

Air Toxics in Minnesota

Collection, Validation, Analysis, and Communication



2015 National Air Toxics Workshop – October 27, 2015

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**Minnesota Pollution
Control Agency**

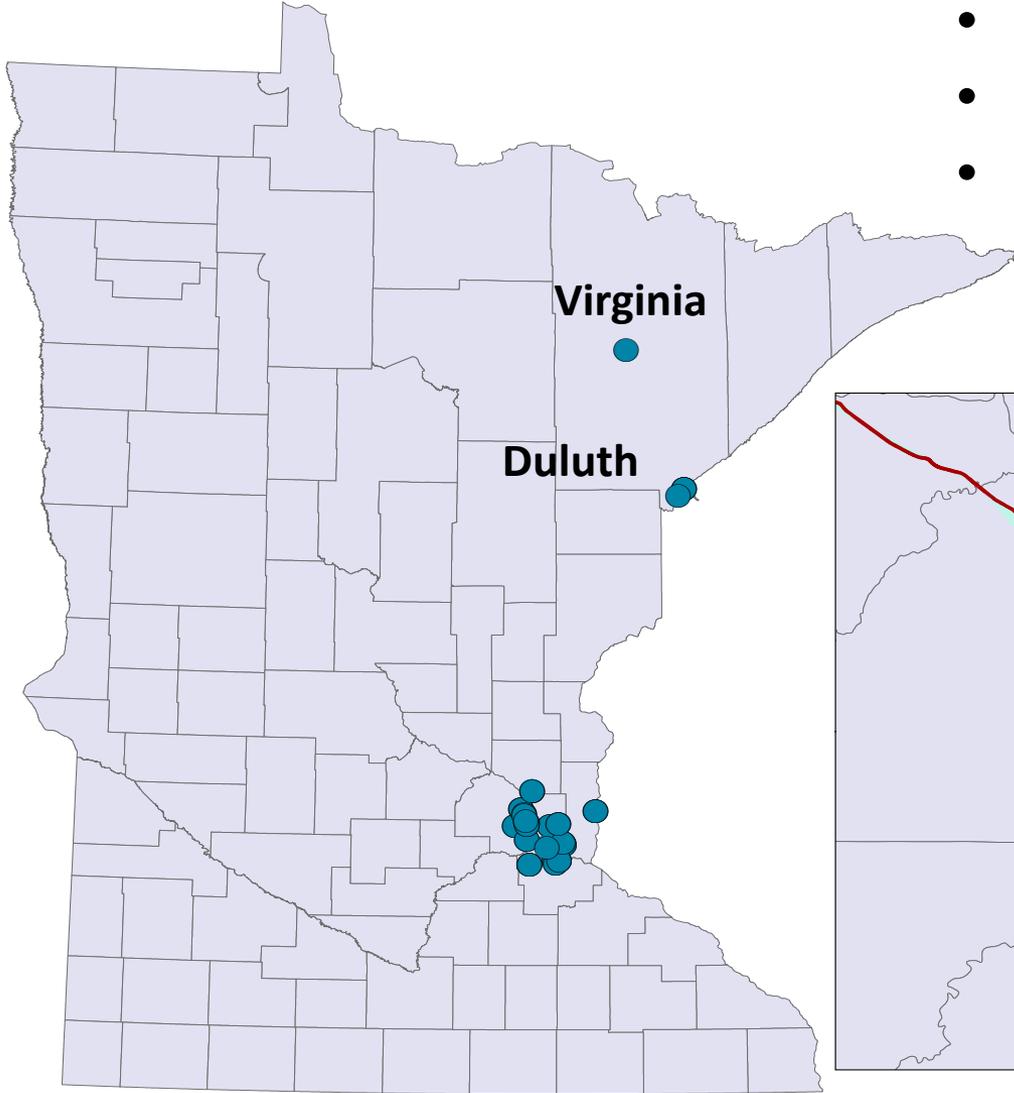
Road map



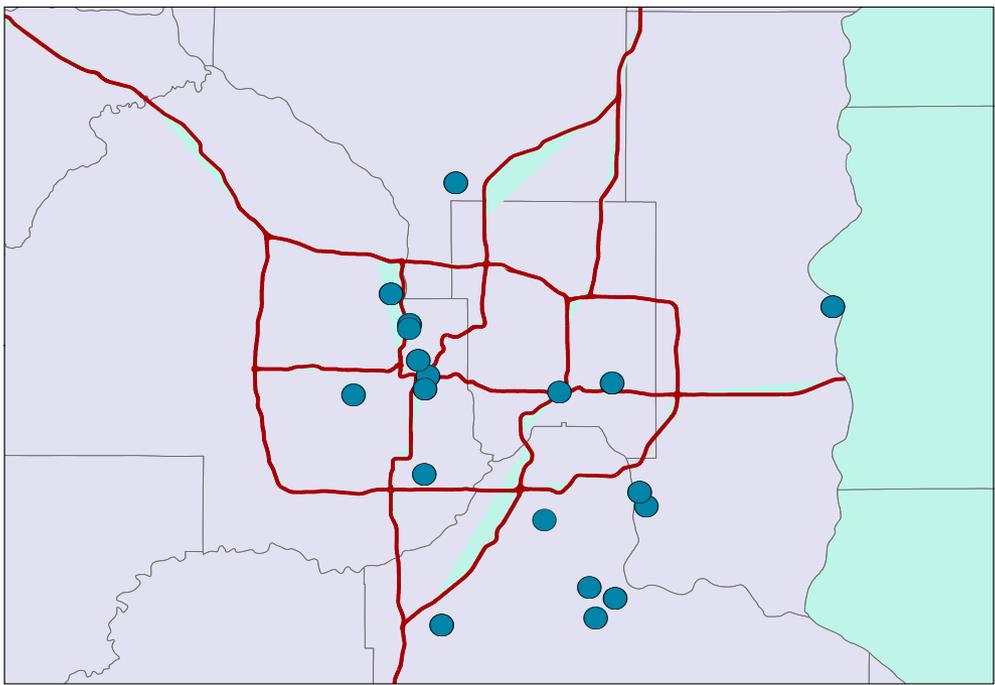
- Minnesota's Air Toxics Program
- Data validation and preparing for analysis
- Analysis methods and metrics
- Communicating results through interactive data visualization

Minnesota's Air Toxics Program

- VOCs, carbonyls, metals (TSP)
- 24-Hour, 1 in 6 day sampling
- 22 Sites



Twin Cities Metro Area

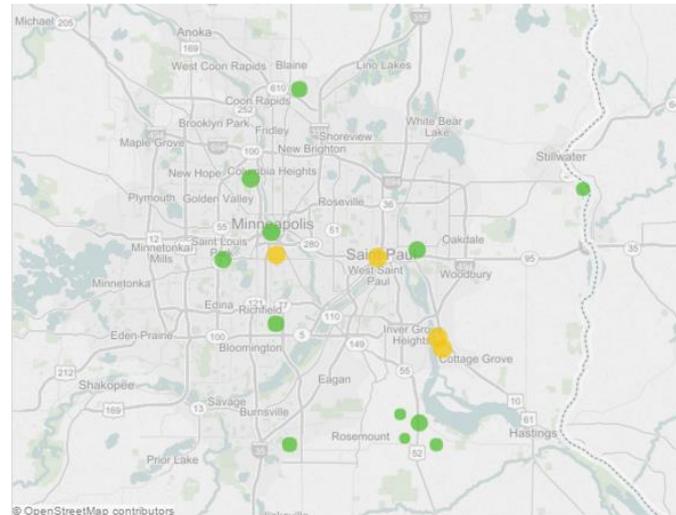


Purpose of analysis: Summarize annual monitoring results to assess risk and evaluate spatial and temporal variability

Benzene 2013

Annual average concentrations at air monitoring sites
shown as percent of most protective health benchmark

This map compares annual average Benzene levels to the pollutant's most protective long-term health benchmark. Pollutants without a long-term health benchmark are shown in blue. Larger points represent higher concentrations.



About air toxics | Download data | Contact us

+ About this pollutant



Select a pollutant

Benzene

Choose year to map

2013

Filter by geography

Regions

(All)

Monitor locations

(All)

