



Chemical Speciation Network (CSN): Updates and Overview

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Today's Discussion

- Current Network:
 - Samplers & Sites
 - Roles and Responsibilities – EPA and Contractors
 - Contract Status
- Recent Improvements:
 - Annual Site Reports
 - New AQS Parameters
 - Data Advisories
- Current Projects:
 - Sampler Flow Rate Verifications & AQS
 - Elements and MDLs
- What's ahead

CSN Sampler and Filter Types

Two samplers

MetOne SASS or SuperSASS – 6.7 LPM

URG – 22 LPM

Three different filter types

47-mm Teflon

MgO Denuded 47-mm Nylon

25-mm Quartz

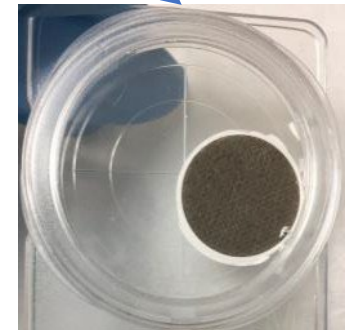
24-hour PM_{2.5} samples every 3
or 6 days



PTFE

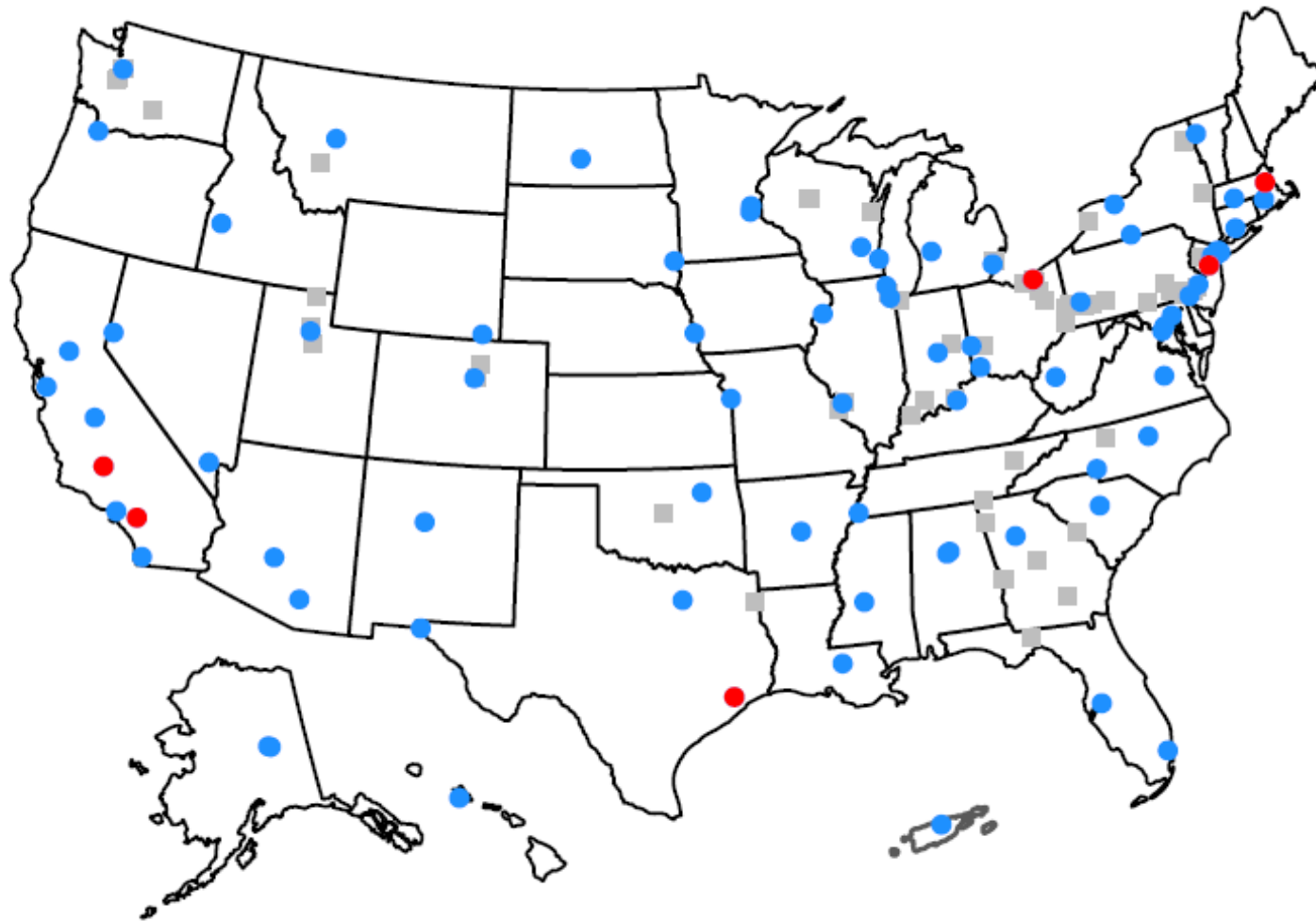
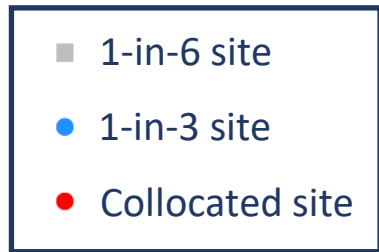


