



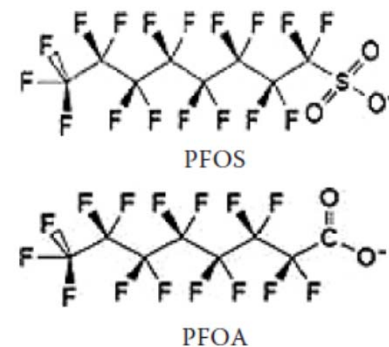
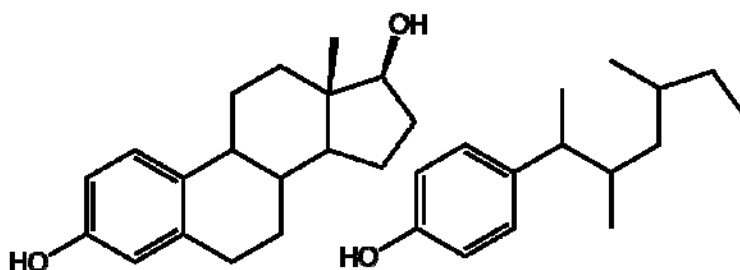
Assessing the Occurrence and Magnitude of Contaminants of Emerging Concern (CECs) in 50 Largest Wastewater Treatment Plants in the U.S.A.

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National Municipal Effluent CEC Study

Plant Selection Process

Large municipal plants

identified from Clean Watershed Needs Survey

>75% municipal flow

surface water (SW) discharge

50-1000 liters per person per day

In the US: 16,500 WWTPs -> 34 BGD

21 BGD = SW dischargers

16 BGD = SW disch, >75% municipal, 50-1000 LPD

Split this 16 BGD into thirds, based on plant flow:

Top third: 51 plants, 17% of US wastewater, 17% of population



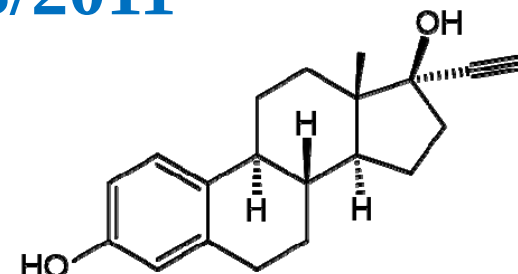


National Municipal Effluent CEC Study

Sampling 12/2010 – 3/2011

50 WWTPs (13 Repeated) serve 46M people,
EPA Regions 2-9 – # States 20

24-hour composite samples - from 50 very large WWTPs (15 to >500 MGD) –
Collected by Plants except for Plants in Regions 2 & 7



119 Analytes Measured

56 active pharmaceutical ingredients (APIs) + 7 metabolites

Kostich, Batt, and Lazorchak, 2014. Env Pol, 184:354.

8 - Hormones (4 estrogens, 3 androgens, and 1 progestin)

32- Alkylphenols (APs, NP, Ops, APEOs, NPEOs & OPEOs))

