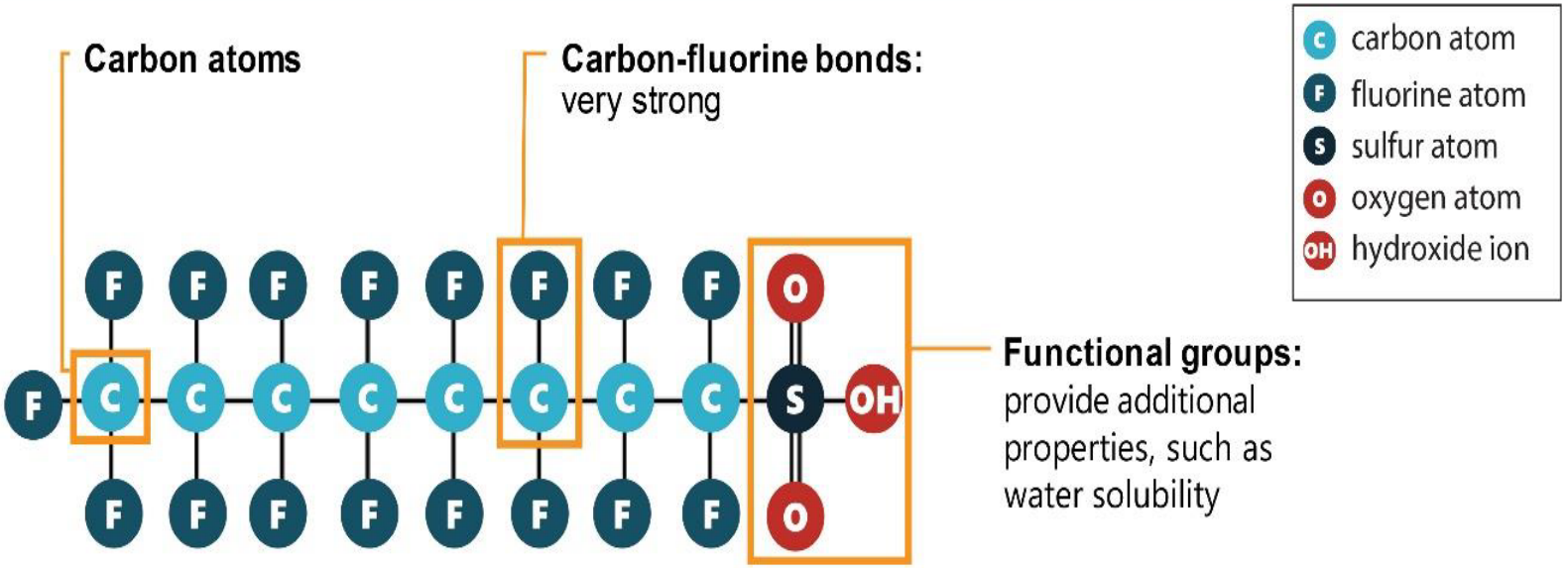
Patrick McDonnell, Secretary

PFAS Background

- Per- and polyfluoroalkyl substances (PFAS) are a class of synthetic chemicals that have been manufactured and in use since the 1940s.
- PFAS are used to make products resistant to water, heat and stains and are found in industrial and consumer products such as clothing, carpeting, food packaging, non-stick cookware, firefighting foam, personal care products, adhesives, metal plating, wire manufacturing and many other uses.
- PFAS have unique chemical properties because they readily dissolve in water and are mobile, are highly persistent in the environment, and bioaccumulate.