Nylon



Quartz

Current CSN Network



CSN National Program Contacts

Role	Contact	Phone Number	Email
EPA Program Manager	Melinda Beaver	919-541-1062	beaver.melinda@epa.gov
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EPA Contracts Project Officer	Jeff Yane	919-541-2962	yane.jeff@epa.gov
Shipping, Handling, & Gravimetric (Wood)	Justin Knoll	352-415-1718	justin.knoll@woodplc.com
Laboratory Analysis (UC Davis)	Nicole Hyslop	530-754-8979	nmhyslop@ucdavis.edu
DVL (DART) Program Manager	Jennifer DeWinter	707-665-9900	jdewinter@sonomatech.com

Contact the team: CSNsupport@sonomatech.com

CSN Contract Status

- CSN operations transitioned with the November 2015 samples to:
 - Wood – Filter Handling and Shipment; Gravimetric Mass
 - UC Davis – Lab Analysis and Data Review, Validation, and Submission
- Next CSN Contract: Request for Proposals was open in March – April 2022.
- We'll communicate outcomes with you all once new contract is awarded (expected to be awarded later in 2022).

Annual Site Reports

- Typically, available 12-18 months after the end of the sampling year.
- <https://aqrc.ucdavis.edu/csn-field-sites-maps>

Air Quality Research Center

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Field Sites & Maps

Air Quality Research Center - Monitoring - CSN - Field Sites & Maps

Chemical Speciation Network Annual Site Reports

Each year, status reports are generated using recent data from each CSN site. These reports provide a summary of the site's results within the context of the site's historical record as well as with nearby sites. Each site report is accessible from the links below.

Reports

Click on the year next to the location of interest to view the PDF report for that year.

EPA Site Name	2017 Report	2018 Report	2019 Report	2020 Report
Birmingham - North Birmingham	2017	2018	2019	2020
Wylam	2017	2018	2019	2020
Alaska NCore	2017	2018	2019	2020
Phoenix Supersite	2017	2018	2019	2020
Children's Park	2017	2018	2019	2020
North Little Rock (NLR Parr)	2017	2018	2019	2020
Fresno - Garland	2017	2018	2019	2020

Annual Site Reports



CSN 2019 Site Report: Lawrenceville (Pittsburgh)

AQS ID: 42-003-0008, POC 6 (40.46542, -79.96076) 1-in-3 Day Schedule

The Chemical Speciation Network (CSN) is a routine air monitoring network designed to complement the PM_{2.5} monitoring network; support the implementation of PM_{2.5} National Ambient Air Quality Standards (NAAQS); assist in developing and tracking emission control strategies; and provide data to aid in health studies. CSN sites are primarily located in urban areas and complement the largely rural Interagency Monitoring of PROtected Visual Environments (IMPROVE) network. The CSN target analytes are trace elements, ions, and carbon.