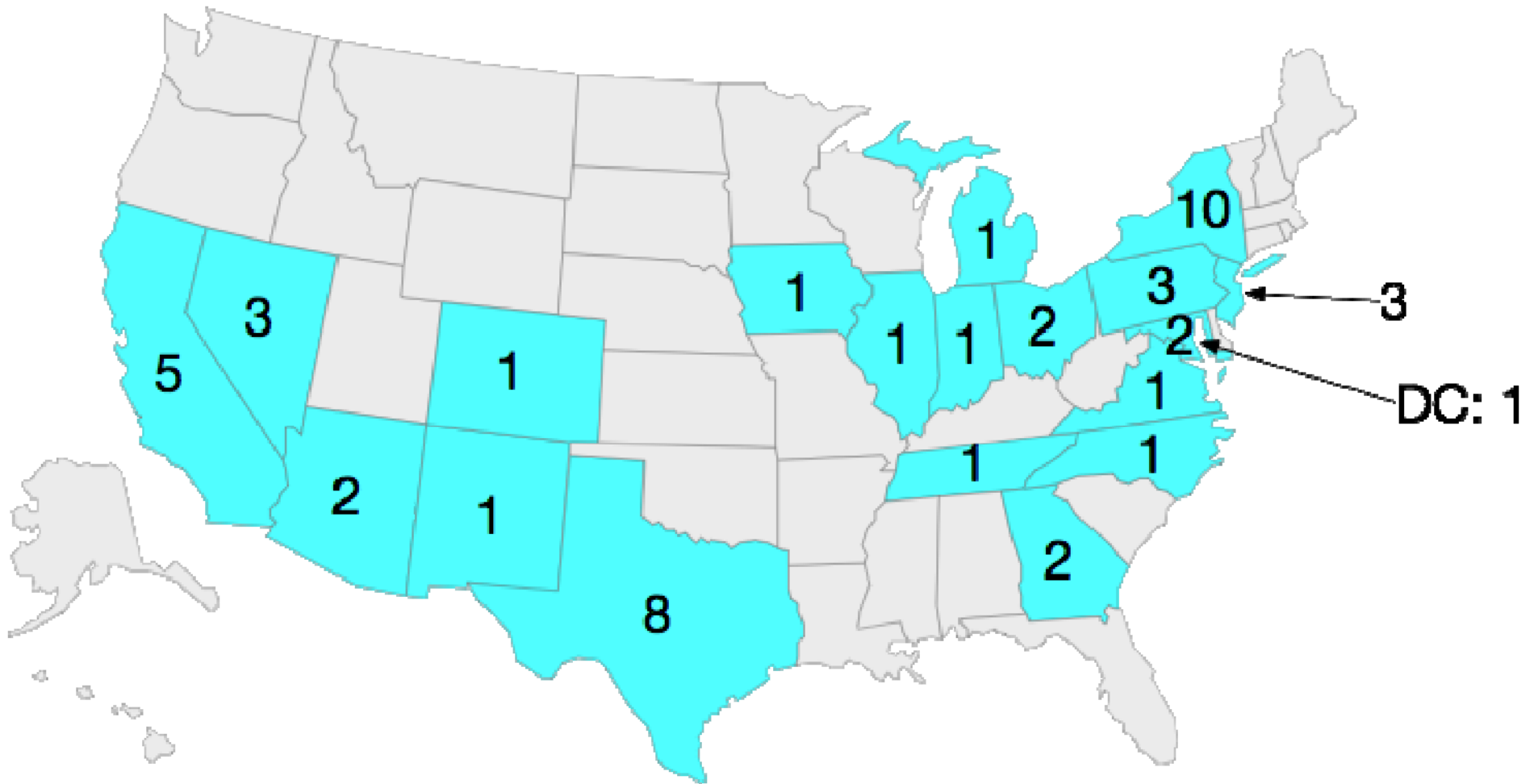
Bisphenol A

15 - Perfluorinated Chemicals (PFCs)

Perfluoralkyl Acids (PFAAs)