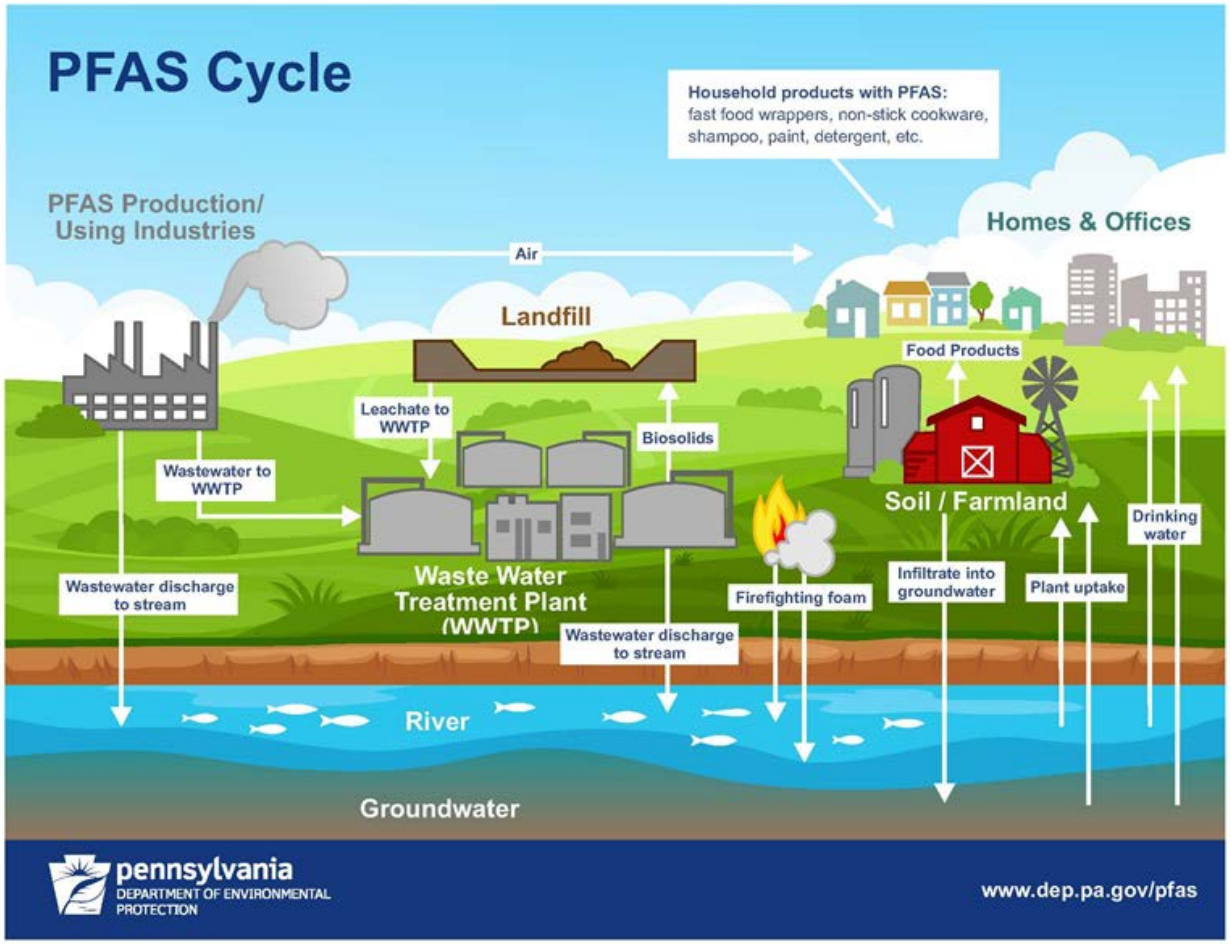
PFAS Background

CHEMICAL STRUCTURE OF PFOS (8 CARBON CHAIN)



Source: American Association for the Advancement of Science Center for Scientific Evidence in Public Issues 2021. Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water: Guides for Local and State Leaders. Washington, D.C.: AAAS Center for Scientific Evidence in Public Issues.

PFAS Background



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Federal Actions to Address PFAS

- EPA issued provisional Health Advisory Levels (HAL) in 2009 for PFOS at 200 ng/L or ppt and PFOA at 400 ng/L or ppt.
- Six PFAS were included in EPA's Third Unregulated Contaminant Monitoring Rule (UCMR 3) (2013-2015).
- In 2016, EPA set a combined Lifetime HAL for PFOS & PFOA of 70 ppt.
- In March 2021, EPA published a final regulatory determination to begin the process to propose a drinking water regulation for PFOS and PFOA. EPA will propose a regulation within 24 months of publication (by March 2023).

State Actions to Address PFAS

- Governor Wolf's Executive Order (Sept. 19, 2018) established a PFAS Action Team to develop a comprehensive response to identify and eliminate sources of contamination, ensure drinking water is safe, manage environmental contamination, review gaps in data and oversight authority, and recommend actions to address those gaps.
  - The PFAS Action Team released an Initial Report in December 2019
  - The Report includes information about PFAS, challenges associated with managing contamination, actions taken to date and recommendations for future actions. Recommendations include additional funding for communities dealing with PFAS contamination and strengthened statutory authorities to adequately address PFAS.

State Actions to Address PFAS

- DEP's Clean Water Program conducted surface water monitoring during August – September 2019 to generate statewide data to inform the development and implementation of a statewide monitoring strategy, water quality standards, assessment methods and/or permitting requirements.