% of Health Benchmark

100% or more

50-100%

50% or less

No Health Benchmark

Relative Concentration

○ ○ ○ ○ ○

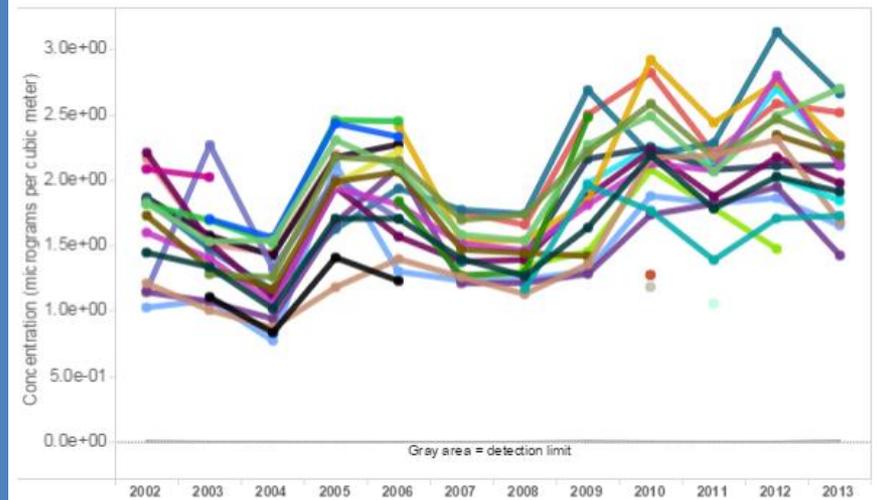
lower → higher

▽ Below detection limit

Formaldehyde 2002 to 2013

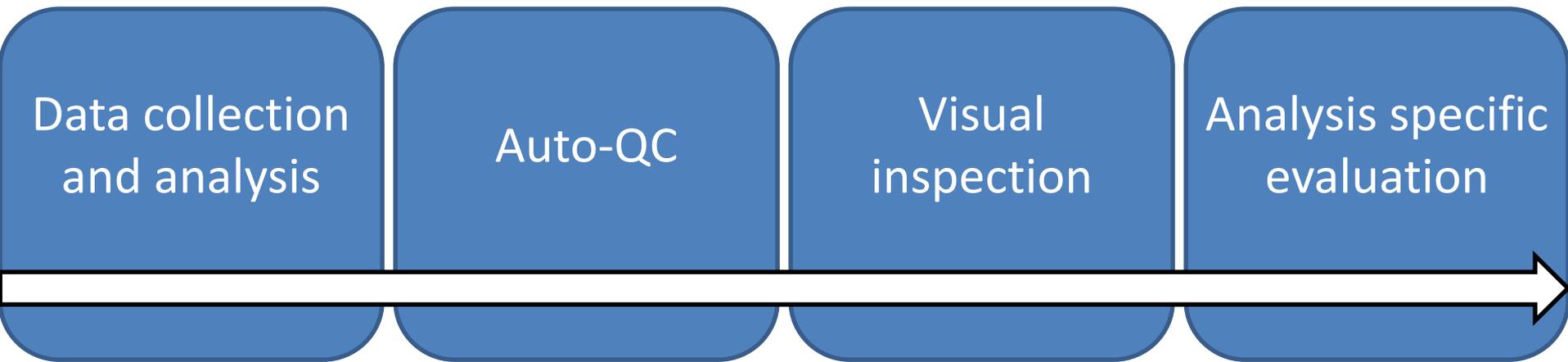
Annual averages by air monitoring location

This chart displays annual average Formaldehyde concentrations with a unique color for each monitoring site. The lower grey area shows the annual method detection limit. When more than 80% of a monitor's collected samples are below the detection limit the annual average is not shown.



