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Laboratory Director

PFAS Monitoring in a Post Health Advisory World-What Should We Be Doing?

Monrovia


South Bend

Poly- and Perfluoroalkyl Substances (PFASs)

- Large class (200+) of surfactants with unique chemical properties
  - Fluorinated carbon chain with various functional group(s)
- Used since 1940s in products that resist heat, stains, water, oil and grease; production increased rapidly in 1970s
- Many other specialized industrial and commercial uses (operative word: **non-stick**)

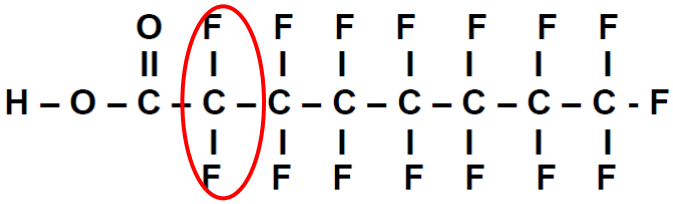
Courtesy of Virginia Yingling (MDH)

PFCs vs PFASs – What's The Difference?



Perfluoro- means "fully" fluorinated

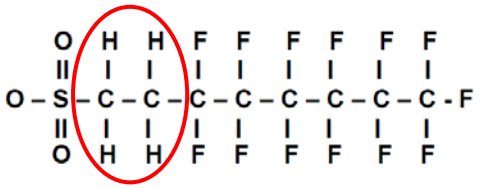
- All carbons in the chain bonded only to F
- "PFCs" actually is correct in this case
- Example: PFOA, PFOS, PFBA, PFBS, etc.
- Essentially non-degradable due to strength of C-F bond



Perfluoro-octanoic Acid (PFOA)

Polyfluoro- means "partially fluorinated"

- Some carbons in the chain bonded to H
- Example: 6:2 FTSA (polyfluorotelomer sulfonate; 6 CF_2, 2 CH_2)
- Susceptible to degradation (biotic and abiotic) due to weakness of C-H bond
- **Some polyfluorinated PFASs may degrade to PFCs**
- May constitute the majority of PFASs at many sites, but typically not tested for

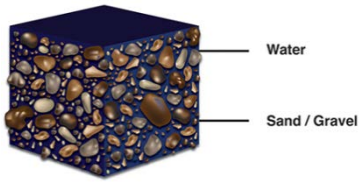


Polyfluorotelmoer sulfonate (6:2 FTSA)

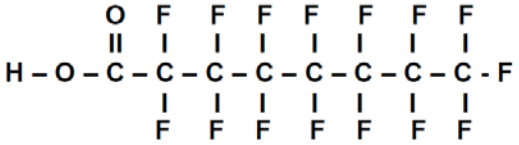
PFCs Behave in Unique Ways

- **Do not break down in the environment**
  - No hydrolysis, photolysis, or biodegradation

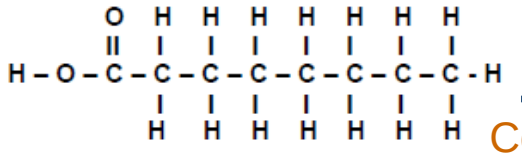
- **Do not adsorb readily to aquifer materials**
  - Infiltrate rapidly to the groundwater
  - Little or no retardation
  - Rates affected by PFC chain length and functional group partitioning
    - Carboxylates (PFBA, PFPeA, PFHxA, PFOA) – prefer water
    - Sulfonates (PFBS, PFHxS, PFOS) – prefer soil and sediment



- **Chemical structure of some are similar to fatty acids**
  - Readily adsorbed into blood serum of living organisms



Perfluoro-octanoic Acid (PFOA)



Caprylic Acid

Courtesy of Virginia Yingling (MDH)

Some “Rules of Thumb”

- **Adsorption:** Longer-chain PFCs > shorter-chain PFCs (Ex: PFOS > PFBS)
- **Solubility:** Perfluorinated carboxylates > perfluorinated sulfonates of similar chain length (Ex: PFOA > PFOS)

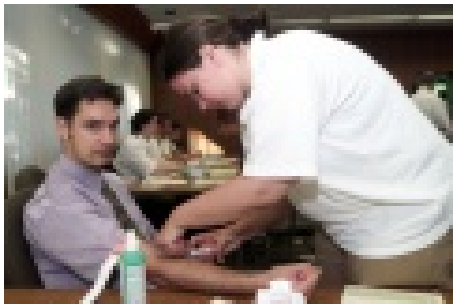
- **Environmental fate (generalized):**
  - PFCs with sulfonate group and/or longer chain:
    - less mobile
    - partition more into soil and more persistent in the body
  - PFCs with carboxylate group and/or short chain:
    - more mobile
    - partition more into water

Courtesy of Virginia Yingling (MDH)

PFASs Are Globally Distributed

Numerous studies have documented PFOS, PFOA, and other PFASs in wildlife worldwide, including deep sea and arctic species.

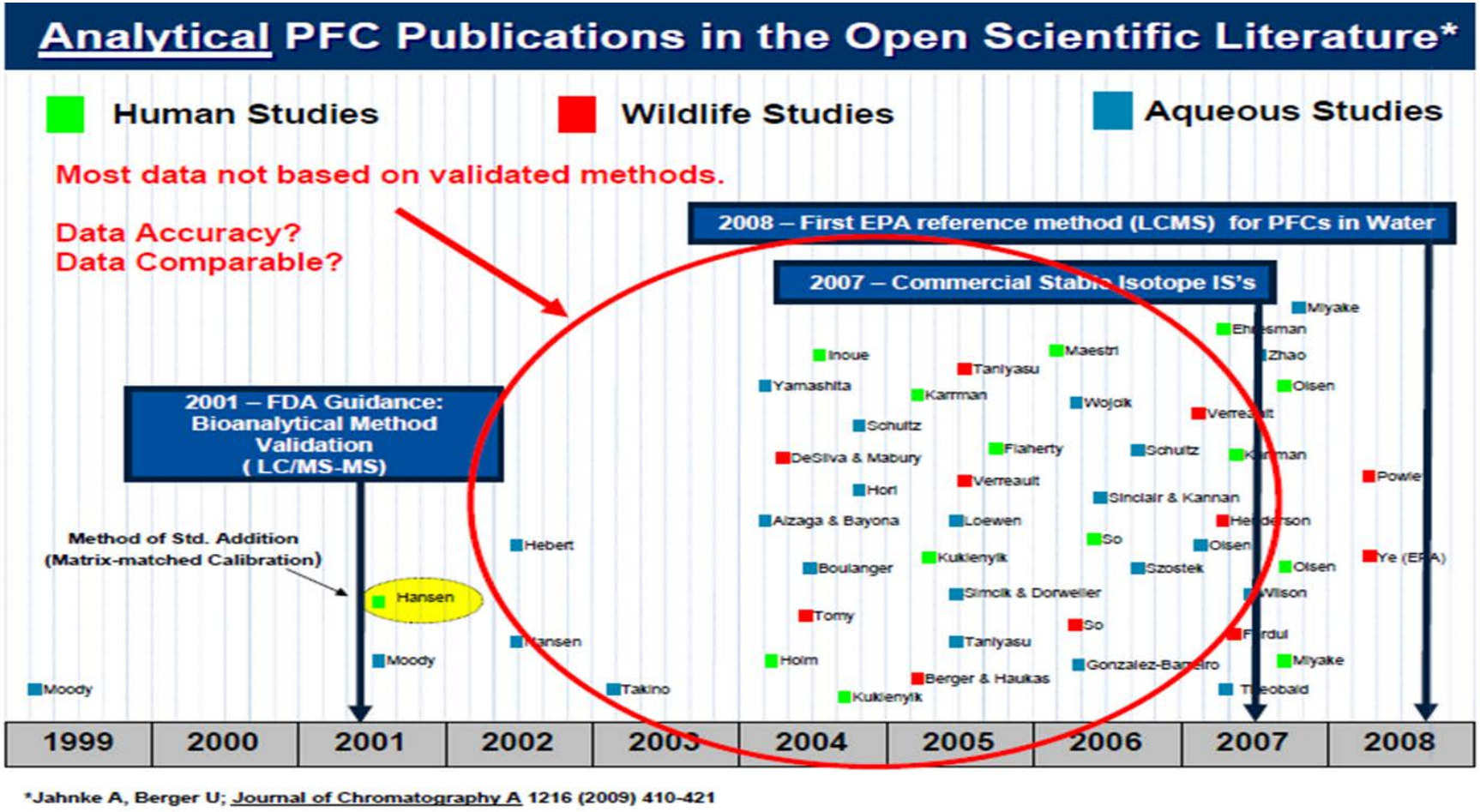
Human blood samples from US, Europe, and Asia also detected PFCs – especially PFOS, PFOA, PFHxS – concentrations higher in very young and the elderly.



Atmospheric and oceanic transport of PFC precursor chemicals are believed to be major mechanisms in the global distribution.

Courtesy of Virginia Yingling (MDH)

These Compounds Have Been Studied for a Long Time



*Jahnke A, Berger U; Journal of Chromatography A 1216 (2009) 410-421

Jahnke A, Berger U; Journal of Chromatography A 1216 (2009) 410-421

How Do You Evaluate PFAS Occurrence (e.g. UCMR 3 Data)?

- You can focus on **exceedances** of Health Advisory Levels (HAs).
- You can focus on **overall frequency of detection by count or PWS** because you are dealing with a **strictly anthropogenic contaminant** and you don't know when a detection is part of a plume.
- You can focus on either **only PFOS and PFOA** or a **broader suite**.
- And this is to help you make educated decisions about any non-UCMR monitoring and/or treatment.

Consider Some of The Monitoring Option Decisions

- How many PFAS compounds should you look for?
  - 2 (PFOS/PFOA)?
  - 6 UCMR compounds?
  - 14 that are in EPA 537?
  - 24 that DOD is now targeting?