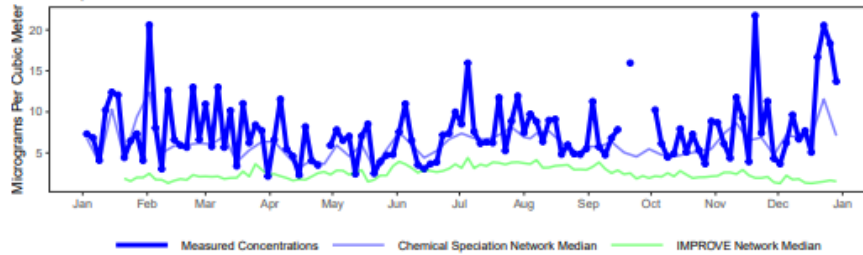
Percent of Samples Successfully Collected and Analyzed Per Year

Year	Percent
2002	91
2003	91
2004	95
2005	96
2006	96
2007	98
2008	100
2009	95
2010	97
2011	99
2012	98
2013	98
2014	99
2015	85
2016	97
2017	97
2018	97
2019	98

Samples Successfully Collected and Analyzed in 2019 by Filter Type. PTFE: 120 (99.2%), Nylon: 120 (99.2%), Quartz: 116 (95.9%)

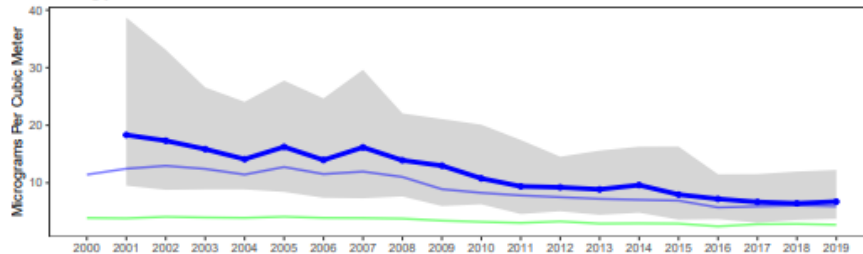
The plots below show temporal trends for site 42-003-0008 alongside network-wide CSN and IMPROVE average concentrations. The top plot shows the variability of the reconstructed fine mass (RFM) concentrations during 2019; RFM can only be calculated if all three filters collected on a sampling day are valid. The bottom plot illustrates the long-term trends of ambient concentrations; the gray shaded region represents the range of values measured each year at this site, illustrated using the 10th and 90th percentile values.

Daily Reconstructed Fine Mass in 2019



Long-Term Trends in Reconstructed Fine Mass

Missing years are due to low number of RFM values.



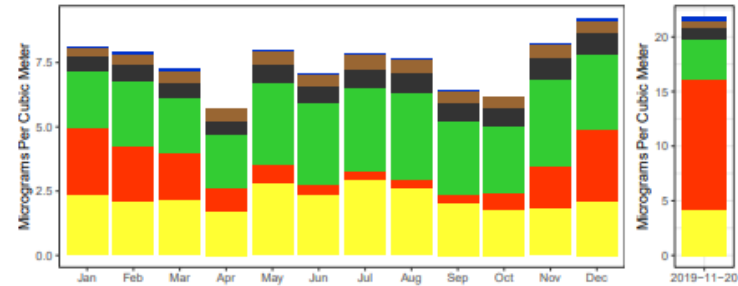
More Information

To view and download CSN data: <https://www.epa.gov/outdoor-air-quality-data>
 The EPA website with guidance documents and background information: <https://www.epa.gov/amtic/chemical-speciation-network-csn>
 EPA real-time air monitoring data: <https://www.airnow.gov/>
 The Univ. of California, Davis website with information about current research and publications: <https://aqre.ucdavis.edu/csn>
 The Colorado State Univ. website with data resources, literature, and visibility overviews: <http://vista.cira.colostate.edu/improve/>

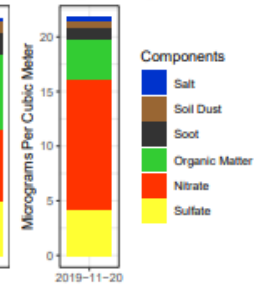


The following plots summarize the chemical composition of particles collected at this site. The monthly averaged compositions calculated from 2015-2019 data are shown on the left while compositions for the day with the highest measured concentrations during 2019 are shown on the right.