- DEP's Environmental Cleanup Program has been and will continue to address PFAS contamination sites. The Program presented final amendments to Chapter 250 to the EQB on June 15, 2021 to establish remediation standards for PFOS, PFOA and PFBS.

BSDW Actions to Address PFAS

Since 2016, as an interim measure, the BSDW has ensured that follow-up and corrective actions are taken at public water systems with PFOS/PFOA levels above EPA's HAL of 70 ppt, including:

- One-hour reporting of sample results to DEP (§ 109.701(a)(3)(iii))
- Collection of confirmation samples (§ 109.302)
- Issuance of Tier 2 Public Notice (§ 109.409)
- Quarterly monitoring at the entry point (§ 109.302)
- If levels continue to exceed the HAL, additional actions may be needed including taking sources off-line, installing treatment, etc. (§ 109.4)

Toxicology Report

In December 2019, the BSDW executed a toxicology services contract with Drexel University to review other state and federal agency work on MCLs; independently review the data, science and studies; and develop recommended maximum contaminant level goals (MCLG) for select PFAS.

- MCLGs are non-enforceable, developed solely based on health effects, and do not take into consideration other factors, such as technical limitations and cost. MCLGs are the starting point for determining MCLs.

Deliverables were completed in January 2021 and include the "Drexel PFAS Workbook" and "MCLG Drinking Water Recommendations for PFAS in the Commonwealth of PA".

Toxicology Report

MCLG Drinking Water Recommendations for PFAS Report:

- Developed by Drexel PFAS Advisory Group (DPAG) – multidisciplinary team of experts in toxicology, epidemiology, and drinking water standards and risk assessment
- Reviewed pertinent literature and work across the country; independently developed recommended MCLGs
- Recommended individual MCLGs based on non-cancer endpoints
- Discusses relevant inputs; includes a summary table for the development of the recommended MCLGs

Toxicology Report

DPAG Reference Dose and Recommended Chronic Non-Cancer MCLGs		
PFAS	**Reference Dose (ng/kg/day)**	**MCLG (ng/L or ppt)**
PFOA	3.9	8
PFOS	3.1	14
PFNA	2.2	6
PFHxS	4.0	20
PFHpA	None derived*	8
PFBS	39	55
GenX (HFPO-DA)	75	108

*Reference dose was not derived due to a lack of evidence on its toxicity. Recommended MCLG is based on its chemical structure.

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BSDW Actions – Sampling Plan

The Plan was intended to prioritize sites for PFAS sampling and generate statewide occurrence data.

Several factors were considered in developing the targeted plan, including:

- Location of potential sources of PFAS contamination (PSOC)
- Relative risk to consumers – CWSs and NTNCWSs
- Public water supply (PWS) sources located within ½ mile of PSOCs – note additional sources located within ¾ of mile were added where needed to complete the sampling plan
- Selection of PWS sources to serve as a control group

