



## Data with a Mission: Data Visualization at US EPA

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U.S. Environmental Protection Agency

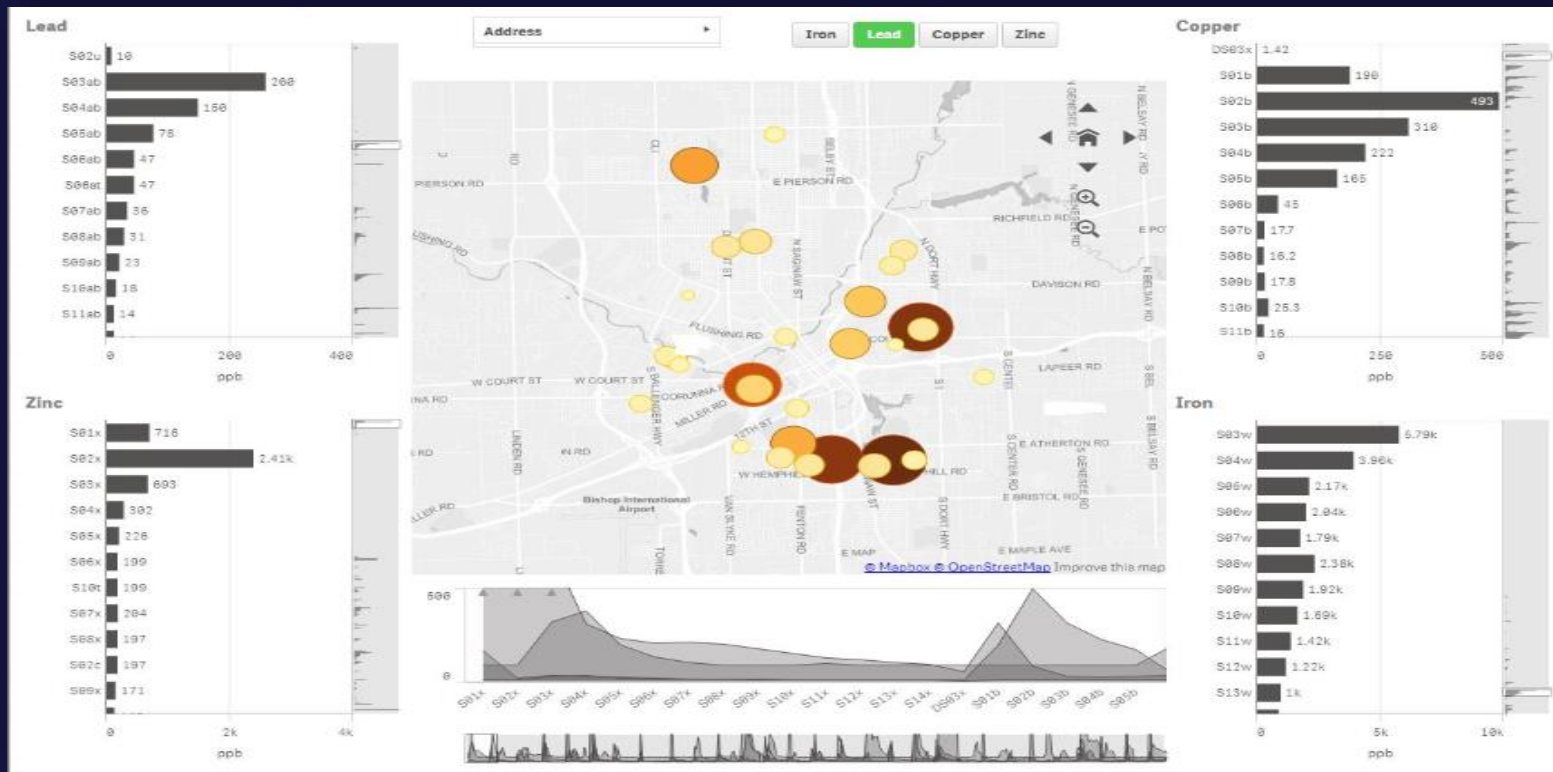




# Data with a Mission

Building a Community for Interactive Data  
Visualization at the U.S. Environmental Protection  
Agency