About a

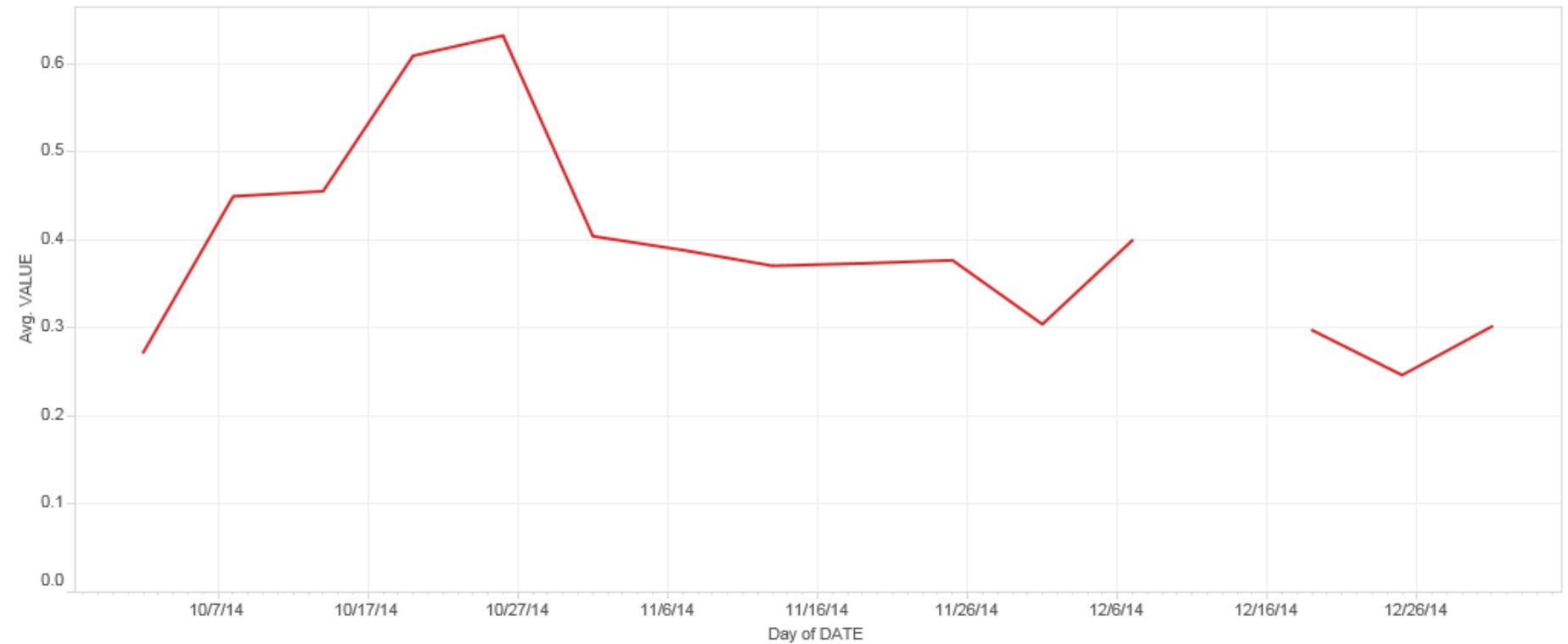
Data validation: Preparing for analysis



Visual Inspection

This data is invalid!