Clearly there are options to consider

Consider Some of The Monitoring Option Decisions

- How low should you look?
  - UCMR 3 limits?
  - Levels that the method can reliably measure?
- EPA established a HA for PFOA & PFOS in drinking water at a combined concertation of 70 ppt
- NYDEP recommends labs that meet 2 ppt for PFOA
- VT has established a HA for PFOA in water at 20 ppt
- NH recommends at least a 5 ppt RL for PFAS
- NJ recommends at least a 10 ppt RL and a guidance level of 40 ppt for PFOA

UCMR 3 Monitoring Significantly Underestimates PFAS Occurrence

- **UCMR 3 reporting limits were determined based on a simulation from data from multiple labs (see next slide).**

- **Method 537 is capable of reliably measuring:**
  - **Levels that are 10-20X lower than UCMR 3**
  - **A much longer list of PFAS compounds**

LCMRLs from Multiple Labs in Initial Method Validation (2008)

	Method 537		Lab A		Lab B		Overall range		
Analyte	DL (ng/L)	LCMRL (ng/L)	DL (ng/L)	LCMRL (ng/L)	DL (ng/L)	LCMRL (ng/L)	Multi lab DL range	Multi lab LCMRL range	UCMR 3 MRL
PFBS	3.1	3.7	4.1	16	ND[b]	72[c]	<1 to 4.1	3.7 to 72	90
PFHpA	0.5	3.8	1.2	8.1	ND	0.82	<1 to 1.2	3.8 to 8.1	10
PFHxS	2	8	3.9	3.3	ND	40[c]	<1 to 3.9	3.3 to 40	30
PFOA	1.7	5.1	1.3	14	ND	0.33	<1 to 1.7	0.33 to 14	20
PFNA	0.7	5.5	1.7	12	ND	0.68	<1 to 1.7	0.68 to 12	20
PFOS	1.4	6.5	3.5	11	ND	45[c]	<1 to 3.5	6.5 to 45	40

Note the DL variation is not nearly as great as the LCMRL variation.

The large variation in LCMRLs among labs results in a high "national" MRL for UCMR 3 because these data are used for the simulation to determine the national UCMR MRL.

The combined PFOS-PFOA UCMR 3 MRL is 60, just below the HA level.

How Can We Determine If There Are Significant Underestimates?

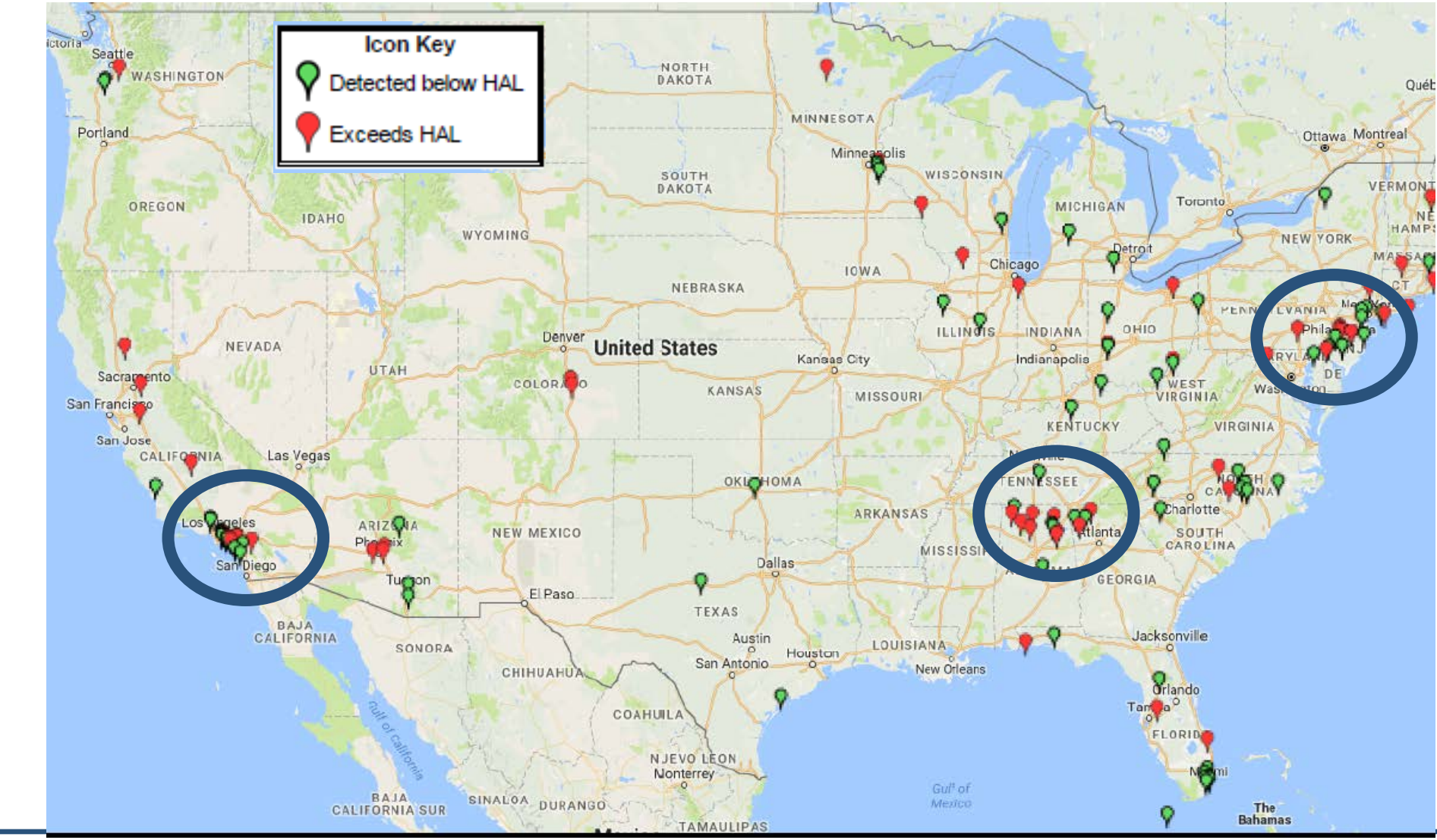
- EEA accounts for nearly 40% of the UCMR 3 PFAS data.
- EEA's in-house MRLs for the 6 PFAS compounds are significantly lower than the UCMR 3 limits.
- We re-examined all of our data, censoring at 5 ng/L for all 6 UCMR 3 PFAS compounds.
- We then compared detection frequencies, and states where there is significant detection.

How Representative Are Our Data of the Whole NCOD?

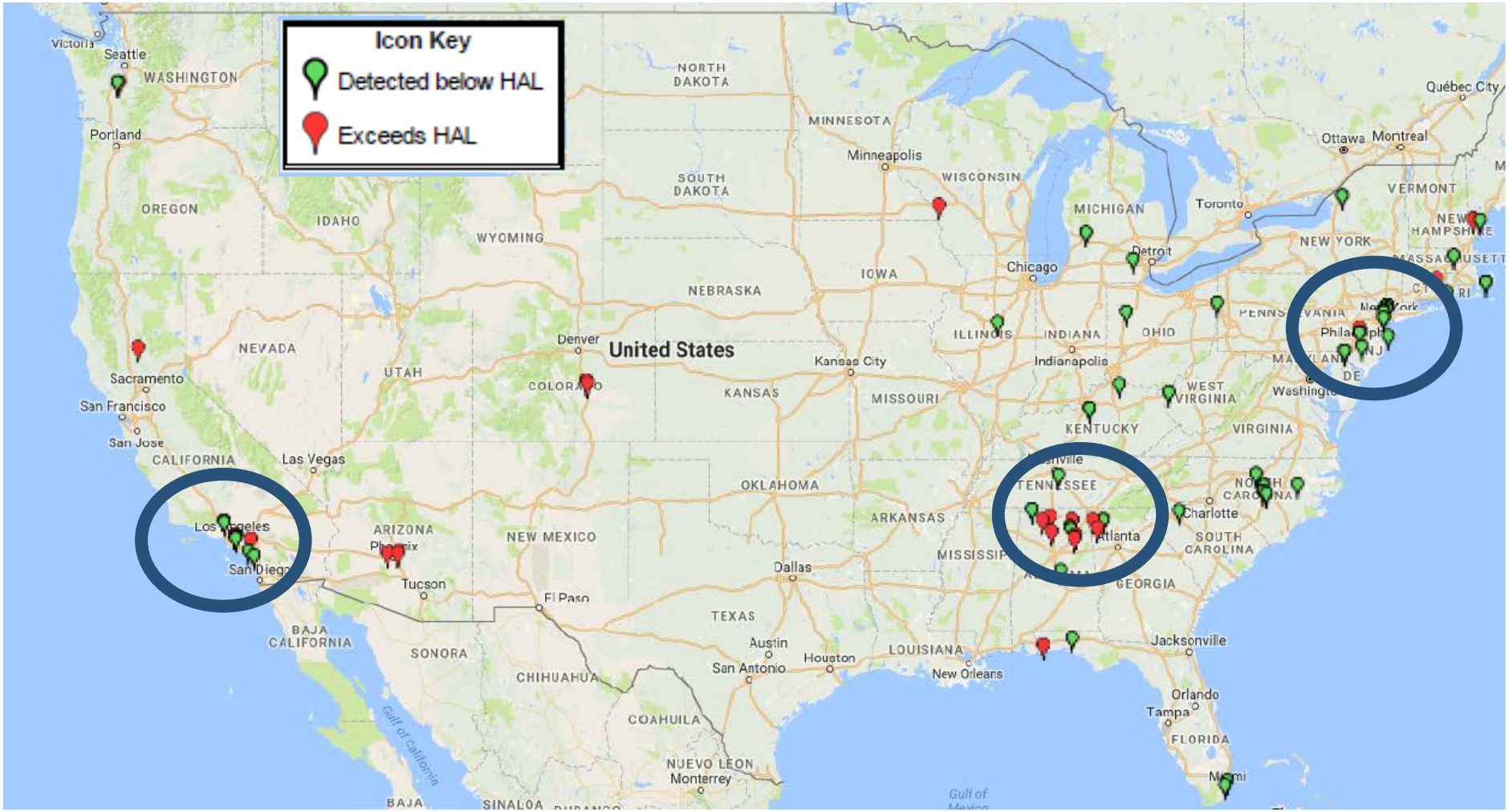
Factor	Overall UCMR 3 NCOD*	EEA UCMR 3 Data (UCMR 3 MRLs)
# of Samples	~36,000	~10,500
# of PWS	~4900	~1800
% of PWS with UCMR3 detection	3.9%	5.3%
% of PWS with HA Exceedances	1.3%	1.8%
# of States/Territories with samples	All	All
# of states/territories with detection	36	27
# of states/territories with HA Exceedances	24	18