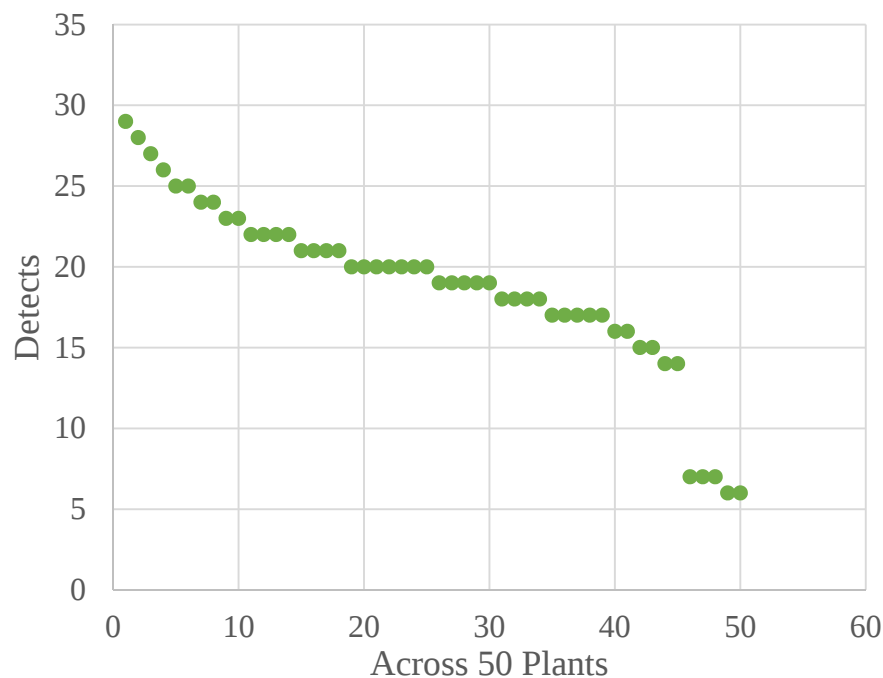
Geographical Distribution



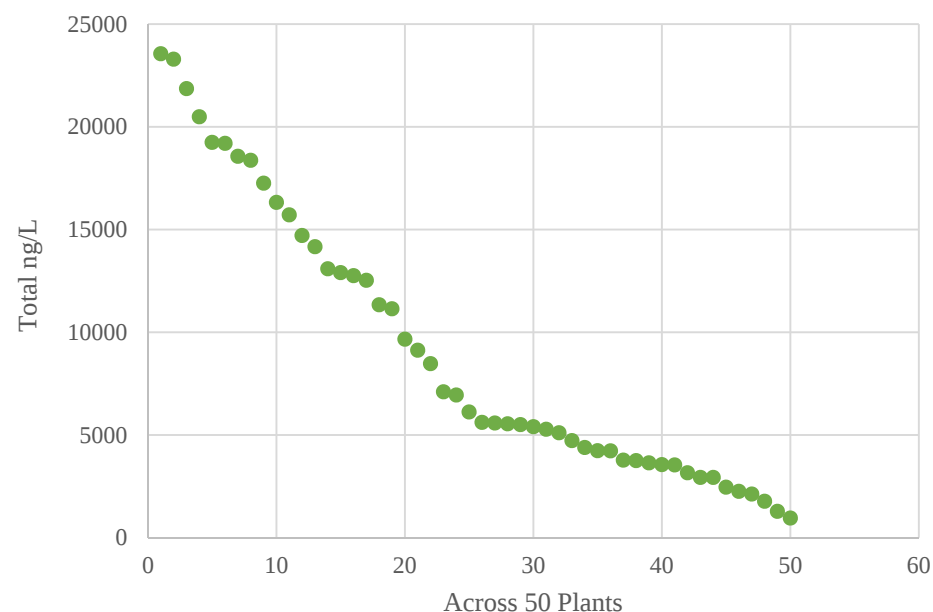
50 Largest Plants (20% pop, 17% discharge)

Summary of 63 Pharmaceuticals plus Metabolites Across all 50 Effluents

Detects out of 63 Pharmaceuticals



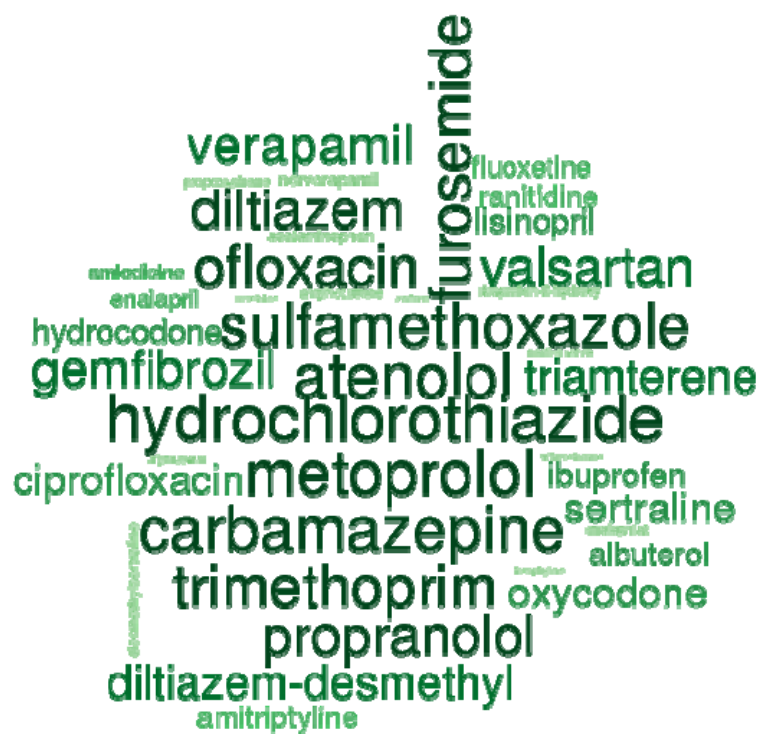
Total Mass of the Pharmaceuticals
Detected