Time Series of FORMALDEHYDE AKA-OXYMETHYLENE



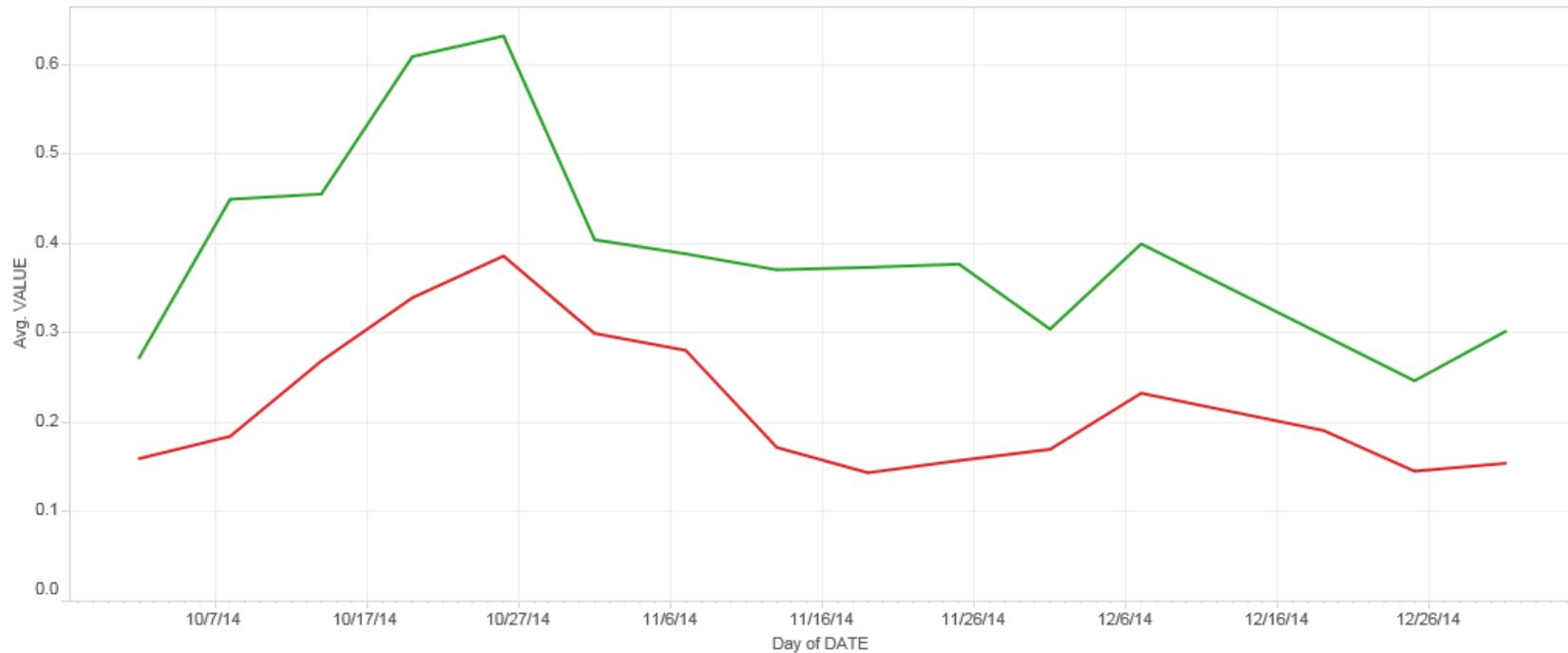
10/2014

12/2014

Visual Inspection

Analyte Name
■ ACETALDEHYDE AKA...
■ FORMALDEHYDE AKA...