* April 2016 release

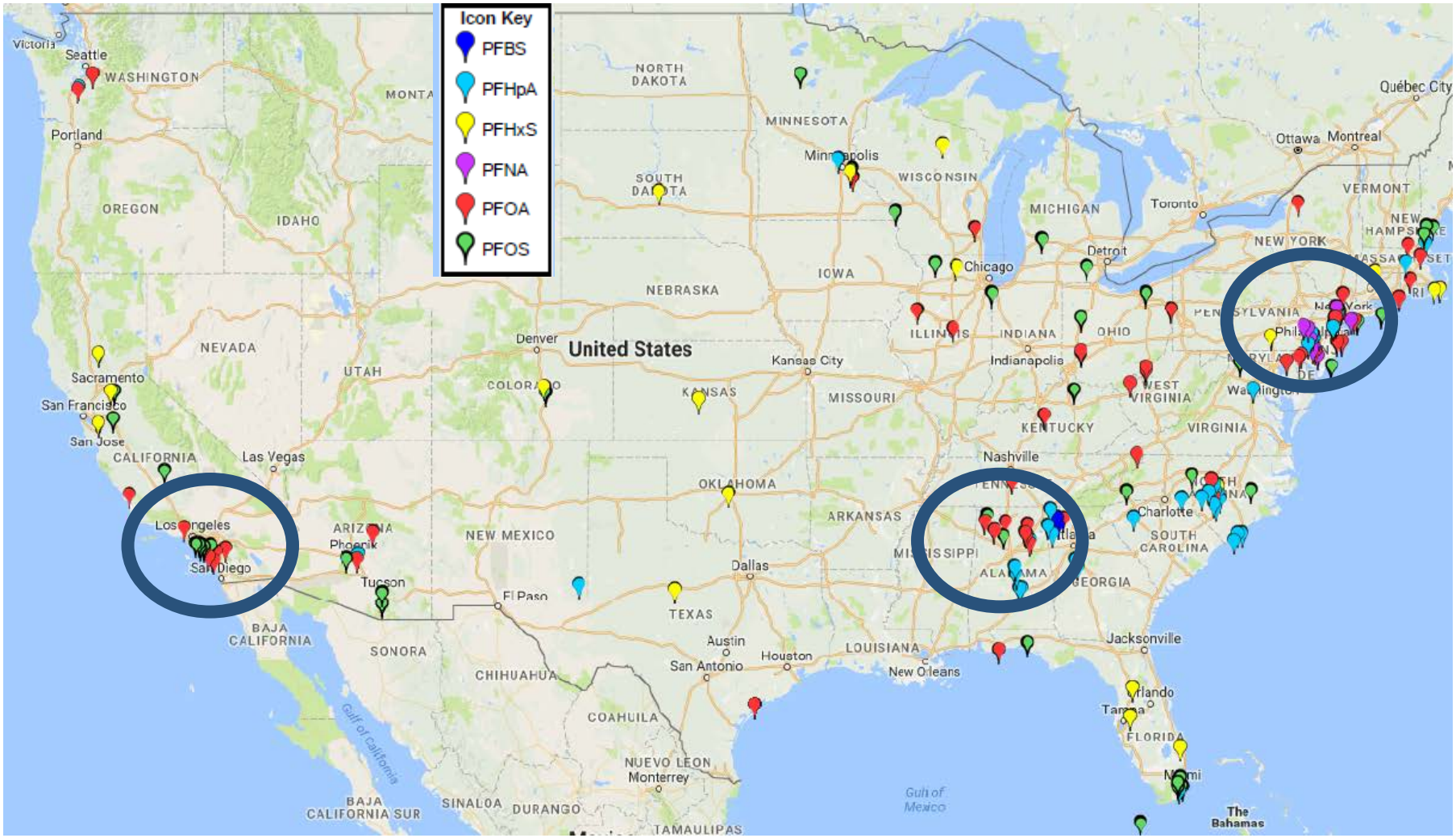
UCMR 3 NCOD PFOS-PFOA Hits



EEA Subset of UCMR 3 NCOD Data
PFOS-PFOA Hits



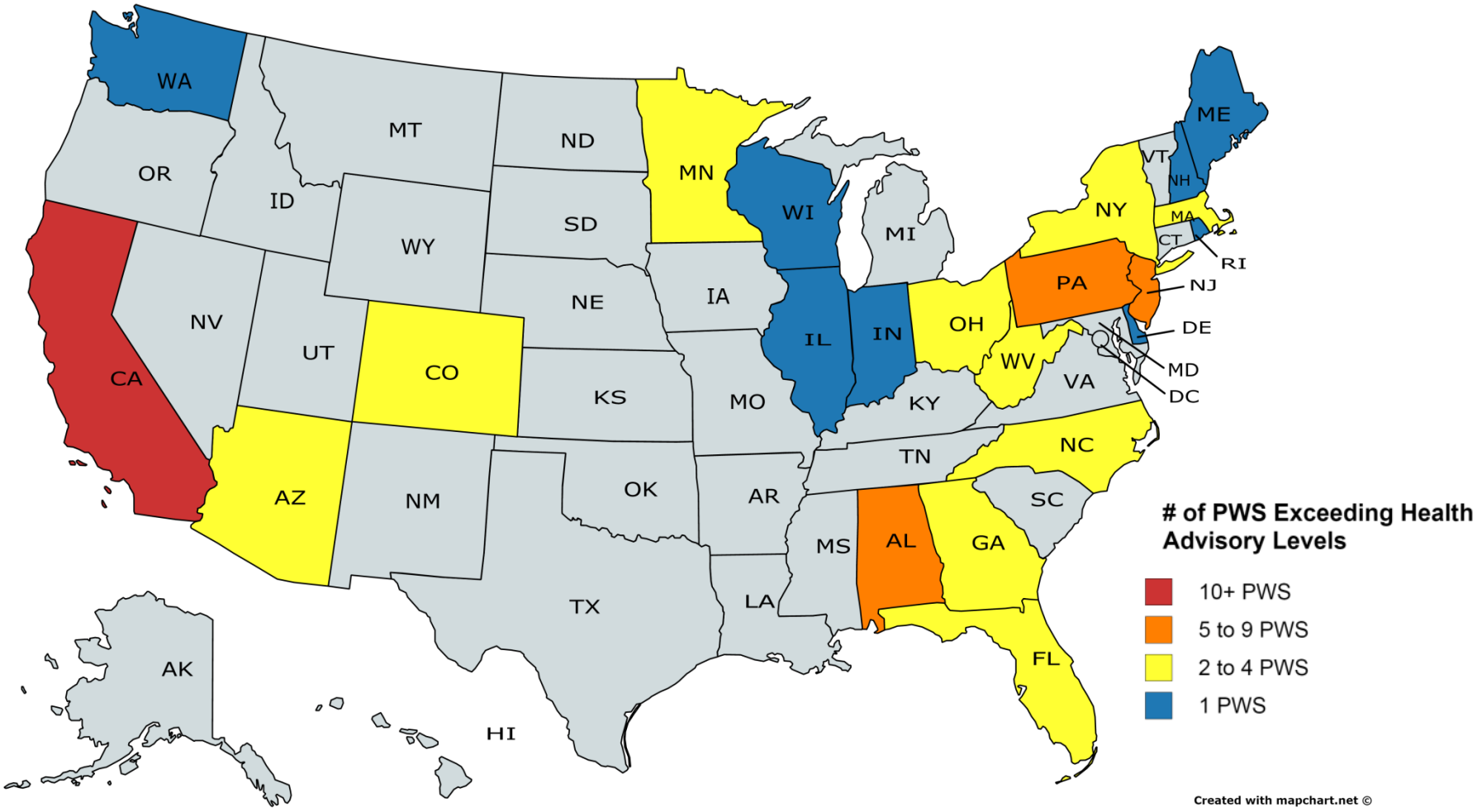
The Picture is Not that Different For Overall UCMR 3 PFAS Occurrence