Average Monthly Particle Composition

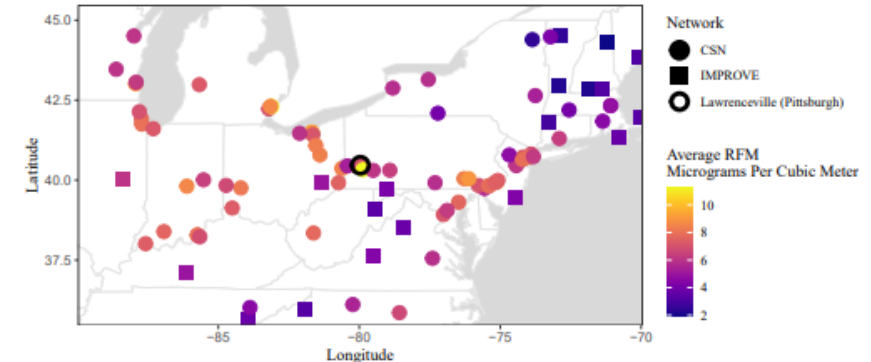


Highest Day



Components	Calculation	Natural Sources	Anthropogenic Sources
Salt	$1.8 \cdot \text{Chloride}$	Ocean spray, dry lakebeds	Chemical manufacturing, lake consumption
Soil Dust	$2.2 \cdot \text{Al} + 2.49 \cdot \text{Si} + 1.63 \cdot \text{Ca} + 2.42 \cdot \text{Fe} + 1.94 \cdot \text{Ti}$	Soil resuspension, dust storms long-range transport	Construction, agriculture, deforestation, unpaved roads
Soot	<i>Elemental Carbon</i>	Wildfires	Motor vehicles, wood burning, smoking
Organic Matter	$1.4 \cdot \text{Organic Carbon}$	Plants, animals, wildfires	Motor vehicles, cooking oils, household cleaners
Nitrate	$1.29 \cdot \text{Nitrate}$	Plants, animals	Fertilizer, stock yards, chemical manufacturing
Sulfate	$4.125 \cdot \text{Sulfur}$	Volcanism	Coal-fired power plants, chemical manufacturing

The following map shows the average RFM concentrations for nearby sites in both CSN and the rural IMPROVE Network. The point shapes indicate which network the sites are associated with. The color bar indicates the average annual RFM concentration (micrograms per cubic meter) measured at each site in 2019.



New CSN Parameters

- CSN now reporting **Soil** and **Reconstructed Mass (RCM)** parameters to AQS
- Started with 2019 data, then went back and added 2018.

Soil (88348) = $2.2 * \text{Aluminum} + 2.49 * \text{Silicon} + 1.63 * \text{Calcium} + 2.43 * \text{Iron} + 1.94 * \text{Titanium}$

RCM (88401) = $4.125 * \text{Sulfur} + 1.29 * \text{Nitrate} + \text{Soil} + 1.8 * \text{Chloride} + \text{EC} = 1.4 * \text{OC}$

- Qualifiers codes from individual parameters are added to the calculated parameter; if one individual parameter has a null code, then the calculated parameter will have a null code.
- List of all reported parameters [here](#).

Recent Data Advisories

- Chromium and Nickel Contamination – documents intermittent contamination and processes for data treatment [Sean Raffuse – last presentation of this morning’s session]
- Carbon Analyzer Change – documents the change to Sunset EC/OC analyzers and impact on the data, especially subfractions (i.e., OC4, EC1, EC2, etc.)
- CSN Analysis Lab Contract Transition – documents the transition from RTI to UCD and processes and data treatment that may have changed. [Sean Raffuse – poster]

Chemical Speciation Network – Data Reporting and Validation

This page contains information on data reporting and validation for the Quality Assurance program for the PM_{2.5} Chemical Speciation Network (CSN).