Time Series of multiple parameters at 442-1

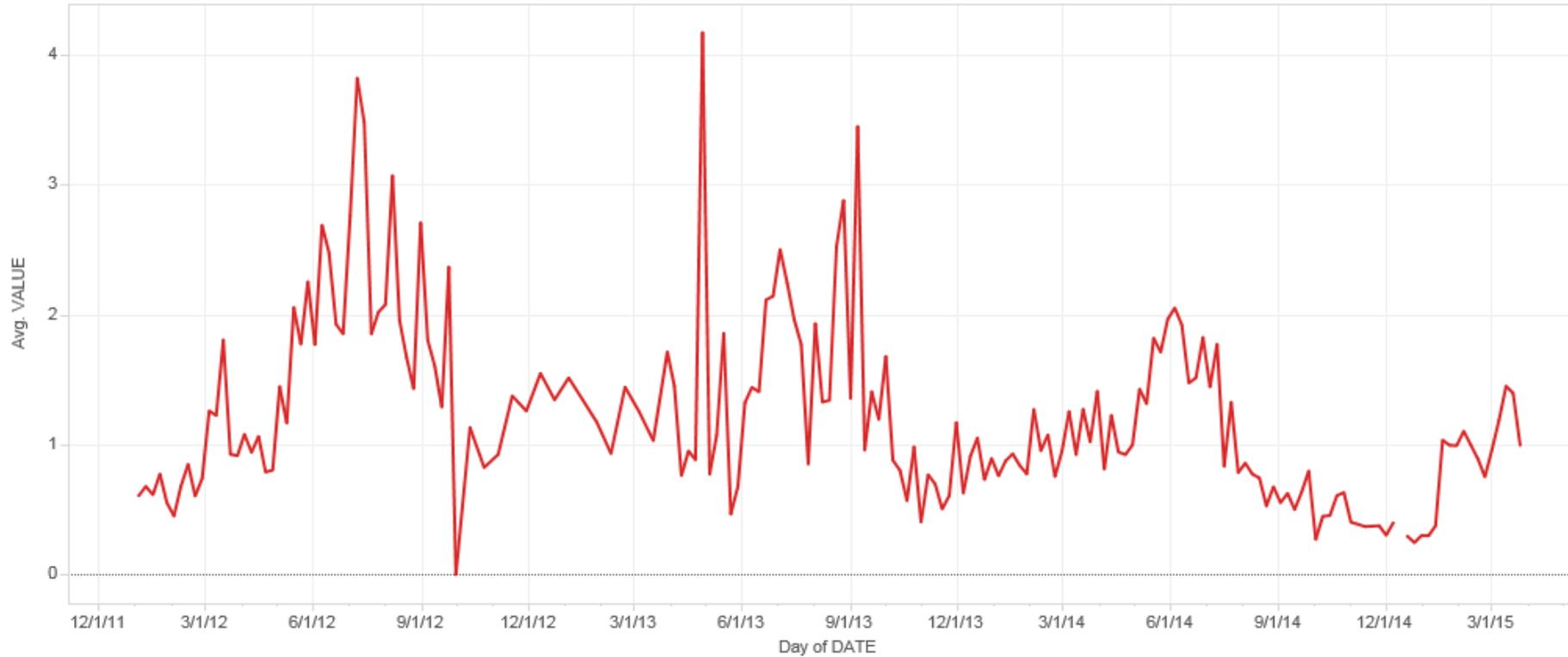


10/2014

12/2014

Visual inspection

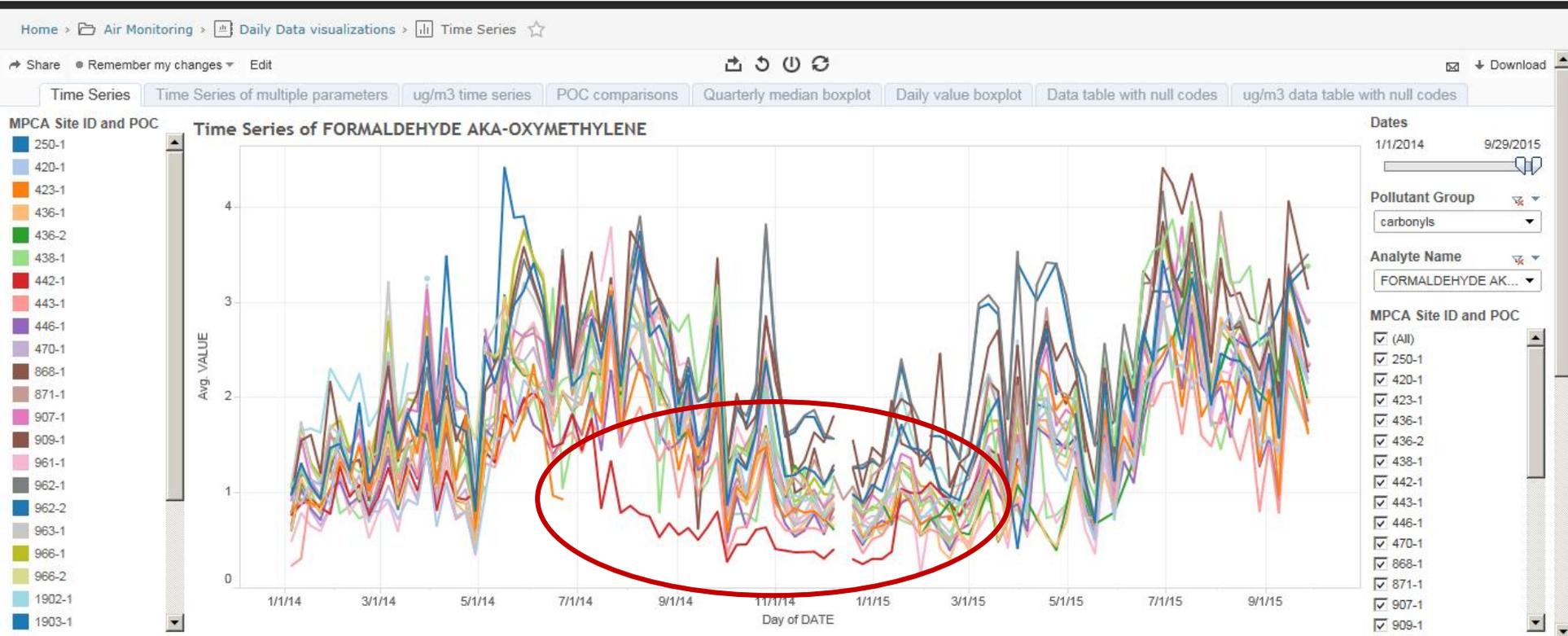
Time Series of FORMALDEHYDE AKA-OXYMETHYLENE