# The Beginning



# Flint, Michigan - Water



**2015: Flint River without Corrosion Control**

**2016: Detroit Water with Enhanced Corrosion Control**

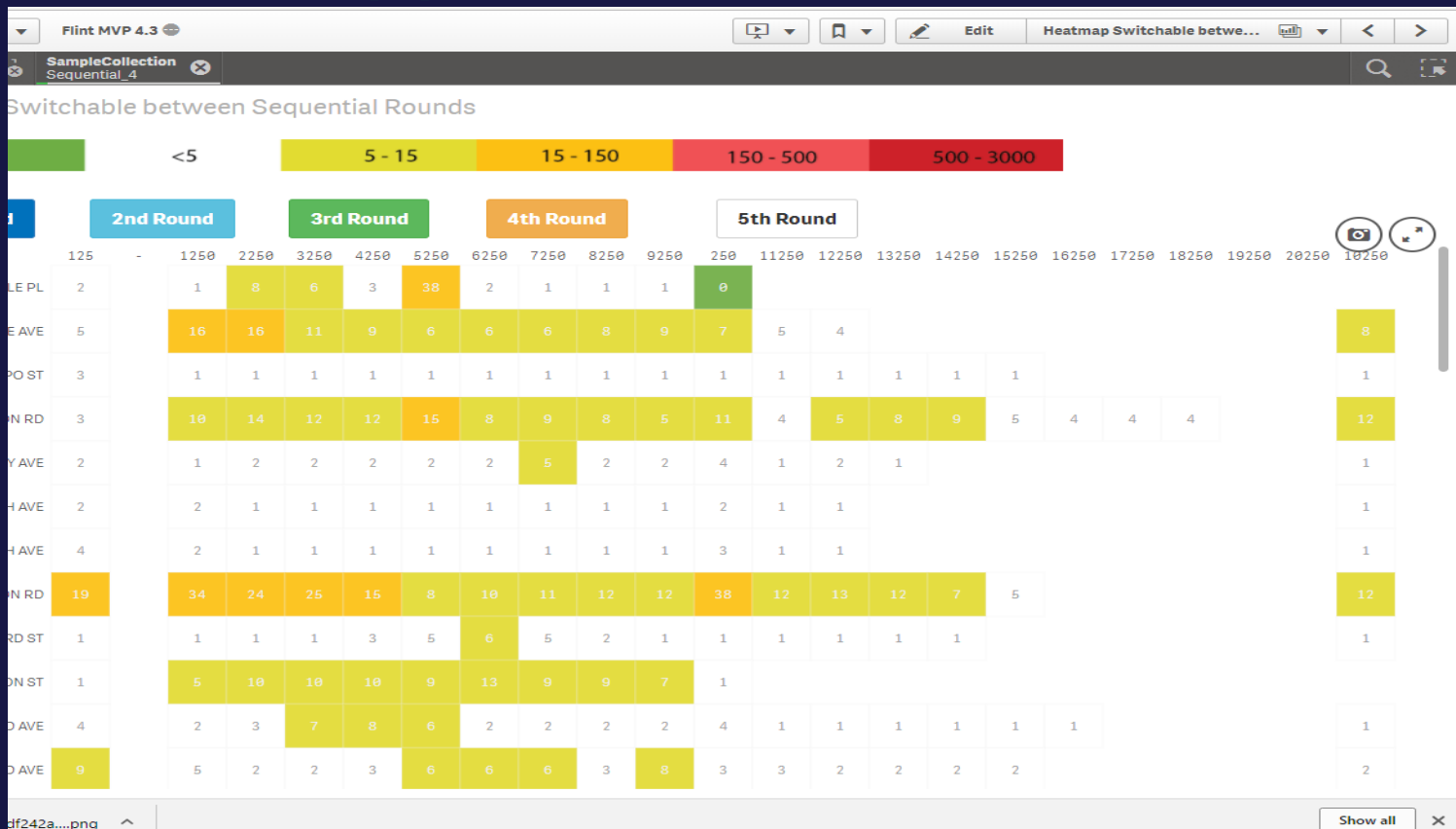
Photographs: Zhu "Joyce" Ni, Min Tang, Pan Ji, Mariah Gnegy