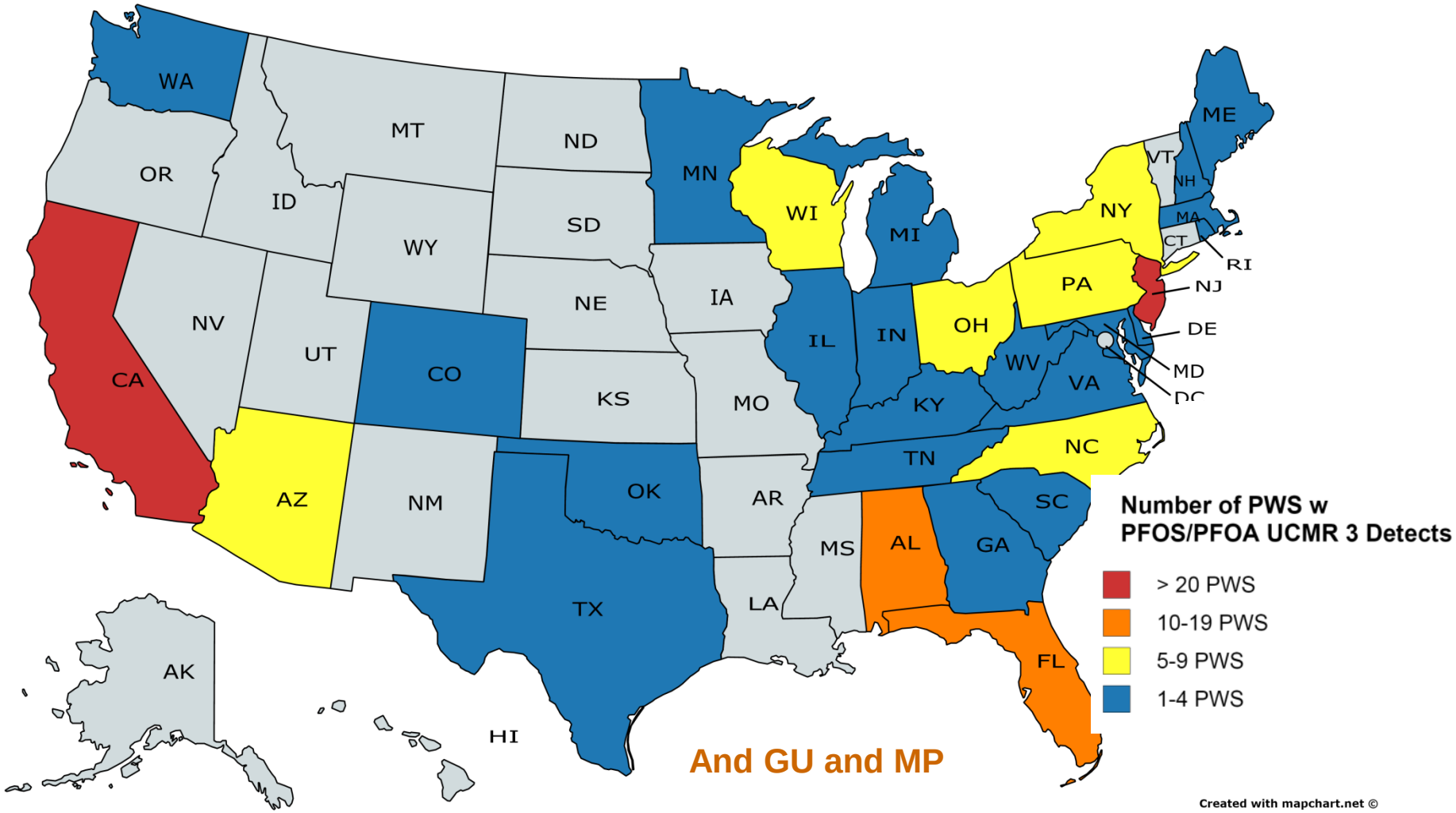
What if we Start Looking at Frequency by State?

- We can look at PFOS/PFOA alone.
- We can compare the frequency of occurrence in different states.
- We can drill down to see how the EEA database compares.
- Most significantly, we can see how the pattern changes when we reduce the reporting limit.

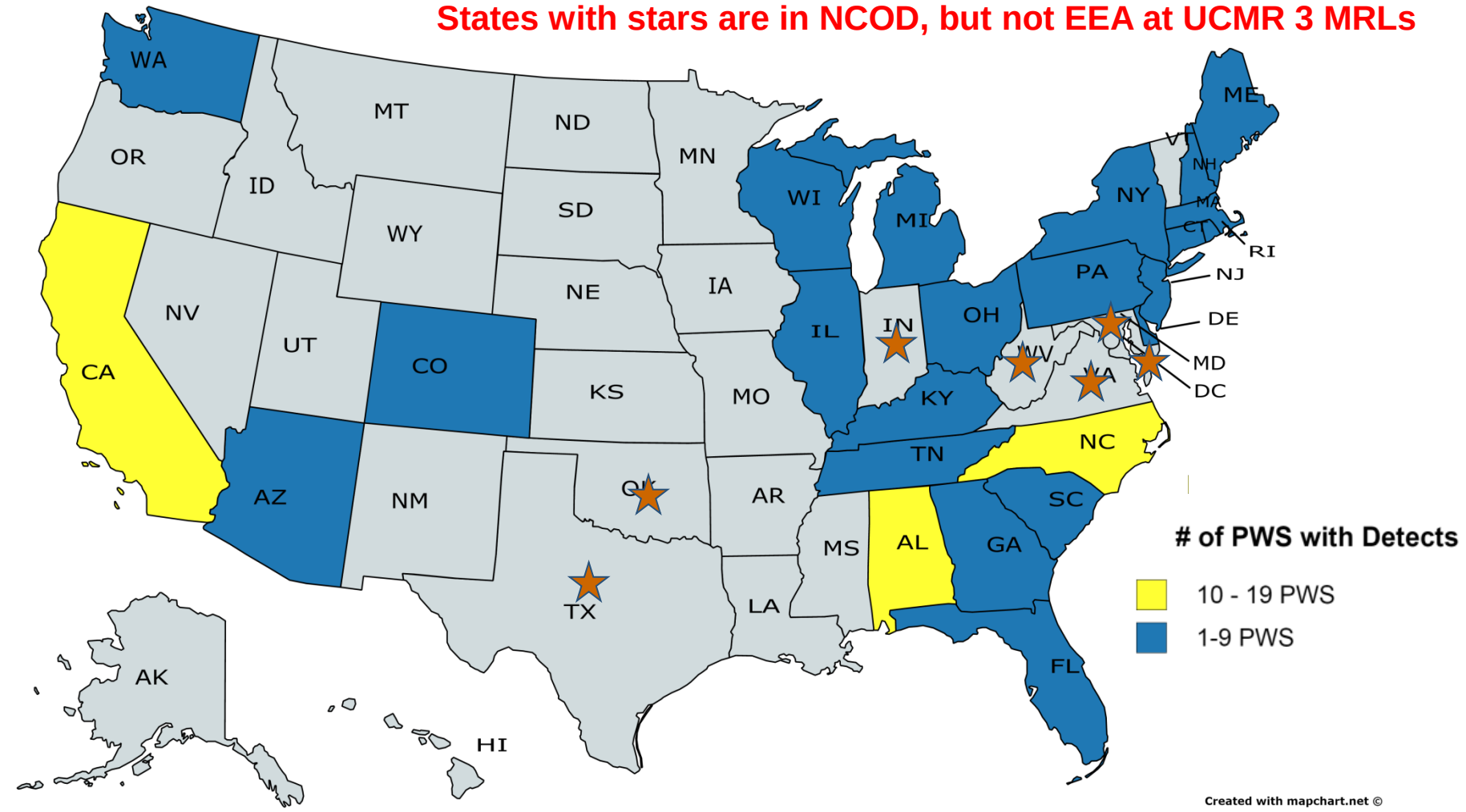
NCOD - 24 States/Territories with PWS with Health Advisory Exceedances



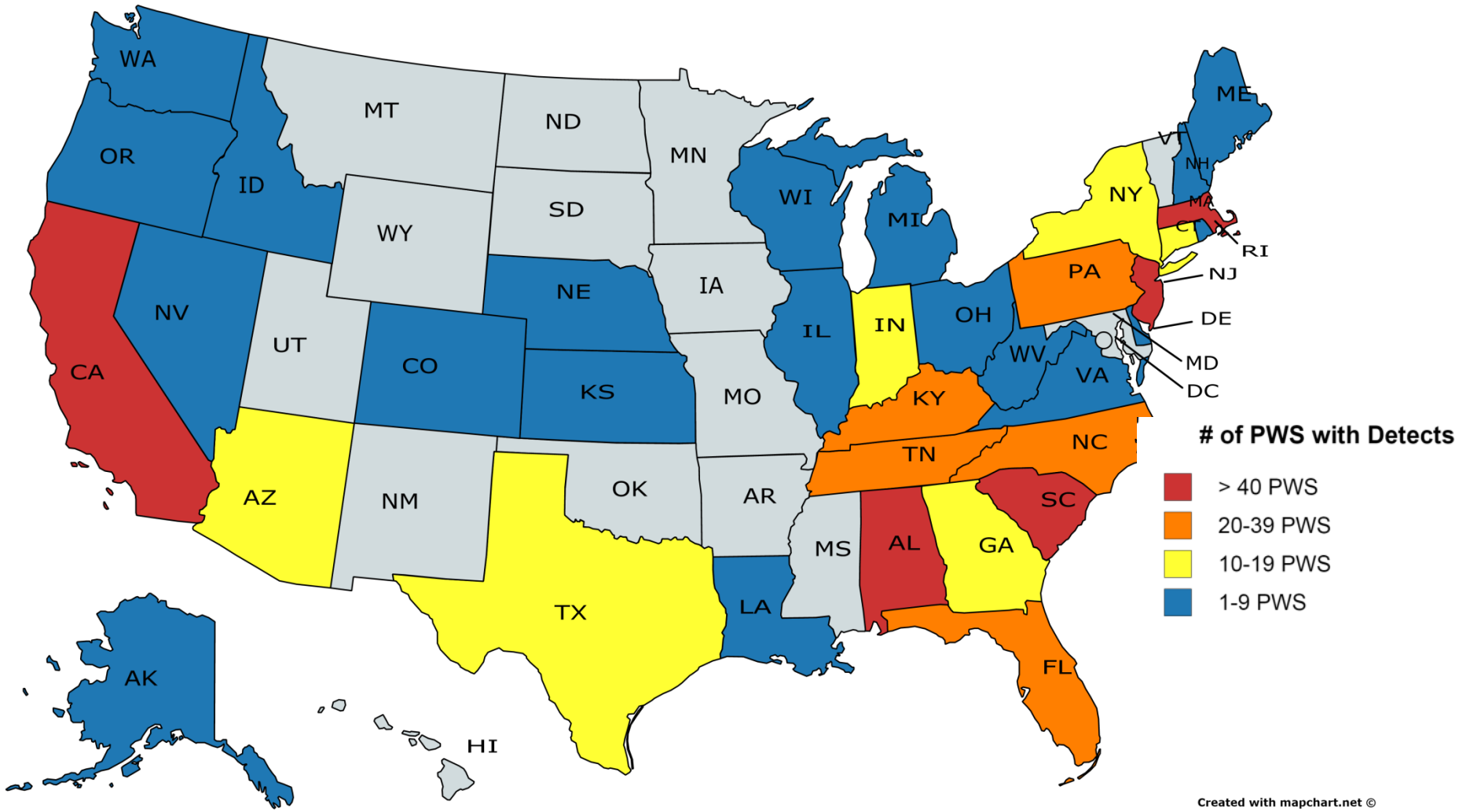
NCOD - 36 States with PWS Detections of PFOS and/or PFOA at UCMR3 MRLs