1/2012

3/2015

Visual inspection

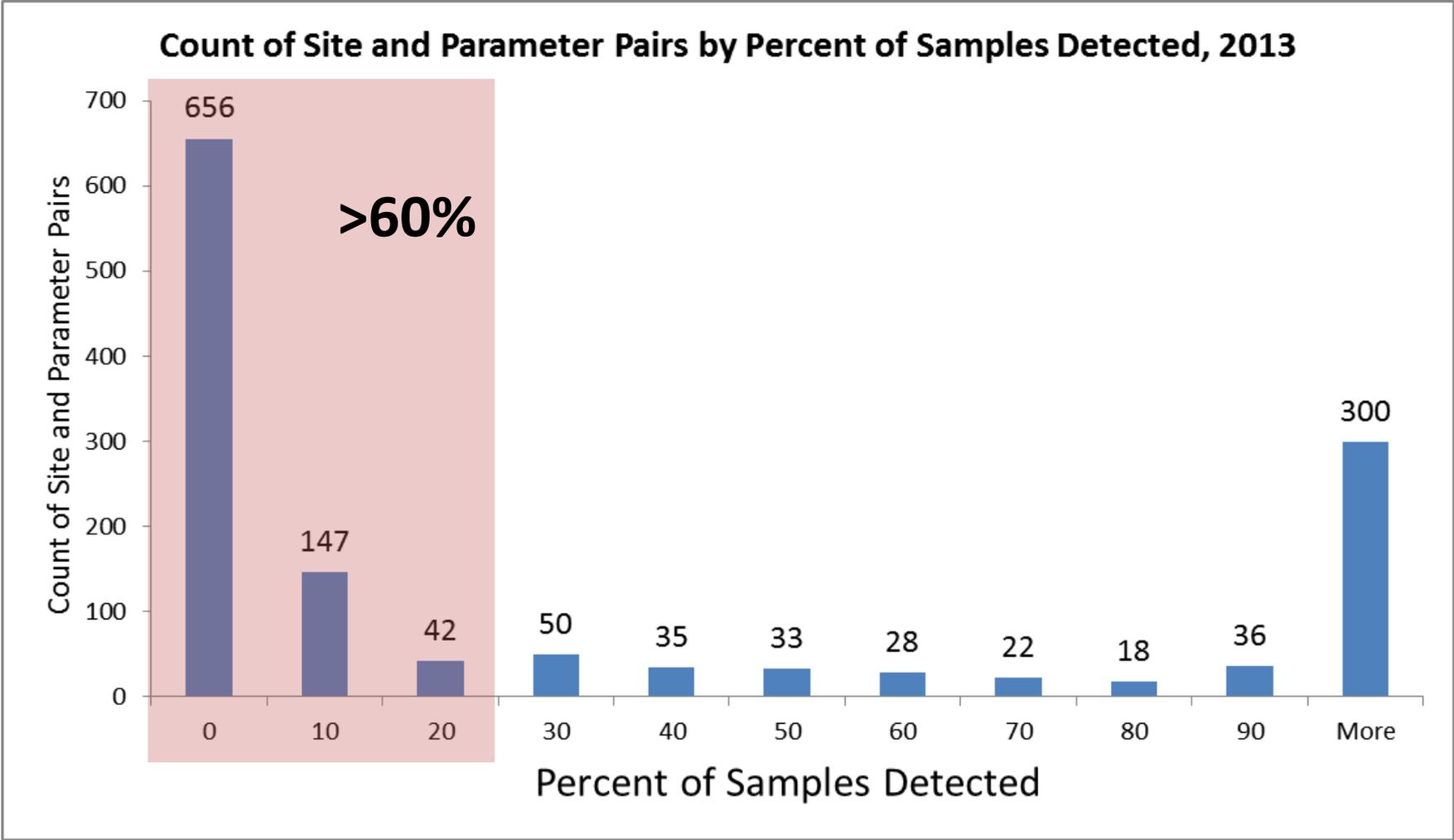


Flow controller was scrubbing out carbonyls!

Data below the detection limit

- We report instrument values below detection limit to AQS
- Current LIMS system does not support including detection limit in AQS upload file!!!
- When using data or sharing with external partners we append detection limits to file
 - Goal is to screen values below detection limit in future
- For analysis no substitutions are made
 - Use advanced methods to calculate summary statistics with left censored data

Data below the detection limit



Choosing a statistical method

Risk analysis – Annual 95% UCL compared to lowest available chronic inhalation health benchmark

IHB's derived from:

- Minnesota Department of Health's Health Risk Values (HRVs)
- EPA's Integrated Risk Information System (IRIS)
- California's Office of Health Hazard Assessment

Choosing a statistical method

- Maximum Likelihood Estimation (MLE)
 - Parametric
 - Large sample sizes preferred (>50)
 - Sensitive to outliers
- Robust Ordered Statistics (ROS)
 - Semi-parametric
 - Assumes a distribution only for censored data
 - Works well for smaller data sets (<30)
- Kaplan Meier (KM)
 - Non-parametric
 - Relies on rank of data