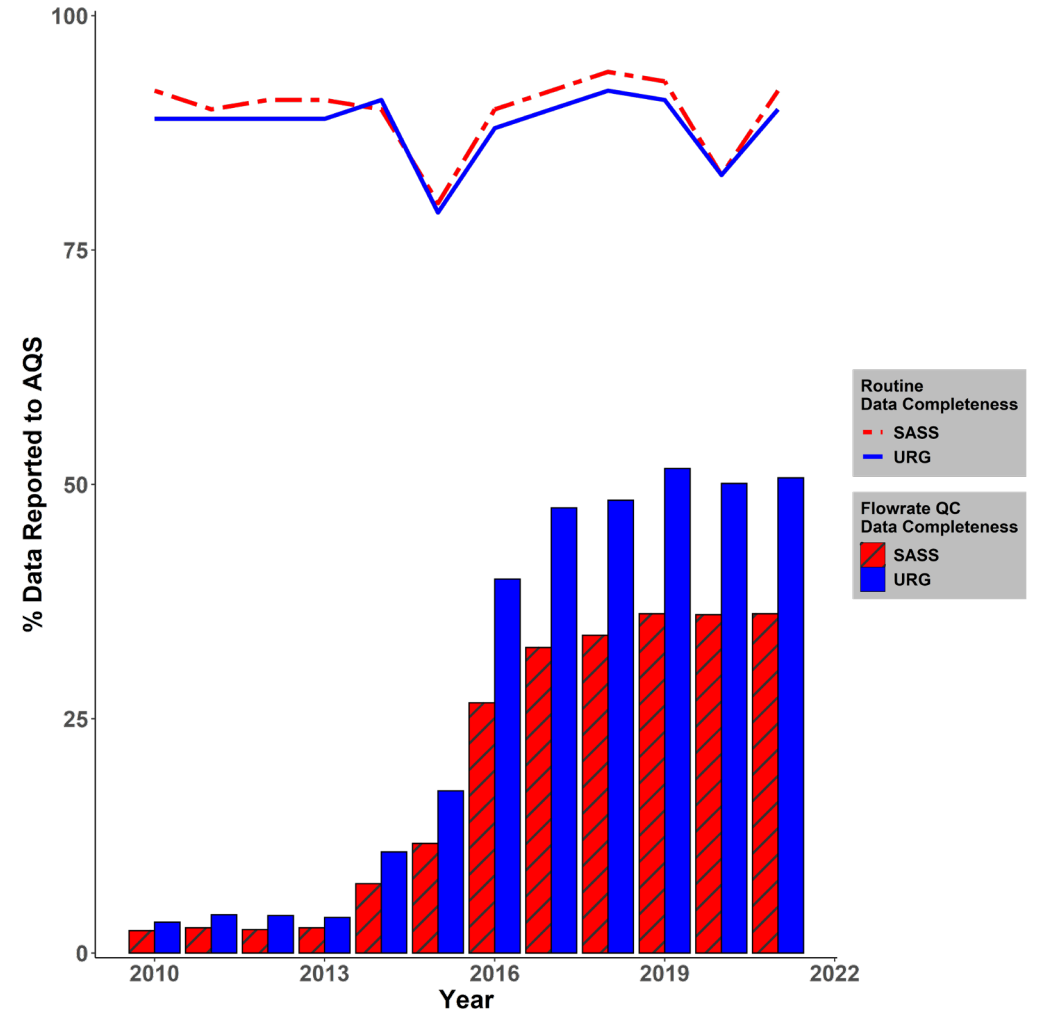
- Annual Data Quality Reports
 - [2020 UC Davis](#)
 - [2019 UC Davis](#)
 - [2018 UC Davis](#)
 - [2017 UC Davis](#)
 - [2016 UC Davis](#)
 - [Sample Filter Handling, Shipment, and Gravimetric Analysis](#)
- Data Advisories
 - [Vanadium Calibration Bias](#)
 - [Carbon Analyzer Signal Integration Threshold Modified](#)
 - [XRF Protocol Change](#)
 - [Intermittent Contamination of Chromium and Nickel](#)
 - [Carbon Analyzer Change](#)
 - [CSN Analysis Lab Contract Transition](#)

Chemical Speciation Navigation

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- [Special Studies](#)
- [Newsletters](#)
- [Training](#)