# Water Testing



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# App Customization



# App Adoption?

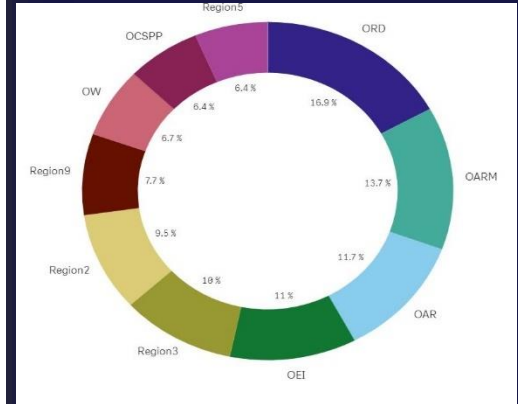
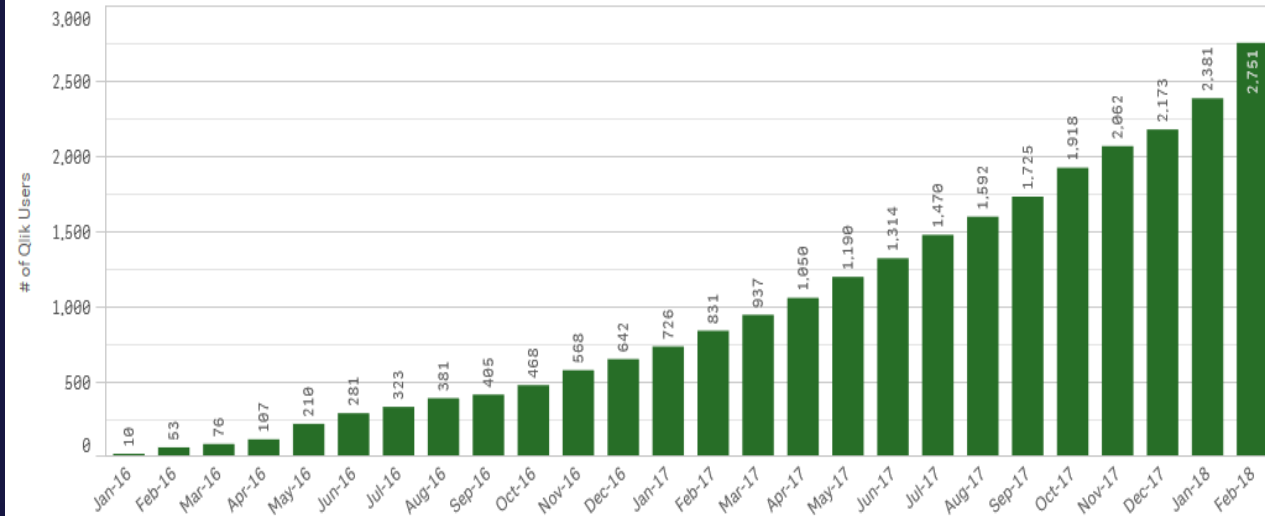


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# How Did We Get Here?

# of Total EPA Qlik users by Month

This data describes accumulated total # of EPA Qlik Users by month



# Takeaways

- How EPA is using interactive data visualization
- Strategies that we used to increase adoption & value

# Title Slide



## Our Mission:

To Protect Human Health and the Environment



U.S. Environmental Protection Agency



U.S. Environmental Protection Agency

# EPA Qlik Sense® Stats

- 3,000 Qlik Sense Accounts
  - 100 – 200 new users / month
  - 800 visitors / month
  - 300 weekly users & 100 daily users
- Users are spread out
  - Across units within EPA
  - Across the country
- Guided Analytics / Self-Service Visualization