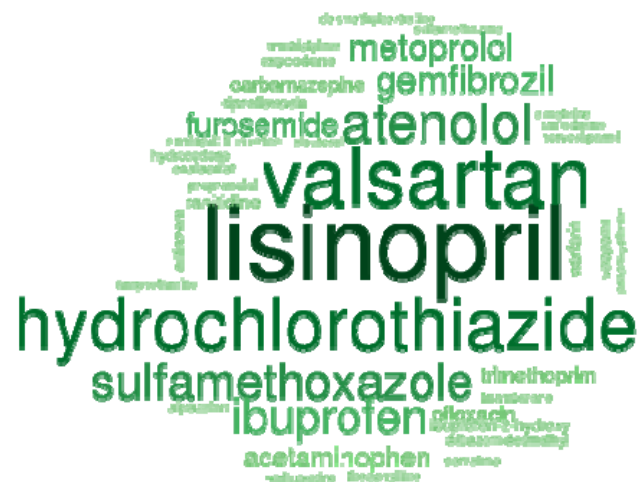
- 9 Pharmaceuticals (14 %) Detected at or above 1 ug/L
- 42 (84%) Effluents with 1-8 Pharms ≥ 0.7 ug/L or higher

Pharmaceuticals By Analyte

Weighted by Detects



Weighted by Total Mass

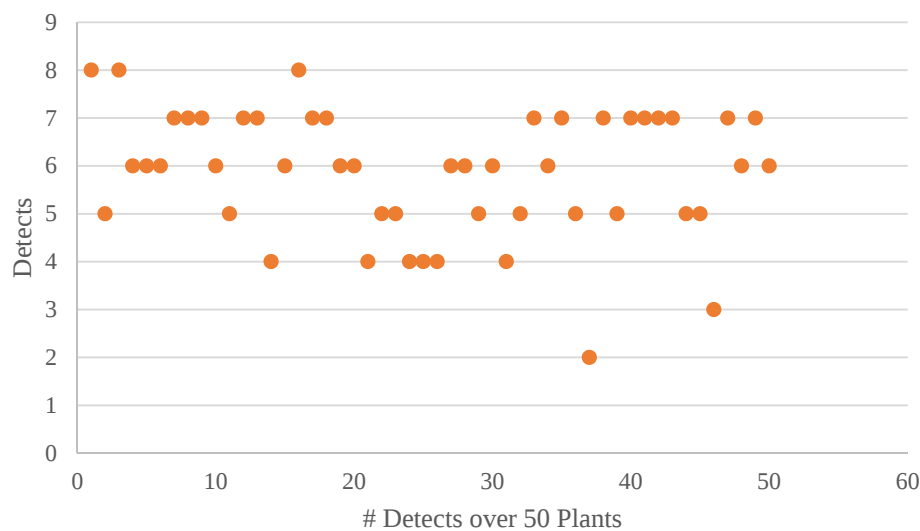


Prepared by Joel Allen U.S. EPA ORD

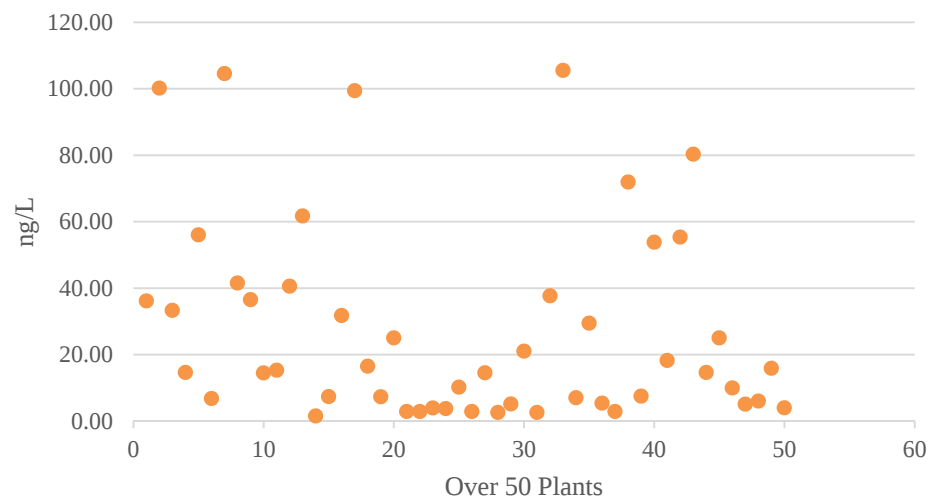
Summary of 8 Hormones