Choosing a statistical method

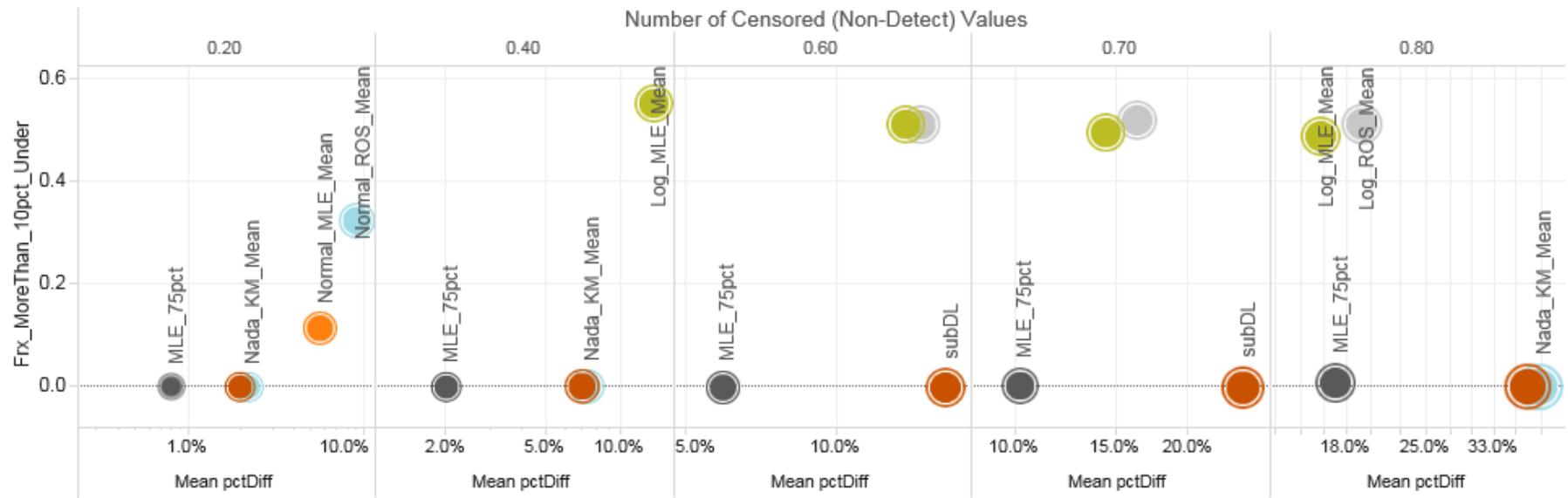
Method Name % Censored Values

- MLE_75pct
- subDL
- Nada_KM_M...
- Normal_MLE...
- Log_MLE_Me...
- Log_ROS_M...
- Normal_ROS...

Fraction More than 10% Under

Scatter Compare Options

Fraction underestimating by more than 10% VS. the mean % difference



Mean Percent Difference

Communicating results

Audience: Appeal to interested public, entry point for knowledgeable users

Key questions to address:

- Is the air safe to breathe where I live?
- How does air pollution in my area compare to air pollution in other areas?
- Has air pollution gotten better or worse over time?

Communicating results

Minnesota Air Toxics Data Explorer

Annual Pollutant Summary Map | Annual Pollutant Results Compared to Health Benchmarks | Time Series of Annual Pollutant Averages | Annual Summary Data Table

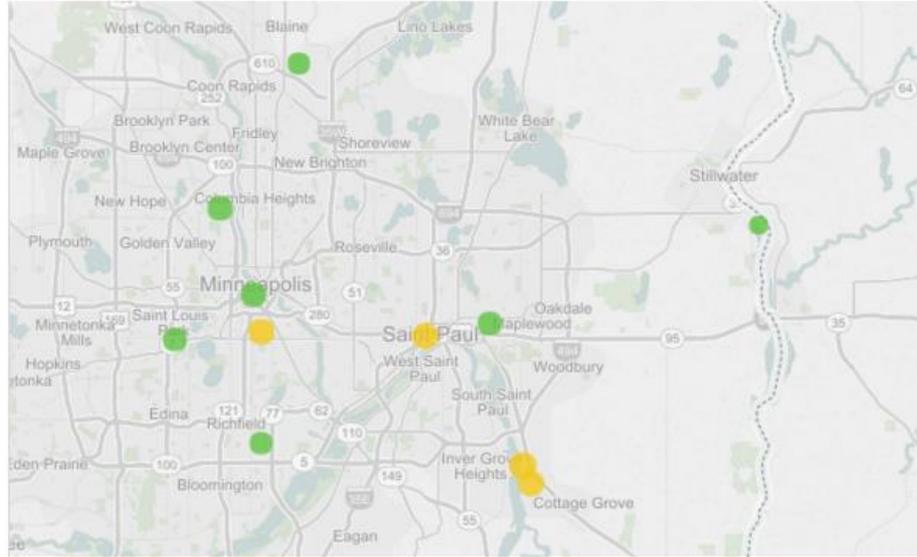
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Benzene 2013

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+ About this pollutant 



Select a pollutant: Benzene

Choose year to map: 2013

Filter by geography

Regions: (Multiple valu...)

Monitor locations: (All)

- (All)
- Metro Industrial
- Metro Suburban
- Metro Urban
- Northern

Relative Concentration

- 50% or less
- No Health Benchmark

<http://www.pca.state.mn.us/rxcwk99>

More Information

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**Minnesota Pollution
Control Agency**