EEA Data - 27 States with PFOS/PFOA Detections based on UCMR 3 MRLs



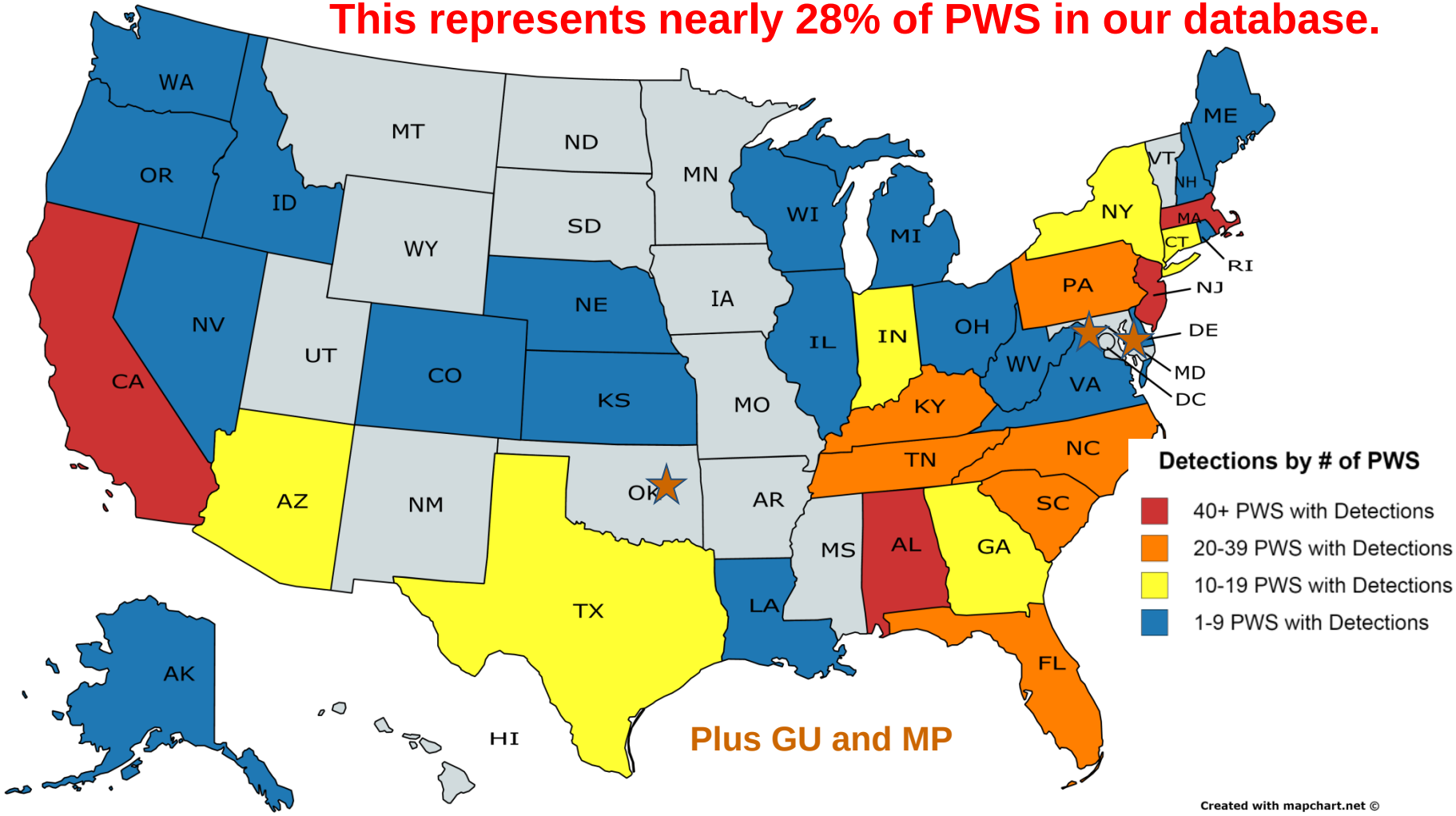
37 States/Territories have PWS with PFOS-PFOA Detects at 5 ng/L MRL



EEA Data - 511 PWS in 40 States/Territories Have at Least 1 Compound at 5 ng/L or More



This represents nearly 28% of PWS in our database.



Plus GU and MP

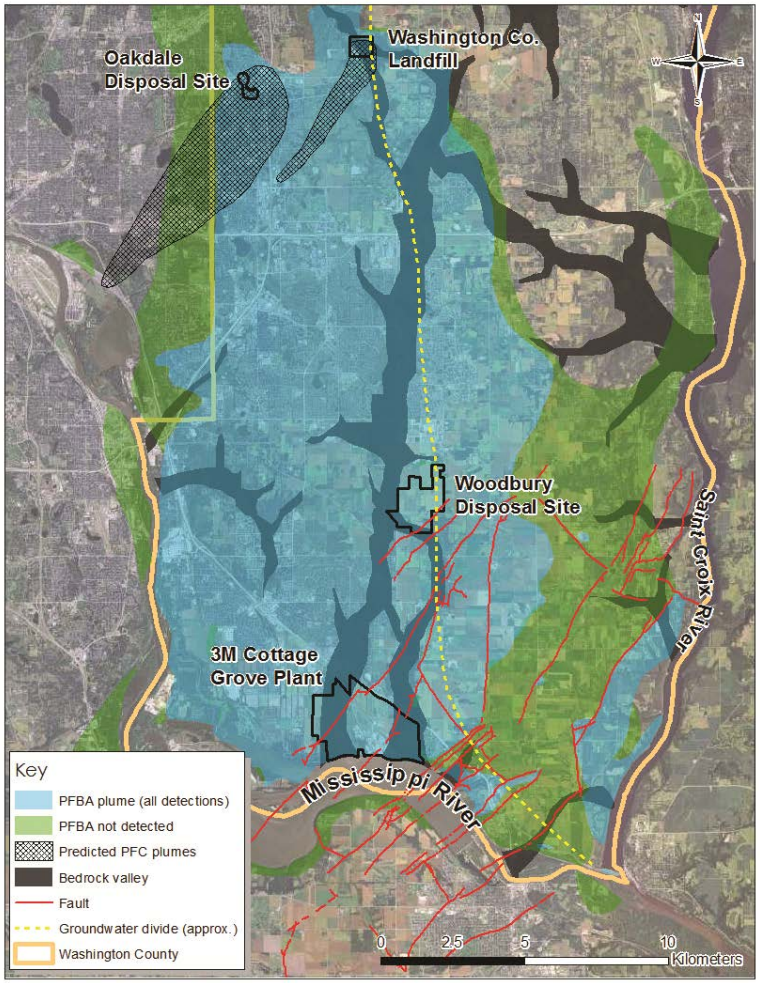
Plus 3 more states with NCOD detections but insufficient EEA data

Frequency of Detection Comparison by # of Samples

Compound	Official NCOD Database samples with detection (UCMR 3 MRLs)	EEA Subset of Samples with detection using UCMR 3 MRLs	EEA Subset of Samples with detection using 5 ng/L MRL	EEA Subset of Samples with detection using 2.5 ng/L MRL
N	~36,000	~10,500	~10,500	~10,500
PFOS	0.8%	1.3%	11.5%	20.5%
PFOA	1.0%	1.8%	12.5%	23.5%
PFNA	0.1%	0.1%	0.6%	1.9%
PFHxS	0.6%	1.0%	6.0%	12.3%
PFHpA	0.6%	1.5%	3.3%	8.8%
PFBS	<0.1%	0.2%	5.3%	11.9%

Washington Co., MN: A PFC Megaplume Investigated Since 2003

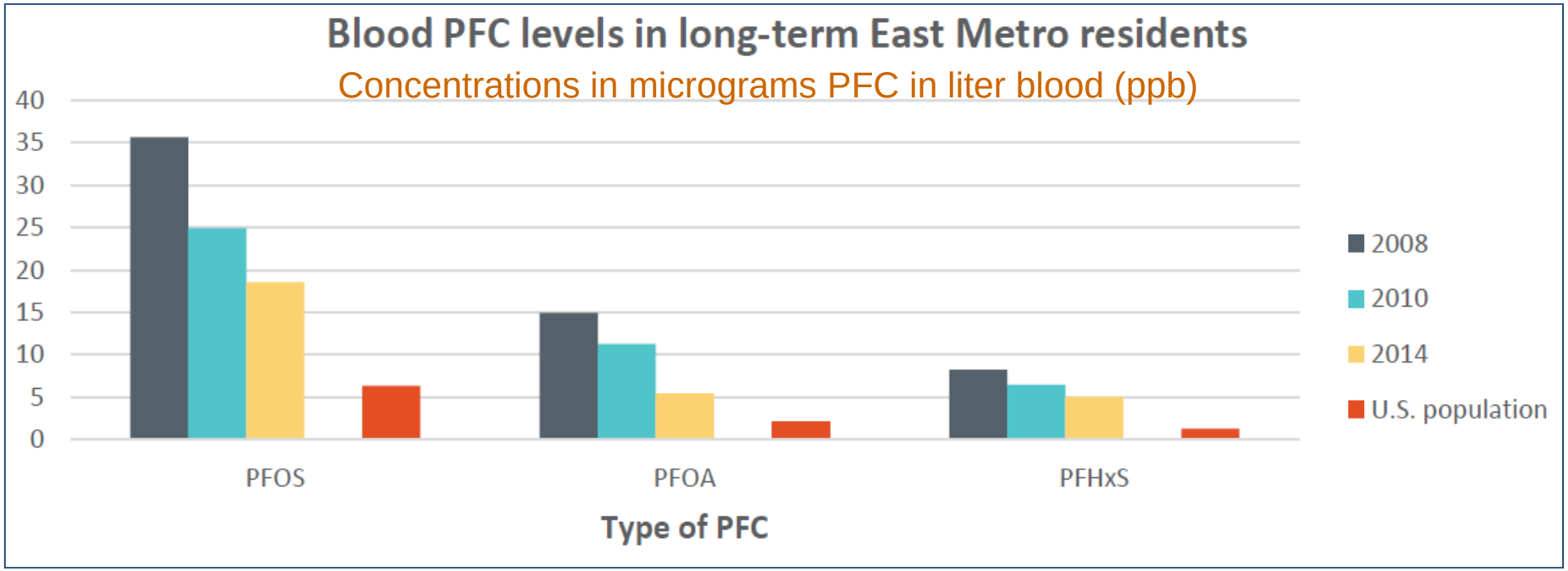
- **Over 100 mi² contaminated**
  - 4 major aquifers
  - 8 municipal systems
  - 140,000+ residents
  - 4,000+ private wells
    - PFAS detected in 1,200+
  - Models under-predicted extent
- **PFBA most widespread**
  - Short-chain carboxylate
  - Also detect PFOA, PFOS, PFHxS in abundance
  - And.. PFPeA, PFHxA, PFBS



Courtesy of Virginia Yingling (MDH)

Biomonitoring – 3M Plume

- Three rounds: 2008, 2010, 2014
- 196 initial participants (164 returned)
- PFCs decreased in blood of people drinking treated water (but ave. concentrations still > national ave.)