Across all 50 Effluents

Hormones Detected out of 8 Analyzed



Total Mass Of Hormones



- EE2 found in 49 (98%) Effluent 44 (88%) > PNEC of 0.35 ng/L
- Estradiol found in 30 (60%) Effluents
- 29 effluents have both EE2 and E2

Hormones By Analyte

Weighted by Detects



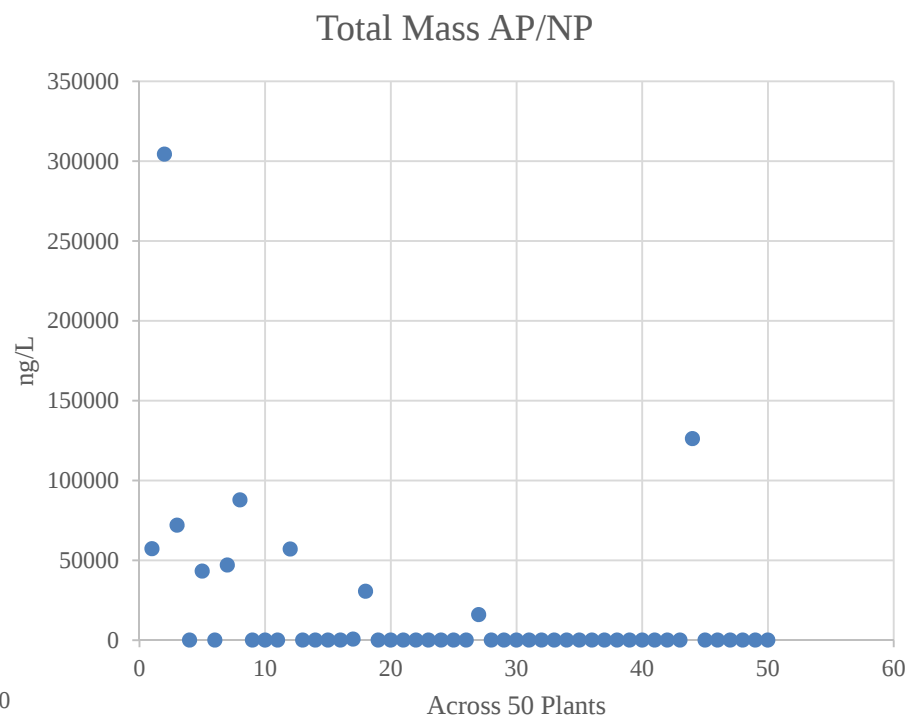
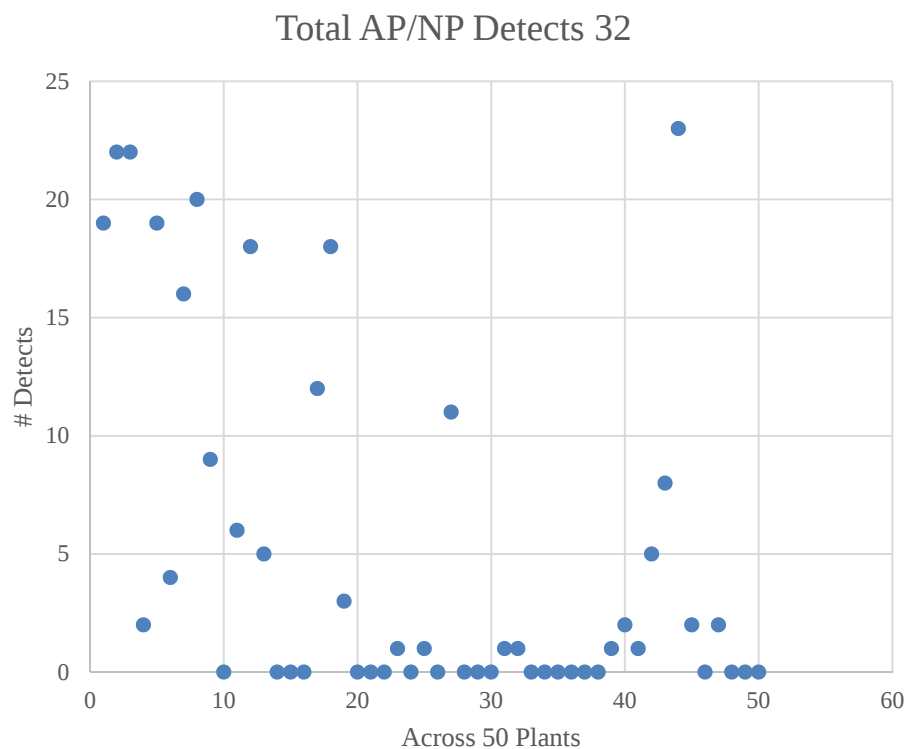
Weighted by Total Mass