# Find Champions and Build



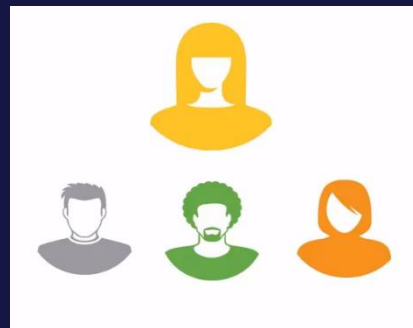
Find Interest



Help Build

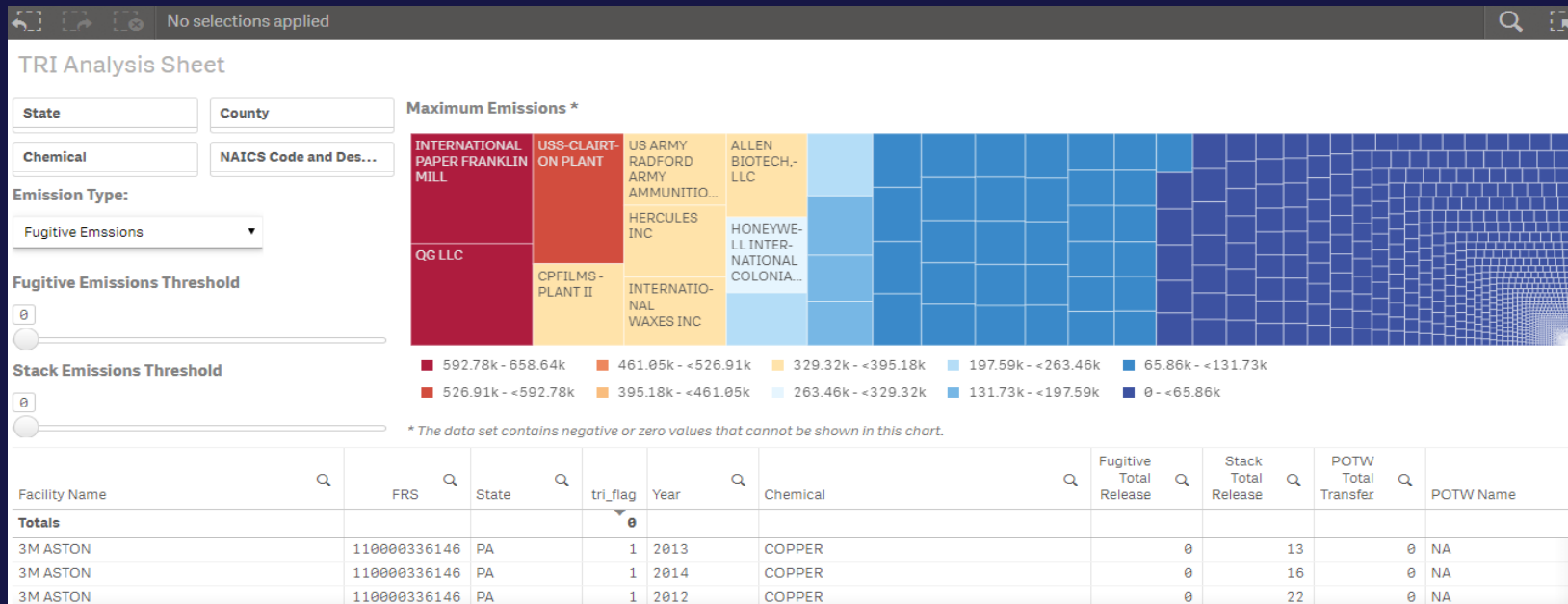


Satellite Groups



Bring People Together

# Region 3 – Facility Filtering

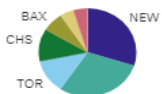


# Region 3 - Air Quality Monitors

## Pollutant Overview

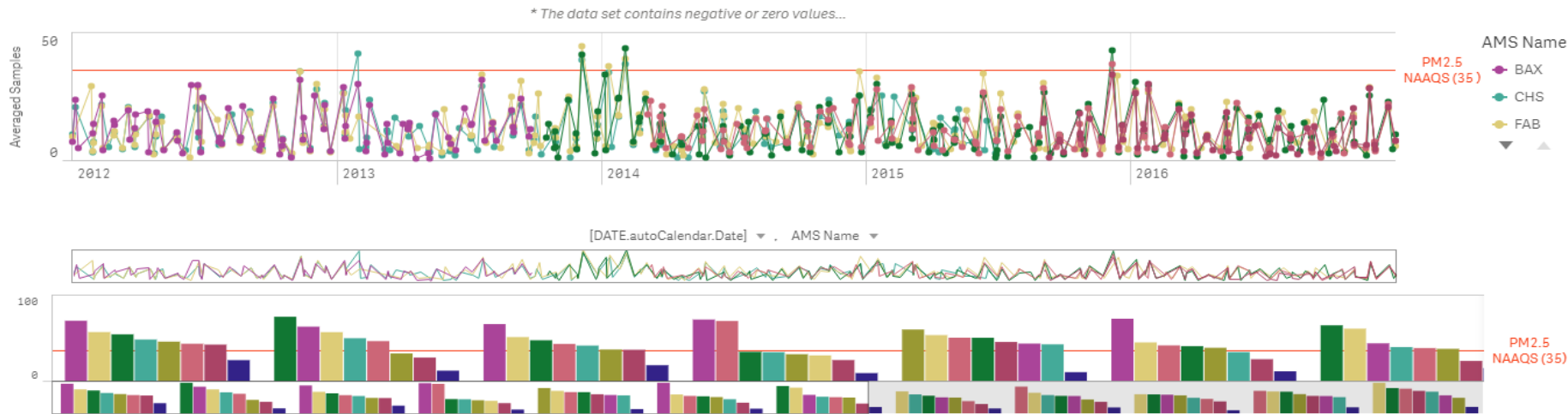
Parameter\_Unit  Year  AMS Name

SAMPLE\_DURATION  Site ID



Readings over 35 Micrograms/cubic meter (...)