Courtesy of Virginia Yingling (MDH)

Conclusions

- The UCMR3 database drastically underestimates the occurrence of PFAS compounds in municipal waters because of MRLs that were too high.
- The high frequency of 5 ng/L detection of any PFAS compound (28% of tested PWS) suggests that utilities should proactively consider monitoring to check for potential plumes, even if the UCMR3 database showed no detection.
- The megaplume in MN shows how complex the problem may be and if you restrict yourself to monitoring PFOS/PFOA you may be short sighted.

Acknowledgements

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Eurofins Eaton Analytical

Any Questions?

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The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017

EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) program to collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act (SDWA). Every five years EPA develops a new list of UCMR contaminants, largely based on the Contaminant Candidate List (CCL). The SDWA Amendments of 1996 provide for:

- Monitoring no more than 30 contaminants per 5-year cycle
- Monitoring only a representative sample of public water systems (PWSs) serving less than or equal to 10,000 people
- Storing analytical results in a National Contaminant Occurrence Database (NCOD)

UCMR 3 required monitoring for 30 contaminants (28 chemicals and two viruses) between 2013 and 2015 using analytical methods developed by EPA, consensus organizations or both. This monitoring provides a basis for future regulatory determinations and/or other actions to protect public health.

This dataset represents the twelfth and final NCOD release of analytical results for UCMR 3. Additional reference material is available to assist with the assessment of the UCMR 3 data.

- EPA's UCMR 3 website
- Instructions for importing and viewing UCMR 3 results
- Additional information for the UCMR 3 contaminants on the CCL & Regulatory Determination website

UCMR 3 Data Considerations

To perform additional data analyses, EPA suggests importing each field into your choice of software as text. Some of the IDs can be misinterpreted as long integer field types when they actually contain alpha characters. Data are presented as tab delimited text files, with field names included in the first row of each file and no text qualifier:

- Select "UCMR 3 Occurrence Data" to find the text file containing ALL results to date (UCMR3_All.txt)
- Select "UCMR 3 Occurrence Data by State" to find the text files containing ALL results to date for tribes and states AK-LA (UCMR3_All_Tribes_AK_LA.txt) and states MA-WY (UCMR3_All_MA_WY.txt)
- Select "UCMR 3 Occurrence Data by Method Classification" to find method-specific text files (UCMR3_*MethodNumber*.txt, example UCMR3_200_8 for EPA method 200.8)
- Text file containing disinfectant residual type (UCMR3_DRT.txt)
- Text file containing the U.S. Postal Service zip code(s) for all areas served by a PWS (UCMR3_ZipCodes.txt)

Samples collected at the maximum residence time in the distribution system (MR) were required to be analyzed for metals (including chromium-6) and chlorate. PWSs monitoring for Method 300.1 (chlorate) reported disinfectant types. In addition to reporting occurrence data for UCMR 3 target analytes, EPA tasked its small-system contract-support laboratories with reporting results for sec-butylbenzene, n-propylbenzene, tellurium, germanium and manganese. These additional unregulated analytes are within the scope of the methods already being performed for the UCMR analytes. Population categories are based on retail population as indicated by the Safe Drinking Water Information System (Federal) (SDWIS/FED) as of December 31, 2010.

UCMR 3 Data Field Names and Definitions

Field Name	Definition
PWSID	Public Water System Identification Code, 9-character identification code (Begins with the standard 2-character postal State abbreviation or Region code, and the remaining seven numbers are unique to each PWS in the state)
PWSName	Name of the Public Water System (PWS)
Size	Size category of the PWS for UCMR, based on retail population as of December 31, 2010: S (≤ 10,000), L (> 10,000)
FacilityID	Public Water System Facility Identification Code, 5-digit identification code
FacilityName	Name of the facility at the PWS
FacilityWaterType	Source of water at the facility: SW (surface water), GW (ground water), GU (ground water under the direct influence of surface water), MX (Any combination of: SW, GW and GU)
SamplePointID	Identification code for each sample point location in the PWS
SamplePointName	Name of the sample point for every sample point ID at a PWS
SamplePointType	Sampling Point Type Code: EP (entry point to the distribution system), MR (distribution system at maximum residence time)
AssociatedFacilityID	The facility ID of the associated MR
AssociatedSamplePointID	The sample point ID of the associated MR
Disinfectant Type	CLGA (Gaseous Chlorine), CLOF (Offsite Generated Hypochlorite, stored as liquid), CLON (Onsite Generated Hypochlorite, no storage), CAGC (Chloramine, formed from gaseous chlorine), CAOF (Chloramine, formed from offsite hypochlorite), CAON (Chloramine, formed from onsite hypochlorite), CLDO (Chlorine Dioxide), OZON (Ozone), ULVL (Ultraviolet Light), OTHD (All other types of disinfectant), NODU (No Disinfectant Used)
CollectionDate	Date of sample collection (month, day, year)
SampleID	Identification code for each sample, as defined by the laboratory
Contaminant	Unregulated contaminant being analyzed in UCMR 3
MRL	Minimum Reporting Level defined by UCMR 3 in µg/L for the chemicals

Field Name	Definition
MethodID	Identification code of the analytical method
AnalyticalResultsSign	Less than (<) the minimum reporting level (MRL) or equal to (=) a numeric value at or above the MRL
AnalyticalResultValue	Numeric value of the analytical result in µg/L for the chemicals, null values represent less than MRL
SampleEventCode	Identification code for each sample event. Includes sample event one (SE1), sample event two (SE2), sample event three (SE3), and sample event four (SE4).
MonitoringRequirement	AM (Assessment Monitoring, List 1), SS (Screening Survey, List 2), PST (Pre-Screen Testing, List 3)
Region	EPA Region (States): 1 (CT, ME, MA, NH, RI, VT), 2 (NJ, NY, PR (Puerto Rico), VI (Virgin Islands)), 3 (DE, DC, MD, PA, VA, WV), 4 (AL, FL, GA, KY, MS, NC, SC, TN), 5 (IL, IN, MI, MN, OH, WI), 6 (AR, LA, NM, OK, TX), 7 (IA, KS, MO, NE), 8 (CO, MT, ND, SD, UT, WY), 9 (AZ, CA, HI, NV, AS (American Samoa), GU (Guam), MP (Northern Marianas Islands), NN (Navajo Nation)), 10 (AK, ID, OR, WA)
State	State abbreviation
ZipCode	U.S. Postal Service zip code(s) for all areas being served water by a PWS

UCMR 3 Chemical Contaminants and Methods

Contaminant	Contaminant Full Name	CAS[1] Number	Method ID	Method Name	Monitoring Requirement
1,2,3-trichloropropane	1,2,3-trichloropropane	96-18-4	524.3	Volatile Organic Compounds	AM
1,3-butadiene	1,3-butadiene	106-99-0	524.3	Volatile Organic Compounds	AM
Chloromethane	methyl chloride	74-87-3	524.3	Volatile Organic Compounds	AM
1,1-dichloroethane	1,1-dichloroethane	75-34-3	524.3	Volatile Organic Compounds	AM
Bromomethane	methyl bromide	74-83-9	524.3	Volatile Organic Compounds	AM
HCFC-22	chlorodifluoromethane	75-45-6	524.3	Volatile Organic Compounds	AM
Halon 1011	bromochloromethane	74-97-5	524.3	Volatile Organic Compounds	AM
1,4-dioxane	1,4-dioxane	123-91-1	522	Synthetic Organic Compound	AM
Vanadium	vanadium	7440-62-2	200.8	Metals	AM
Molybdenum	molybdenum	7439-98-7	200.8	Metals	AM
Cobalt	cobalt	7440-48-4	200.8	Metals	AM
Strontium	strontium	7440-24-6	200.8	Metals	AM
Chromium	total chromium	N/A	200.8	Metals	AM
Chromium-6	chromium-6	18540-29-9	218.7	Chromium-6	AM
Chlorate	chlorate	14866-68-3	300.1	Oxyhalide Anion	AM
PFOS	perfluorooctanesulfonic acid	1763-23-1	537	Perfluorinated Compounds	AM
PFOA	perfluorooctanoic acid	335-67-1	537	Perfluorinated Compounds	AM
PFNA	perfluorononanoic acid	375-95-1	537	Perfluorinated Compounds	AM
PFHxS	perfluorohexanesulfonic acid	355-46-4	537	Perfluorinated Compounds	AM
PFHpA	perfluoroheptanoic acid	375-85-9	537	Perfluorinated Compounds	AM
PFBS	perfluorobutanesulfonic acid	375-73-5	537	Perfluorinated Compounds	AM
17β-estradiol	estradiol	50-28-2	539	Hormones	SS
17α-ethynylestradiol	ethinyl estradiol	57-63-6	539	Hormones	SS
Estriol	16-α-hydroxyestradiol	50-27-1	539	Hormones	SS
Equilin	equilin	474-86-2	539	Hormones	SS
Estrone	estrone	53-16-7	539	Hormones	SS
Testosterone	testosterone	58-22-0	539	Hormones	SS
4-androstene-3,17-dione	4-androstene-3,17-dione	63-05-8	539	Hormones	SS