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Summary of 32 Alkylphenols and Nonylphenol Across all 50 Effluents





NonylPhenols By Analyte

Weighted by Detects



Weighted by Total Mass



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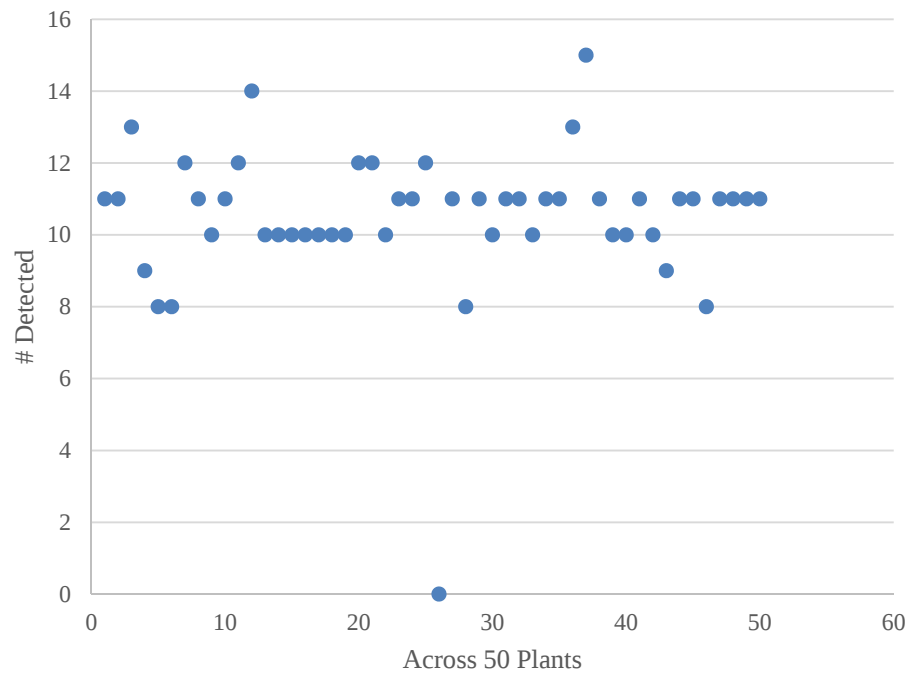
*NonDetects Dropped



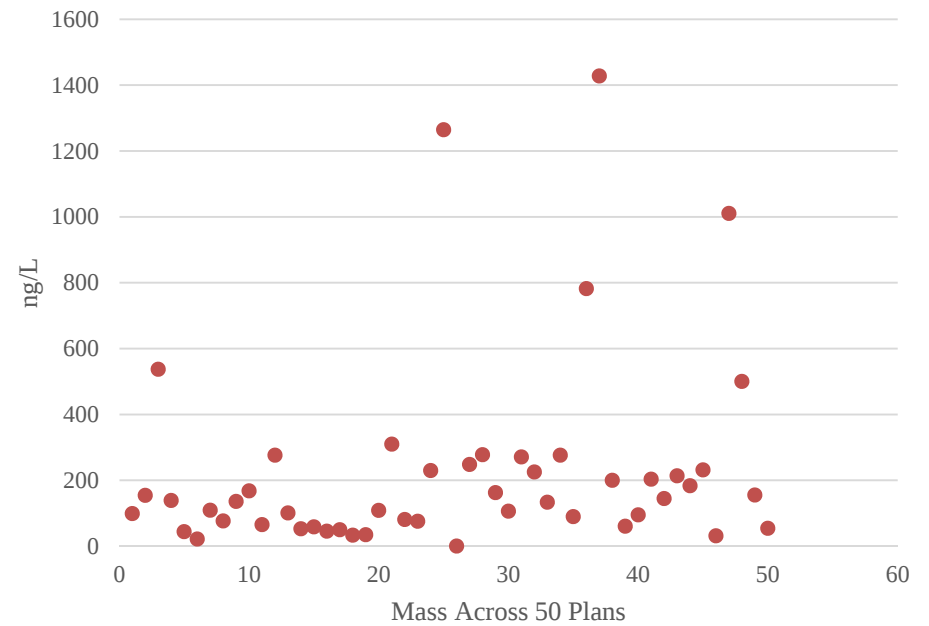
Summary of 15 PFAA (PFCs)