1.15k

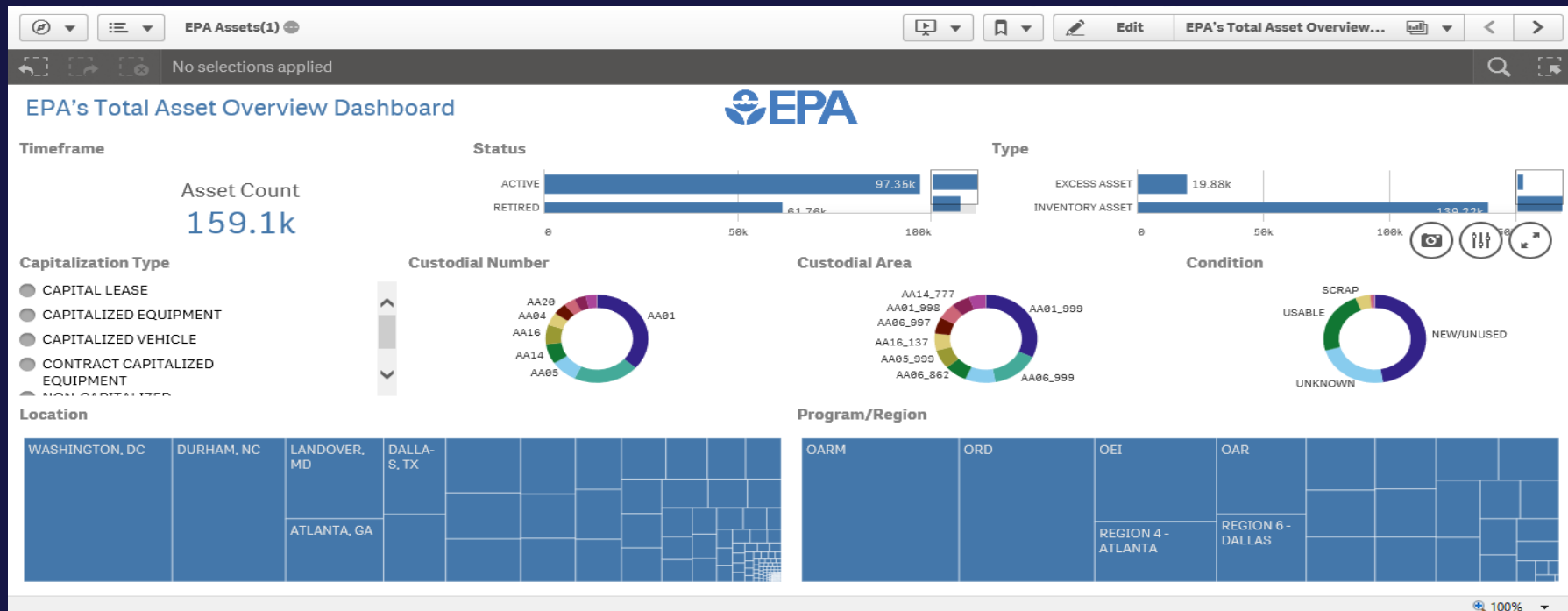


# Locations



U.S. Environmental Protection Agency

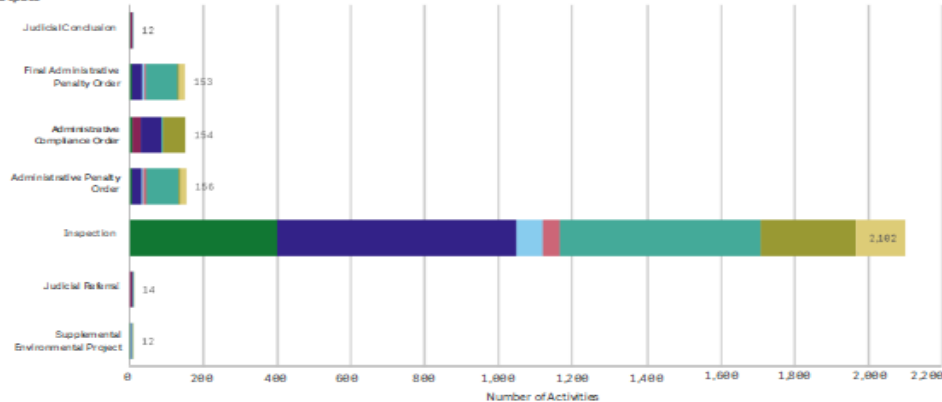
# Facilities & Assets



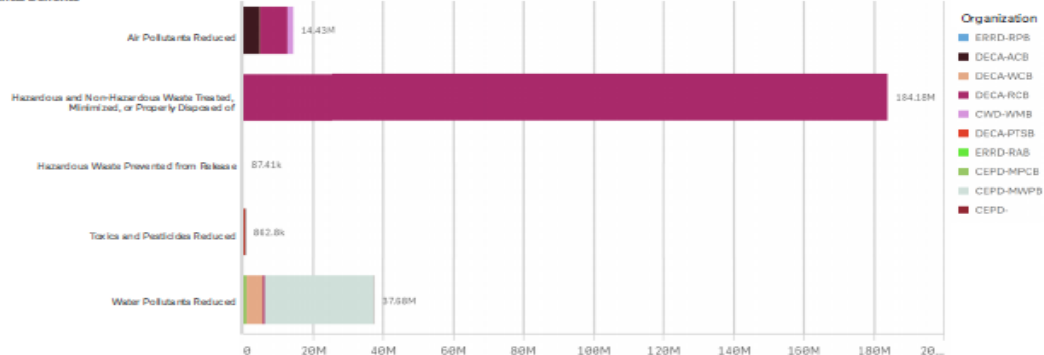
# Regional Reporting

FY 2016 Enforcement by the Numbers - EPA Region 2

## Enforcement Outputs



## Environmental Benefits

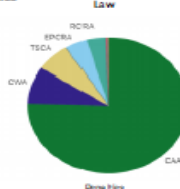


## Complying Action Cost



Complying Action Cost  
**\$1,599M**

## Penalties



Penalties  
**\$6,621,544**

SEP Value  
**\$1,584,335**

Potential Water Supply Protected  