Sampling Plan

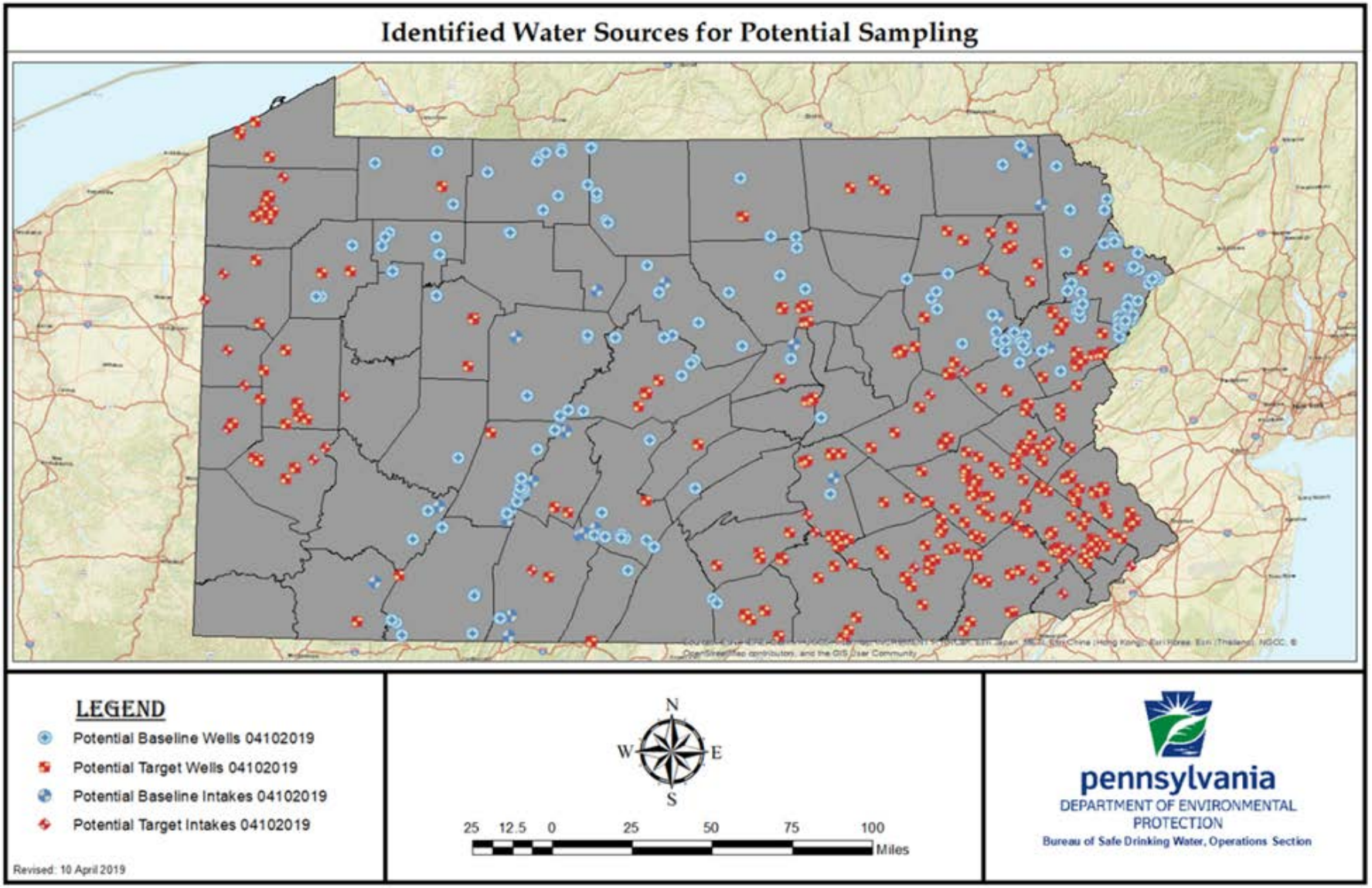
The GIS data layer of PSOCs included the following industries and land uses:

- Military bases
- Fire training schools/sites
- Airports
- Landfills
- Manufacturing facilities (apparel, chemicals, electronics, fabricated metal, paper products, textiles and leather, upholstered furniture)
- State HSCA, EPA Superfund and other known PFAS-contamination sites

Sampling Plan

- Initial sampling pool = 493 sources
  - CWSs: 294 GW, 35 SW
  - NTNCWSs: 162 GW, 2 SW
  - Mix of system types and sizes
  - Good spatial distribution across state
  - Process did not inadvertently exclude EJ communities (~ 11.5% of sites located within EJ communities)
- Number of target sites = 360 samples; number of control/baseline sites = 40 samples

Sampling Plan



Sampling Plan

- Posted the Plan to PFAS webpage in April 2019
- Sampling began Summer 2019 using EPA Method 537 (6 PFAS) and contract lab
- In 2020, had opportunity to modify sampling:
  - Switched to EPA Method 537.1 (18 PFAS)
  - Repeated 2019 sampling for consistency
  - Sent samples to contract lab and state lab
- Impacts from pandemic - sampling was halted in March 2020 and resumed in August 2020 under approved Health and Safety Plan
- Sampling was completed in March 2021, with final sample results posted in June 2021

Sampling Plan – Summary of Results

	PFOA	PFOS	PFNA	PFHxS	PFHpA	PFBS	Units
Total # Samples	412	412	412	412	412	412	--
Average	2.0	2.5	0.4	1.4	0.7	1.1	ng/l
Median	0 (ND)	0 (ND)	0 (ND)	0 (ND)	0 (ND)	0 (ND)	ng/l
Minimum	0 (ND)	0 (ND)	0 (ND)	0 (ND)	0 (ND)	0 (ND)	ng/l
Maximum	59.6	187.1	18.1	140.0	32.6	64.0	ng/l
# and % of Detects	112 (27%)	103 (25%)	23 (6%)	52 (13%)	49 (12%)	66 (16%)	--
Avg Detect Value	7.5	9.9	7.2	10.9	6.1	7.0	ng/l
Med Detect Value	5.3	6.5	5.6	4.5	4.5	4.2	ng/l
Min Detect Value	1.7	1.8	1.8	1.9	1.8	1.7	ng/l
Max Detect Value	59.6	187.1	18.1	140.0	32.6	64.0	ng/l