[1]Chemical Abstract Service

UCMR 3 Microbiological Contaminants and Methods

Contaminant	Method ID	Method Name	Monitoring Requirement
Enteroviruses	EPA 1615A	Enterovirus cell culture	PST
Enteroviruses	EPA 1615B	Enterovirus RT-qPCR	PST
Noroviruses	EPA 1615C	Norovirus genogroup I with RT-qPCR primer set A	PST
Noroviruses	EPA 1615D	Norovirus genogroup I with RT-qPCR primer set B	PST
Noroviruses	EPA 1615E	Noroviruses genogroup II	PST
Total coliforms	SM 9223B	Colilert®	PST
E.coli	SM 9223B	Colilert®	PST
Enterococci	ASTM D6503-99	Enterolert®	PST
Aerobic spores	SM 9218	Aerobic endospores	PST
Somatic phage	EPA 1602	Bacteriophage	PST
Male specific phage	EPA 1602	Bacteriophage	PST

UCMR 3 Reference Concentrations for Chemical Contaminants

For the third Unregulated Contaminant Monitoring Rule (UCMR 3) chemicals were being studied at levels that were often significantly below those in prior UCMR cycles. Importantly, UCMR 3 minimum reporting levels (MRLs) were established based on the capability of the analytical method, not based on a level established as "significant" or "harmful." In fact, the UCMR 3 MRLs are often below current "health reference levels" (to the extent that HRLs have been established).

Results of UCMR 3 measurements should be interpreted accordingly. The detection of a UCMR 3 contaminant above the MRL does not represent cause for concern, in and of itself. Rather, the implications of the detection should be judged considering health effects information (which is often still under development or being refined for unregulated contaminants).

The intent of the following table is to identify draft UCMR reference concentrations, where possible, to provide context around the detection of a particular UCMR contaminant above the MRL. The draft reference concentration does not represent an "action level" (EPA requires no particular action[1,2] based simply on the fact that UCMR monitoring results exceed draft reference concentrations), nor should the draft reference concentration be interpreted as any indication of an Agency intent to establish a future drinking water regulation for the contaminant at this or any other level. Decisions as to whether or not to regulate the contaminant in drinking water will continue to be made following the Agency's Regulatory Determination process. Visit EPA's Regulatory Determination website for more information.

The following key principles guided the development of the table:

(1) The reference concentrations are based on publically-available health information found in the following EPA resources: 2012 Drinking Water Standards and Health Advisories, the CCL 4 Contaminant Information Sheets, the Human Health Benchmark for Pesticides (HHBPs), the Integrated Information Risk System (IRIS), or the 2014 Preliminary Regulatory Determinations for Contaminants on CCL 3. The primary/secondary sources of health information vary with respect to scientific rigor from health assessment to single studies and are cited in the table.

(2) If health information was available from more than one of the EPA resources listed above, the most recent health information was used for the draft reference concentrations.

(3) Where both cancer and non-cancer draft reference concentrations existed, the lower (more conservative) of the two concentrations was used. For chemicals with reference concentrations based on a cancer endpoint, the table presents a range of values associated with 10^{-6} to 10^{-4} cancer risk. For chemicals with reference concentrations based on a non-cancer endpoint, the duration of exposure (short-term, intermediate/long-term, chronic) of the toxicity factor (e.g., Reference Dose) used as the basis for the reference concentration is shown.

Recognizing that additional health effects information will become available over time, those attempting to assess UCMR occurrence data are encouraged to visit EPA's Drinking Water Contaminant Human Health Effects Information website for the most recent information.

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[1] Consumer Confidence Report (CCR) and Public Notification (PN) reporting requirements (see 40 CFR 141.153(d) and 141.207, respectively) apply to PWSs; CCR requires particular reporting based on measurements relative to the UCMR method reporting limits (MRLs) defined in 40 CFR 141.40.
[2] States may establish requirements for drinking water contaminants not yet regulated by EPA, and those requirements may be based on state-established levels that differ from EPA's reference concentrations. PWSs are responsible for being aware of and complying with their state's requirements, if any.

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
Cobalt	1	70	N (intermediate exposure)	CCL 4 Contaminant Information Sheets
Molybdenum[1]	1	40	N (chronic exposure)	2012 Edition of the Health Advisories Table
Strontium[2]	0.3	1,500	N (chronic exposure)	Federal Register Notice for the Preliminary Regulatory Determinations for Contaminants on CCL 3
Vanadium[3]	0.2	21	N (intermediate exposure)	CCL 4 Contaminant Information Sheets
Chromium (Total)	0.2	100	N (chronic exposure)	The MCL for the National Primary Drinking Water Regulation
Chromium-6[4]	0.03	NA	-	-
Chlorate	20	210	N (chronic exposure)	CCL 4 Contaminant Information Sheets
1,4-dioxane[5]	0.07	0.35 to 35	Y	2012 Edition of the Health Advisories Table
1,1-dichloroethane[5]	0.03	6.14 to 614	Y	CCL 4 Contaminant Information Sheets
1,2,3-trichloropropane[5,6,7]	0.03	0.0004 to 0.04	Y	2009 IRIS Assessment

[1] The 2012 Edition of the Health Advisories Table and the CCL 4 Contaminant Information Sheets (35 µg/L) have slightly different numbers due to rounding.
[2] The reference concentration is based on the HRL cited in the preliminary regulatory determination for strontium [Docket No. EPA-HQ-OW-2012-0155].
[3] The ATSDR, 1992 used for the CCL 4 Contaminant Information Sheets is no longer publically available and has been replaced by a new assessment (ATSDR, 2012). The minimum risk level (RfD equivalent) was 0.003 mg/kg/day for minor renal effects in an animal study (ATSDR, 1992) compared to 0.01 mg/kg/day for lack of minor effects in blood pressure, body weight, and hematological parameters in a human study with a 12 week exposure (ATSDR, 2012).
[4] The contaminant is on the IRIS Agenda for either a new assessment or an updated assessment; check status here.
[5] Reference Concentration range based on cancer risk of 10^{-6} to 10^{-4}.
[6] 10^{-6} cancer risk < MRL < 10^{-4} cancer risk.
[7] To derive the reference concentration, age dependent adjustment factors were applied to the IRIS oral slope factor of 30 per mg/kg-day (calculated using adult exposure data) to address presumed early-life susceptibility for this chemical (per EPA's Guidelines for Carcinogen Risk Assessment).

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
1,3-butadiene[5,6]	0.1	0.0103 to 1.03	Y	CCL 4 Contaminant Information Sheets
HCFC-22 (chlorodifluoromethane) [8]	0.08	NA	-	-
Chloromethane (methyl chloride)[5]	0.2	2.69 to 269	Y	CCL 4 Contaminant Information Sheets
Halon 1011 (bromochloromethane)[9]	0.06	90	N (chronic exposure)	2012 Edition of the Health Advisories Table
Bromomethane (methyl bromide)	0.2	140	N (chronic exposure)	Human Health Benchmark for Pesticides (HHBPs)
PFBS	0.09	NA	-	-
PFHpA	0.01	NA	-	-
PFHxS	0.03	NA	-	-
PFNA	0.02	NA	-	-
PFOS	0.04	0.07	N (chronic exposure)	Health Advisory and Supporting Documentation for PFOS
PFOA	0.02	0.07	N (chronic exposure)	Health Advisory and Supporting Documentation for PFOA
17α-ethynylestradiol (ethinyl estradiol)	0.0009	0.035	N (chronic exposure)	CCL 4 Contaminant Information Sheets
17β-estradiol (estradiol)[5]	0.0004	0.0009 to 0.09	Y	CCL 4 Contaminant Information Sheets

[8] The CCL 4 Contaminant Information Sheets provide a reference level of 31.5 µg/L; the number is based on a single LOAEL from a 1983 study.

[9] The 2012 Edition of the Health Advisories Table and the CCL 4 Contaminant Information Sheets (70 µg/L) have slightly different numbers due to rounding.

Contaminant	*MRL (µg/L)*	*Reference Concentration (µg/L)*	*Reference Concentration based on a Cancer Endpoint (Y/N)*	*EPA Reference(s)*
Equilin	0.004	0.35	N (chronic exposure)	CCL 4 Contaminant Information Sheets
Estriol (16-α-hydroxyestradiol)	0.0008	0.35	N (chronic exposure)	CCL 4 Contaminant Information Sheets
Estrone	0.002	0.35	N (chronic exposure)	CCL 4 Contaminant Information Sheets
4-androstene-3,17-dione	0.0003	NA	-	-
Testosterone	0.0001	NA	-	-