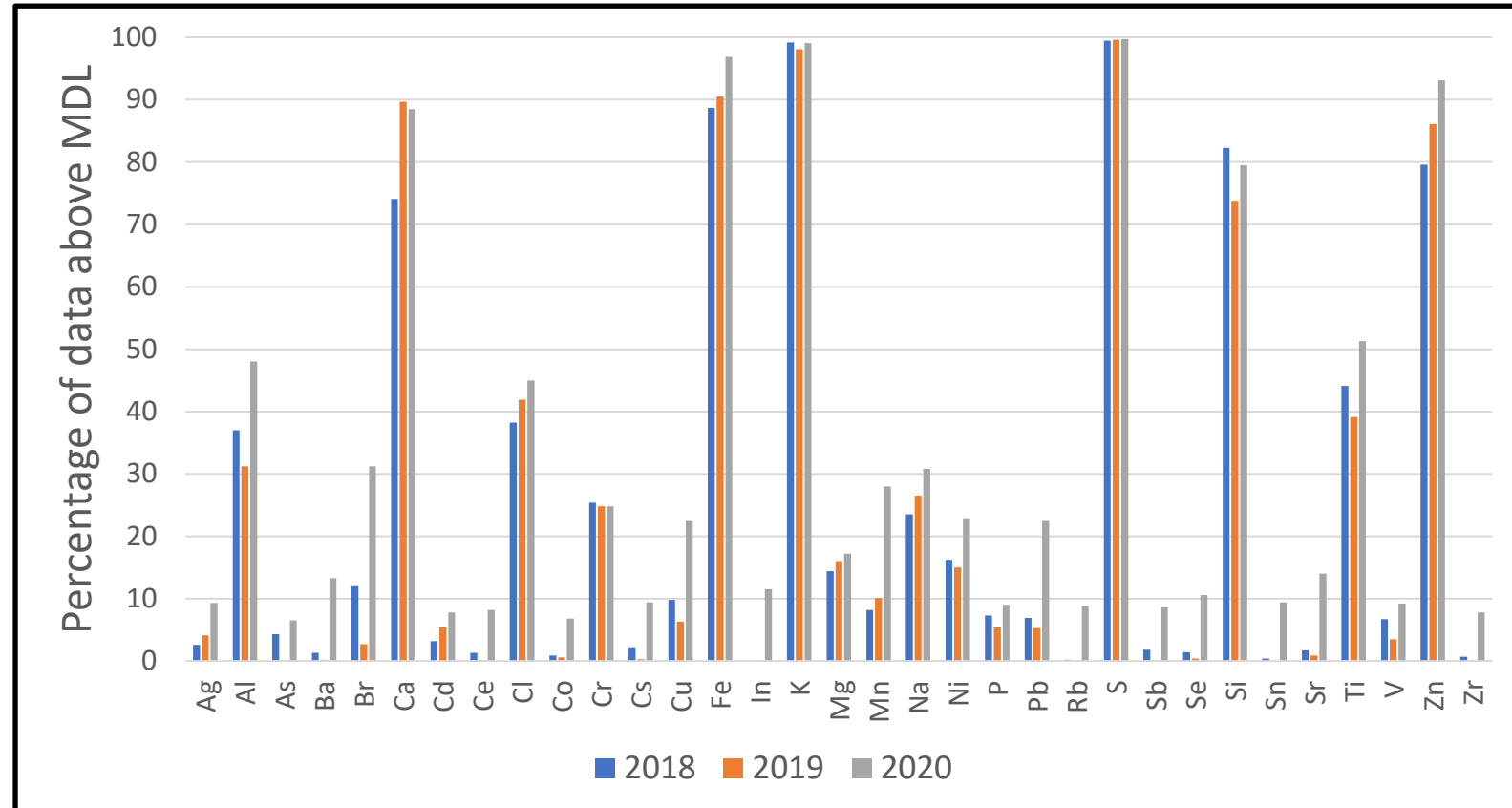
Sampler Flow Rate Verifications and AQS

- When assessing the sampler QC check criteria, we looked at the monthly flow verification data available in AQS.
- Currently, 30-50% of expected monthly flow verification data are being loaded to AQS.
- Configuring AQS to accept flow verifications for additional SuperSASS channels seems to be one reason.
- See [2022 newsletter](#) for more details.
- Contact EPA AQS Regional Rep, Doug, or Melinda if you need help entering these data.



Ambient Element Concentrations vs MDLs

- Ambient PM_{2.5} concentrations have been declining over time.
- CSN reports concentrations for 33 elements by EDXRF analysis.
- Many network samples are below the MDL.
- Two projects underway to decrease the amount of data flagged as “below detection limit.”



Ambient Element Concentrations vs MDLs Projects

- #1: 25mm filters instead of 47mm filters
 - Currently use 47mm diameter PTFE filters.
 - Since 2019, we've been field testing (at the 6 collocated sites) the use of 25mm filters to increase the particle density per cm^2 (~factor of 3).
 - Currently working to understand the comparisons between the 47mm and 25mm filters.
 - Stay tuned.
- #2: ICP-MS vs XRF
 - ICP-MS has lower MDLs for some elements.
 - Hear more about an investigation between the two later in this session [*Dr. Colleen Rosales – An Interlaboratory Comparison of Elemental Loadings on PM_{2.5} Samples via Energy-Dispersive XRF and Single Quadrupole ICP-MS*].

What's Ahead for CSN

- CSN national contract award
 - Complete the CSN Field Operations QAPP revision
 - Continue methods evaluations
 - Data review and validation support and development
 - Laboratory Performance Evaluation (Mega PE)
-
- Thank you!!