**277k**

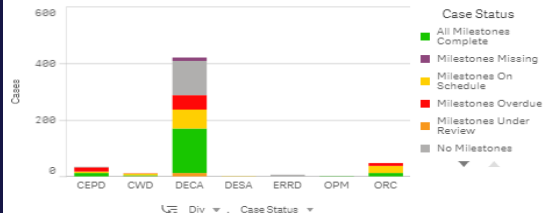
Unretreated Discharge Eliminated  
**878.5M G**

Contaminated Soil/Debris to be Cleaned Up  
**12.9 cu yd**

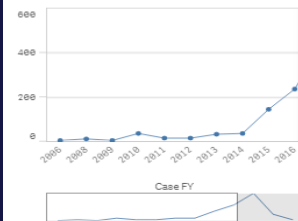
# Tracking Milestones

MTS Dashboard (Under Development)

Case Status Summary



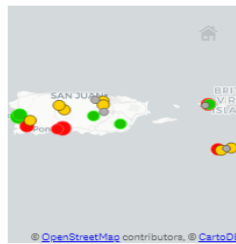
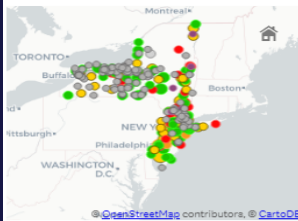
Milestones by Case FY



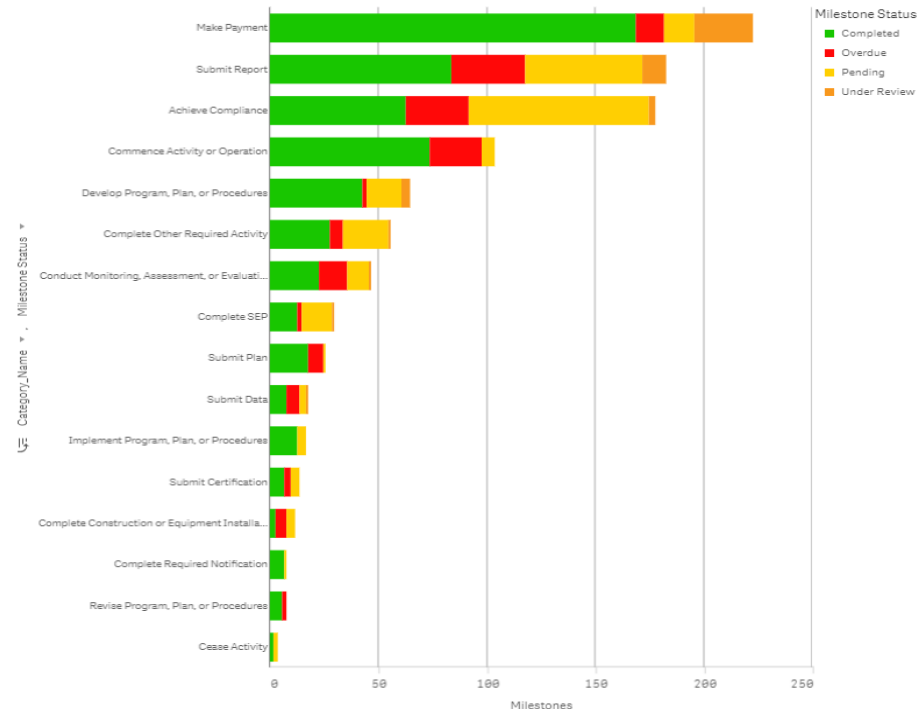
Milestone Status Summary



Use mousewheel to zoom on map



Milestones by Category / Description - Use arrow next to Category\_Name for alternative breakdown