Full results available at www.dep.pa.gov/pfas

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MCL Rulemaking Process

An MCL rulemaking should be based on available data, studies, and science, and must consider all factors as required by the Federal Safe Drinking Water Act (SDWA) and Pennsylvania's Regulatory Review Act (RRA), including:

- Health effects
- Occurrence data
- Technical limitations such as available analytical methods and detection and reporting limits
- Treatability of the contaminant and available treatment technologies
- Costs and benefits

Pre-Draft MCL Rulemaking

DEP is proposing to:

- Move forward with MCLs for **PFOA** and **PFOS**
- ***NOT*** move forward with an MCL for other PFAS at this time

Pre-Draft MCL Rulemaking

DEP is proposing to ***NOT*** move forward with an MCL for other PFAS at this time for the following reasons:

	PFNA	PFHxS	PFHpA	PFBS	HFPO-DA
Lack of occurrence data* > MCLG	X	X		X	X
Incomplete cost/benefit data and analysis	X	X	X	X	X
Reference dose was not derived due to lack of evidence on its toxicity			X		
Lack of treatability data					X

*Occurrence data includes PFAS Sampling Plan and UCMR3 results

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Pre-Draft MCL Rulemaking

Criteria to support a proposed MCL for PFOA and PFOS:

- Evaluation of health effects and determination of MCLG
- Sufficient occurrence data
- Available analytical methods
- Available treatment technologies
- Sufficient cost/benefit data and analysis

PFOA - Recommended MCLG

PFOA – Development of Recommended MCLG:

- DPAG selected Koskela (2016) and Onishchenko (2011) as the critical studies – identified developmental effects (neurobehavioral and skeletal)
- POD = 8.29 mg/L
- Uncertainty Factor Total = 300
- Reference dose = 3.9 ng/kg/day
- Receptor – Infant exposure via breastmilk for 1 yr., from mother chronically exposed via water, followed by lifetime of exposure via drinking water (also protective of formula fed infant); Goeden Model; human serum half-life = 840 days; RSC = 50%
- Chronic non-cancer MCLG = 8 ng/L or ppt; protects health during the growth and development of a breast fed infant

PFOA – Occurrence Data

PFOA - Occurrence Data*:

PFOA Recommended MCLG = 8 ppt	
# of sites (of 435) > MCLG	46
% of sites > MCLG	10.6%
Estimated # of EPs (of 3785) > MCLG	400

*Occurrence data includes PFAS Sampling Plan and UCMR3 results
(412 Sampling Plan samples + 23 UCMR3 detect samples = 435)

PFOS - Recommended MCLG

PFOS – Development of Recommended MCLG:

- DPAG selected Dong I (2011) as the critical study – identified immunological effects (immune suppression)
- POD = 2.36 mg/L
- Uncertainty Factor Total = 100
- Reference dose = 3.1 ng/kg/day
- Receptor – Infant exposure via breastmilk for 1 yr., from mother chronically exposed via water, followed by lifetime of exposure via drinking water (also protective of formula fed infant); Goeden Model; human serum half-life = 1241 days; RSC = 50%
- Chronic non-cancer MCLG = 14 ng/L or ppt; protects health during the growth and development of a breast fed infant

PFOS – Occurrence Data

PFOS - Occurrence Data*:

PFOS Recommended MCLG = 14 ppt	
# of sites (of 435) > MCLG	23
% of sites > MCLG	5.3%
Estimated # of EPs (of 3785) > MCLG	200

*Occurrence data includes PFAS Sampling Plan and UCMR3 results
(412 Sampling Plan samples + 23 UCMR3 detect samples = 435)

Analytical Methods & Treatment

PFOA and PFOS:

- Analytical methods
  - PA Method 533, 537.1 & 537 Version 1.1
  - Minimum Reporting Level = 5 ng/L or ppt
- Treatment technologies
  - BAT is GAC, Ion Exchange, Reverse Osmosis
  - Other treatment technology as approved by DEP

Proposed PFOA MCLG & MCL

Proposed PFOA MCL of 14 ppt:

- # of sites (of 435) > 14 ppt = 25 (or 5.7%)
- Estimated # of EPs (of 3785) > 14 ppt = **218**
- Estimated costs:
  - Total annual cumulative monitoring costs (@ $716/EP/Q) = **$3,365,387**
  - Total annual treatment costs (to treat 1 MGD) over 20 years per EP (includes capital and annual O&M costs):
    - GAC = $416,470 per MGD
    - IX = $333,750 per MGD
    - Average of GAC & IX = **$375,110 per MGD**
  - Total annual cumulative treatment costs over 20 years = **$81,773,904**
  - Total annual cumulative costs over 20 years (includes average of (GAC & IX treatment per MGD) + monitoring costs = **$85,139,291**
- Estimated benefits:
  - **90%** improvement in health protection as compared to current EPA HAL of 70 ppt

	PFOA (ng/L or ppt)
Proposed MCLG	8
Proposed MCL	14

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PFOA Costs vs. Benefits

Value (ng/L)	Estimated # of EPs (of 3785) > Value	Monitoring Costs (Millions)	Treatment Costs (Millions)	Total Costs (Millions)	% Increase in Cost Compared to HAL	% Improvement in Health Protection Compared to HAL
HAL = 70	58	$2.84	$21.76	$24.60	----	----
35	78	$2.97	$29.26	$32.23	31%	56%
MCL = 14	**218**	**$3.36**	**$81.78**	**$85.14**	**246%**	**90%**
10	313	$3.57	$117.41	$120.98	392%	96%
MCLG = 8	400	$3.94	$150.05	$153.99	526%	100%

Source of data:

- Treatment costs are based on survey of vendors, PWSs in PA w/existing treatment, and other states.
- Monitoring costs are based on survey of PA-accredited labs.
- Estimate of benefits presented as Percent Improvement in Health Protection Compared to Current EPA HAL (70 ppt)

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Proposed PFOS MCLG & MCL

Proposed PFOS MCL of 18 ppt:

- # of sites (of 435) > 18 ppt = 22 (or 5.1%)
- Estimated # of EPs (of 3785) > 18 ppt = **191**
- Estimated costs:
  - Total annual cumulative monitoring costs (@ $716/EP/Q) = **$3,141,028**
  - Total annual treatment costs (to treat 1 MGD) over 20 years per EP includes capital and annual O&M costs):
    - GAC = $416,470 per MGD
    - IX = $333,750 per MGD
    - Average GAC & IX = **$375,110 per MGD**
  - Total annual cumulative treatment costs over 20 years = **$71,645,943**
  - Total annual cumulative costs over 20 years (includes average of (GAC & IX treatment per MGD) + monitoring costs = **$74,786,971**
- Estimated benefits:
  - **93% improvement** in health protection as compared to current EPA HAL of 70 ppt

	PFOS (ng/L or ppt)
Proposed MCLG	14
Proposed MCL	18

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PFOS Costs vs. Benefits

Value (ng/L)	Estimated # of EPs (of 3785) > Value	Monitoring Costs (Millions)	Treatment Costs (Millions)	Total Costs (Millions)	% Increase in Cost Compared to HAL	% Improvement in Health Protection Compared to HAL
HAL = 70	96	$3.00	$36.00	$39.00	----	----
35	148	$3.07	$55.51	$58.58	50%	63%
MCL = 18	**191**	**$3.14**	**$71.65**	**$74.79**	**92%**	**93%**
16	200	$3.18	$75.02	$78.20	101%	96%
MCLG = 14	200	$3.35	$75.02	$78.37	101%	100%

Source of data:

- Treatment costs are based on survey of vendors, PWSs in PA w/existing treatment, and other states.
- Monitoring costs are based on survey of PA-accredited labs.
- Estimate of benefits presented as Percent Improvement in Health Protection Compared to Current EPA HAL (70 ppt)

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Summary

The Proposed PFOA and PFOS MCLs:

- Are technically feasible
- Increase public health protection by 90% for PFOA and 93% for PFOS
- Strike a balance between public health protection and costs
- Are within the range of other federal standards where the MCL ≠ MCLG
  - Federal range of MCLs is 125% - 400% of MCLG
  - PFOA MCL is 175% of MCLG, PFOS MCL is 129% of MCLG
- Are within the range and same magnitude as other state standards

	NY	MI	NJ	NH	PA	MA	VT
PFOA	10	8	14	12	**14**	20*	20*
PFOS	10	16	13	15	**18**	20*	20*

*The MCL for MA & VT is for a PFAS group (not individual contaminants).

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