<https://www.epa.gov/amtic/chemical-speciation-network-csn>
CSNsupport@sonomatech.com

Extra Slides

COVID-19 Impacts on CSN

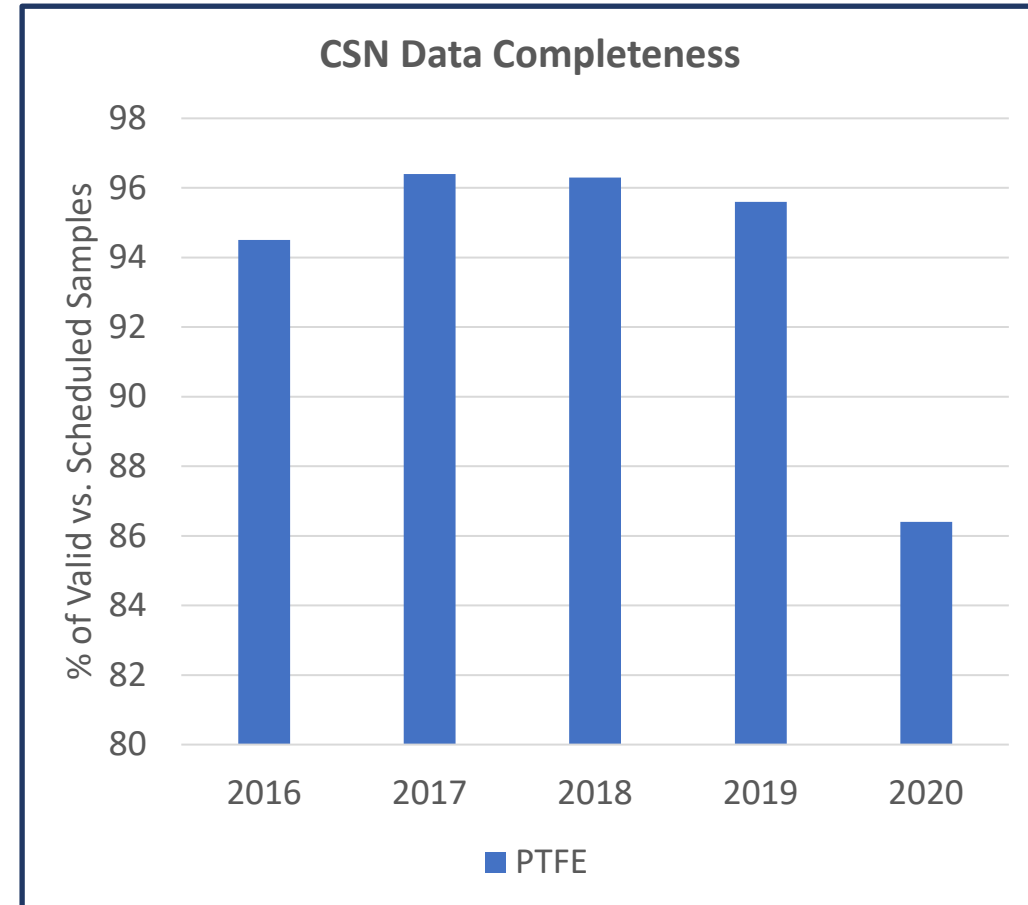
Field Operations:

- In 2020, approximately 40 sites paused sampling for varying periods of time due to COVID (uncertainty in stay-at-home orders, staffing, illness, etc.).
- Maximum of 27 sites down at once.
- Additional impacts in early 2021 (not shown here).

Analysis Lab Operations:

- UC Davis labs closed for approximately 6 weeks in March – April 2020.
- AQS data deliveries were delayed up to 30 days for the samples in the analysis pipeline during March-June 2020 (January – April 2020 network samples).

Thanks to everyone for minimizing impacts on the network!



CSN Field QAPP

- OAQPS is working to update the [CSN Field Operations QAPP](#) (first created in 2000; addendum in 2014).
- Revisions Include:
 - NCore requirement to conduct PM_{2.5} speciation
 - Consolidation of samplers to SASS/SuperSASS and URG 3000N
 - CSN Assessment
 - Sequential Sampling
 - COC
 - Sampler QC Checks
 - Field Blank Collection
- Targeting mid-2023 for review and finalization.



PM_{2.5} Chemical Speciation Network Field Sampling QAPP

OAQPS QA Category II Quality Assurance Project Plan

Version 2.0

United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

DRAFT