# Take Advantage of What You Have



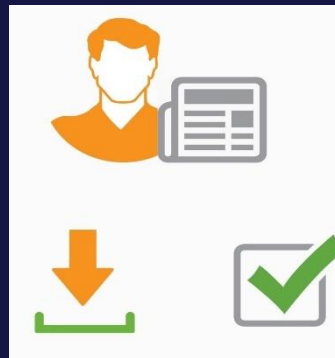
Human Capital:  
Staff & Contracted



Shared Resources:  
Data & software



Promote Sharing with  
Existing Groups



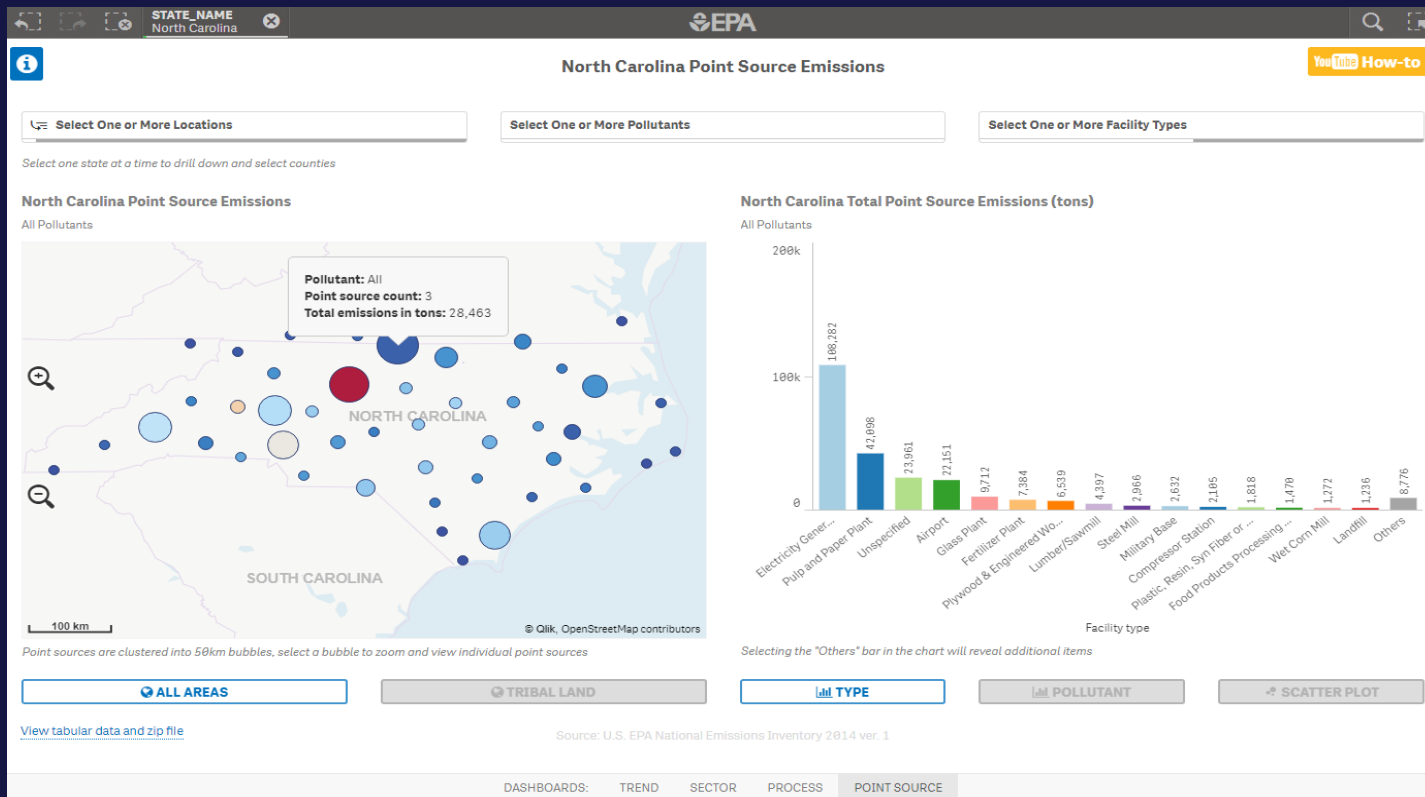
Projects  
&  
Processes

# National Emissions Inventory



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# Geospatial / Development Expertise