Across all 50 Effluents

Of PFAA Detects out of 15 Analytes



Total Mass PFAAs (PFCs)





Perfluoroalkyl Acids PFAA (PFCs)

Perfluorinated Compounds By Analyte

C3A = PFPA
C4A = PFBA
C5A = PFPeA
C6A = PFHxA
C7A = PFHpA
C8A = PFOA
C9A = PFNA
C10A = PFDA
C11A = PFUdA
C12A = PFDoA
C13A = PFTTrDA
C4S = PFBS
C6S = PFHxS
C8S = PFOS

Weighted by Detects



Weighted by Total Mass



Prepared by Joel Allen U.S. EPA ORD

*NonDetects Dropped



Summary of Detects and Total Mass of all COCs & by Mode of Action (MOA)

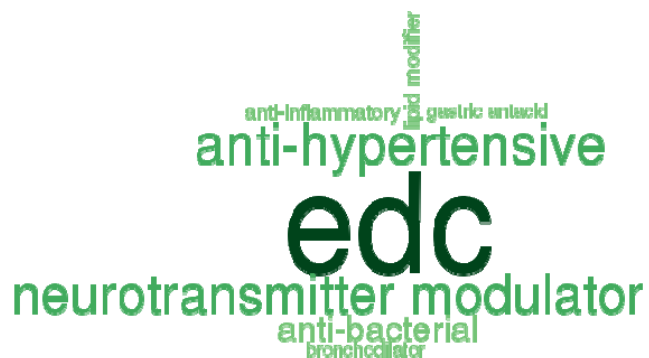
	Mean	Max	Min
116 total detected analytes	40 (34%)	67 (58%)	22 (19%)
Total Mass ng/L	25,849	294,367	1,233

MOA	Mean	Max	Min
EDCs (Hormones, NPs, PFAAs)	16,699	278,854	2.9
Anti Hypertensives 12	4,787	15,658	378
Neuro Trans Mod 19	1,559	4,716	182
Anti Inf (10)	1,039	8,097	0
Anti Bacterial 8	1,116	3,295	2.6
Gastric Anti acid (2)	234	1,352	13
Bronchodilator (1)		121	121
Anti Coagulant (1)		3,193	3,193

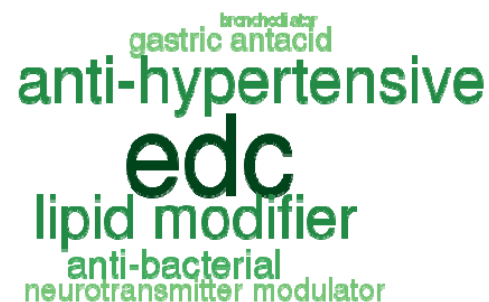


Mode Of Action

Weighted by Detects



Weighted by Mean



Prepared by Joel Allen U.S. EPA ORD

*NonDetects Dropped



Take Home Message

- Need to be looking at the mixture not just the individual compounds
- Should look at groups of compounds within a similar MOA
- Total Mass is just to illustrate the magnitude of individual contaminants and MOAs.
- Using some activity or equivalency approach would be better for risk assessments
- There are quite a few Pharmaceuticals exceeding 1 ug/L within the same effluent
- EDCs – Blood Pressure Meds – Antidepressants – Anti-inflammatories – Antibacterials in that order are the dominate MOAs.

**Remember what is good for the fish
is good for us too!**