Terms

a) UCMR Draft Reference Concentration = The reference concentrations are based on publically-available health information found in the following EPA resources: 2012 Drinking Water Standards and Health Advisories (HAs), the CCL 4 Contaminant Information Sheets (i.e., HRLs), the Human Health Benchmark for Pesticides (HHBPs), or the 2014 Preliminary Regulatory Determinations for Contaminants on CCL 3 (i.e., HRLs). The primary/secondary sources of health information vary with respect to scientific rigor from health assessment to single studies. Many of the contaminants are currently under regulatory review or development and are subject to change as new health assessments are completed.
b) MRL = UCMR Minimum Reporting Level. *[Note that the Agency for Toxic Substances & Disease Registry (ATSDR) uses the term "MRL" for a different purpose (i.e., to describe "Minimal Risk Levels"). The UCMR term and the ATSDR term have no relationship to each other.]*
c) HAs = Health advisories. HAs provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's health advisories are non-enforceable and non-regulatory and provide technical information to state agencies and other public health officials on health effects, analytical methodologies, and treatment technologies to assist with risk management decisions.
d) HRLs = Health Reference Levels. The CCL process derives HRLs using single studies to health assessments for screening purposes. The CCL HRLs derived from health assessments are used in the Regulatory Determination process as risk-derived concentrations against which to evaluate the occurrence data to determine if contaminants may occur at levels of public health concern. HRLs are not final determinations about the level of a contaminant in drinking water that is necessary to protect any particular population and are derived prior to development of a complete exposure assessment.
e) MCL = Maximum Contaminant Level. The highest level of a contaminant allowed in drinking water. MCLs are enforceable standards.
f) Cancer Risk of 10^{-6} to 10^{-4} = the concentration of a contaminant in drinking water corresponding to an excess estimated lifetime cancer risk of one-in-a-million ($1x\ 10^{-6}$) to one-in-ten-thousand (1×10^{-4}). The 2012 Drinking Water Standards and Health Advisories provide the cancer risk at 1×10^{-4}. The CCL 4 Contaminant Information Sheets provide the cancer risk at $1x\ 10^{-6}$.
g) LOAEL = Lowest Observed Adverse Effect Level
h) NA = Not Available
i) Short-term = Typically refers to animal toxicological studies with an exposure duration of days to weeks.
j) Intermediate/Longer-term = Typically refers to animal toxicological studies with an exposure duration of weeks to months.
k) Chronic = Typically refers to animal toxicological studies with an exposure duration of months to years; representing a lifetime exposure in humans.

References

2012 Drinking Water Standards and Health Advisories (https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information)
CCL 4 Contaminant Information Sheets (https://www.epa.gov/sites/production/files/2016-11/documents/815r16003.pdf)
Human Health Benchmark for Pesticides (HHBPs) (https://ofmpub.epa.gov/apex/pesticides/f?p=109:3)
Announcement of Preliminary Regulatory Determinations for Contaminants on the Third Drinking Water Contaminant Candidate List (https://www.epa.gov/ccl/regulatory-determination-3)
Integrated Risk Information System (IRIS) (http://cfpub.epa.gov/ncea/iris2/atoz.cfm)

January 2017 UCMR 3 Data Summary for Chemical Contaminants

Contaminant	MRL (µg/L)	Reference Concentration (µg/L)	Total number of results	Number of results ≥MRL	Number of results >Reference Concentration	% of total results >Reference Concentration	Total number of PWSs with results	Number of PWSs with results ≥MRL	Number of PWSs with results >Reference Concentration	% of PWSs with results >Reference Concentration
1,2,3-trichloropropane	0.03	0.0004 / 0.04[1]	36,848	256	256 / 197[1]	0.7% / 0.5%[1]	4,916	67	67 / 55[1]	1.4% / 1.1%[1]
1,3-butadiene	0.1	0.0103 / 1.03[1]	36,848	2	2 / 0[1]	0.005% / 0%[1]	4,916	2	2 / 0[1]	0.04% / 0%[1]
Chloromethane	0.2	2.69 / 269[1]	36,845	283	20 / 0[1]	0.05% / 0%[1]	4,916	138	8 / 0[1]	0.2% / 0%[1]
1,1-dichloroethane	0.03	6.14 / 614[1]	36,848	835	1 / 0[1]	0.003% / 0%[1]	4,916	244	1 / 0[1]	0.02% / 0%[1]
Bromomethane	0.2	140	36,848	115	0	0%	4,916	49	0	0%
HCFC-22	0.08	NA	36,847	827	- -	- -	4,916	286	- -	- -
Halon 1011	0.06	90	36,847	655	0	0%	4,916	309	0	0%
1,4-dioxane	0.07	0.35 / 35[1]	36,810	4,197	1,081 / 0[1]	2.9% / 0%[1]	4,915	1,077	341/ 0[1]	6.9% / 0%[1]
Vanadium	0.2	21	62,981	37,954	1,680	2.7%	4,922	3,625	163	3.3%
Molybdenum	1	40	62,986	25,377	151	0.2%	4,922	2,546	40	0.8%
Cobalt	1	70	62,982	833	3	0.005%	4,922	247	3	0.06%
Strontium	0.3	1,500	62,913	62,799	1,739	2.8%	4,922	4,922	286	5.8%
Chromium	0.2	100	62,917	31,773	1	0.002%	4,922	3,660	1	0.02%
Chromium-6	0.03	NA	62,837	47,503	- -	- -	4,919	4,401	- -	- -
Chlorate	20	210	62,859	34,426	9,796	15.6%	4,918	3,391	1,896	38.6%
PFOS	0.04	0.07	36,972	292	124	0.3%	4,920	95	46	0.9%
PFOA	0.02	0.07	36,972	379	32	0.09%	4,920	117	13	0.3%
PFNA	0.02	NA	36,972	19	- -	- -	4,920	14	- -	- -
PFHxS	0.03	NA	36,971	207	- -	- -	4,920	55	- -	- -
PFHpA	0.01	NA	36,972	236	- -	- -	4,920	86	- -	- -
PFBS	0.09	NA	36,972	19	- -	- -	4,920	8	- -	- -
17β-estradiol	0.0004	0.0009 / 0.09[1]	11,795	4	1 / 0[1]	0.008% / 0%[1]	1,201	2	1 / 0[1]	0.08% / 0%[1]
17α-ethynylestradiol	0.0009	0.035	11,796	4	0	0%	1,201	4	0	0%
Estriol	0.0008	0.35	11,796	4	0	0%	1,201	4	0	0%
Equilin	0.004	0.35	11,796	0	0	0%	1,201	0	0	0%
Estrone	0.002	0.35	11,796	0	0	0%	1,201	0	0	0%
Testosterone	0.0001	NA	11,795	72	- -	- -	1,201	65	- -	- -
4-androstene-3,17-dione	0.0003	NA	11,796	101	- -	- -	1,201	77	- -	- -

[1]Where two reference concentrations are listed, the first number is associated with a 10^{-6} cancer risk; the second number a 10^{-4} cancer risk.
Where two results are presented the first number is associated with the first reference concentration; the second number is associated with the second reference concentration.

January 2017 UCMR 3 Data Summary for Microbiological Contaminants

Contaminant	MRL	Unit	Total number of results	Number of results ≥MRL	Total number of PWSs with results	Number of PWSs with results ≥MRL
Aerobic spores	1	SFO[1]/100 mL[2]	1,047	317	793	252
E. coli	1	MPN[3]/100 mL	1,045	3	791	3
Enterococci	1	MPN/100 mL	1,044	41	792	41
Enteroviruses (cell culture)	0.002	MPN/L[4]	1,044	2	789	2
Enteroviruses (RT-qPCR[5])	0.398	GC[6]/L	1,044	6	789	6
Male specific phage	1	PFU[7]/100 mL	1,029	14	783	14
Noroviruses GIA[8]	0.398	GC/L	1,044	4	789	4
Noroviruses GIB[9]	0.398	GC/L	1,044	2	789	2
Noroviruses GII[10]	0.398	GC/L	1,044	4	789	4
Somatic phage	1	PFU/100 mL	1,029	5	783	5
Total coliforms	1	MPN/100 mL	1,045	57	791	53

[1]SFO = Spore Forming Units
[2]mL = milliliters
[3]MPN = Most Probable Number
[4]L = liters
[5]RT-qPCR = Reverse Transcription-Polymerase Chain Reaction
[6]GC = Genomic Copies
[7]PFU = Plaque Forming Units
[8]Noroviruses GIA = qPCR analysis of Norovirus genogroup I with RT-qPCR primer set A
[9]Noroviruses GIB = qPCR analysis of Norovirus genogroup I with RT-qPCR primer set B
[10]Noroviruses GII = qPCR analysis of Norovirus genogroup II

UCMR 3 Minimum Reporting Levels for Microbiological Contaminants

Under UCMR 3 microbe analytical results are reported as “below”, “at” or “above” MRL. UCMR 3 MRLs were established based on the capability of the analytical method.

It is important to note that microbial contamination can be transient in nature and microbial detections under UCMR 3 should be interpreted in the context of the time samples were collected. However, the presence of any UCMR 3 microbe indicates a potential vulnerability of the PWS to contamination.

Questions asked by this news organization, answers provided by EPA.

1. Has EPA staff conducted any significant analyses on the occurrence of PFAS compounds in public water systems below the MRL levels used in the UCMR3 program? Additionally, has it done any reexamination of UCMR3 data looking below the previously-used MRL levels (20 ng/l PFOA, 40 ng/l PFOS?)

EPA has not collected PFAS occurrence data at levels below the Unregulated Contaminant Monitoring Rule (UCMR 3) maximum residue levels (MRLs). Under UCMR 3, laboratories only reported results at or above the MRL.

2. Is EPA staff familiar with the attached report from Eurofins Eaton Analytical? Either way, how does EPA respond to the report's statement that "The UCMR3 database drastically underestimates the occurrence of PFAS compounds in municipal waters because of MRLs that were too high" and does EPA agree or disagree that "The high frequency of 5 ng/L detection of any PFAS compound (28% of tested PWS) suggests that utilities should proactively consider monitoring to check for potential plumes, even if the UCMR3 database showed no detection?"

EPA is aware that some laboratories are able to achieve reporting limits lower than those established for UCMR 3. However, UCMR 3 MRLs were established so that a national array of laboratories could meet them and were based on looking at the capability of multiple commercial laboratories.

3. In my understanding, the UCMR program is to help the EPA decide which chemicals require regulation. Where is the EPA in the regulatory determination process for UCMR3 chemicals, and if decisions have been made, were PFOS and PFOA included or excluded from a list of "to-be" regulated chemicals?

EPA is currently conducting the scientific data collection and analysis called for under the Safe Drinking Water Act to evaluate PFOA and PFOS. EPA will consider occurrence data along with health effects information to determine whether or not to initiate the process to develop a National Primary Drinking Water Regulation (NPDWR) under Regulatory Determination 4. The agency expects to publish the fourth Regulatory Determination (RD4) in 2021.