# Cha Cha Change

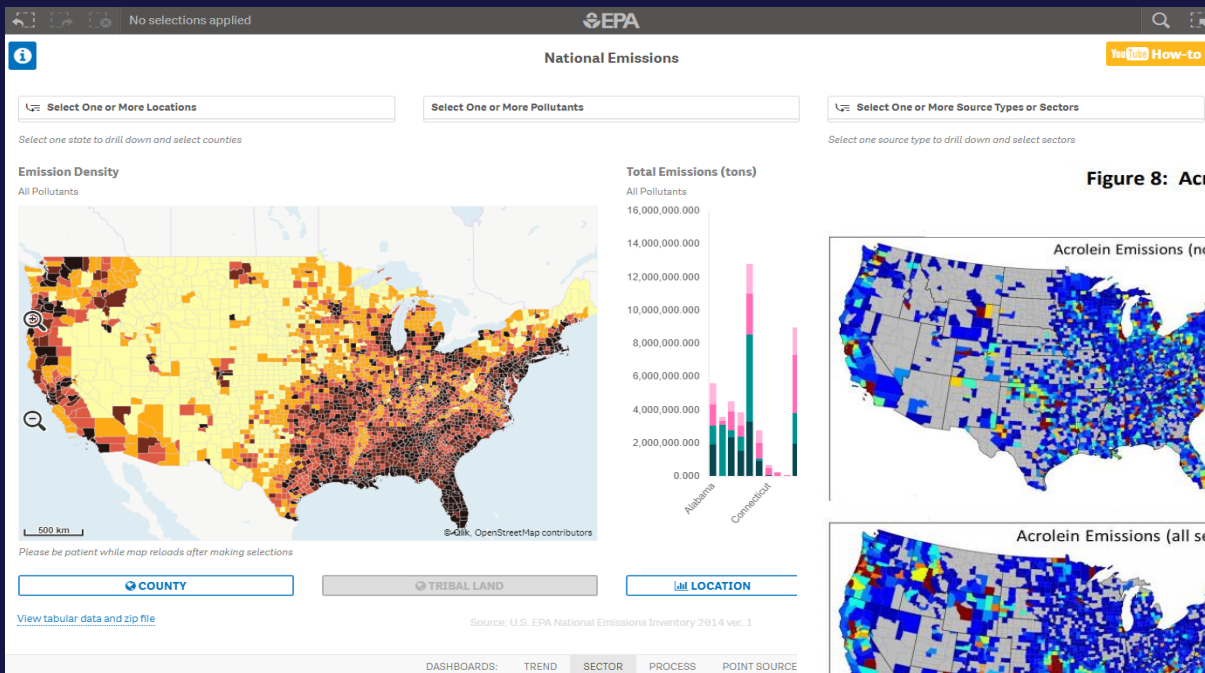
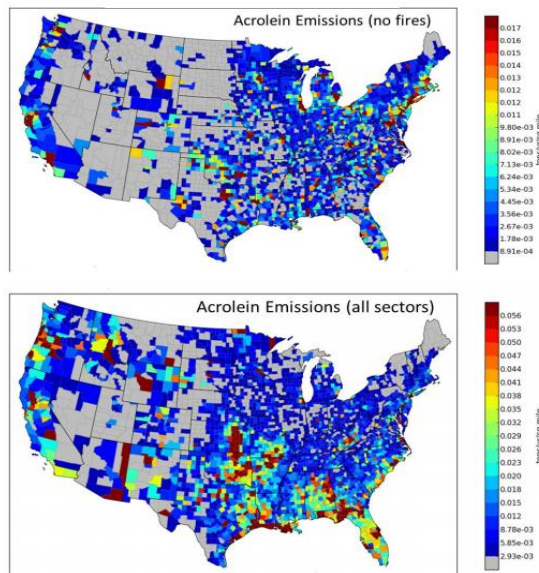


Figure 8: Acrolein Emission Density Maps, 2011 NEI v1



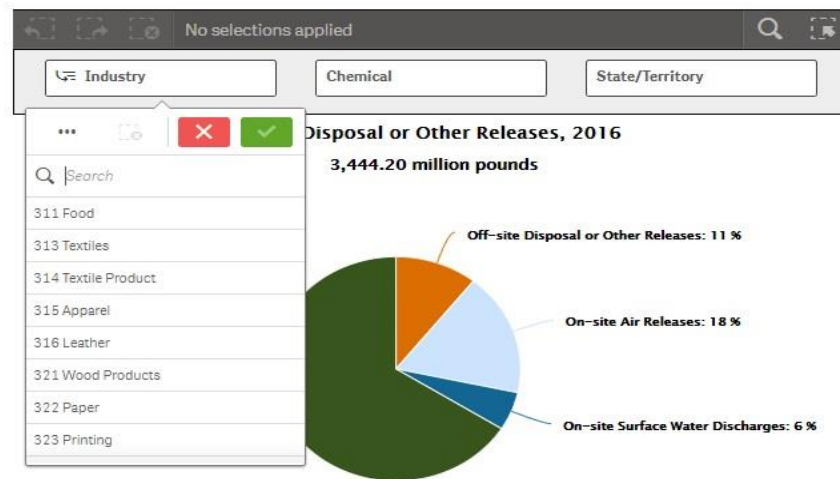
- These maps provide examples of HAP emission density (tons/year/sq mile) for acrolein (Figure 8) and benzene (Figure 9).
- While these sample maps describe the national and regional patterns of HAP emission distributions in the 2011 NEI v1, they do not assess or predict the absolute risks to human health and ecosystems that may be associated with the presence of any of these specific air pollutants. Rather, they focus on the intensity of emission releases.
- The top map excludes fires (wild, prescribed and agricultural). The bottom map shows emissions when these large fires are included.
- Fires are a significant contributor to acrolein emissions. The bottom map indicates a higher magnitude of emissions when fires are included. Including fires also changes the spatial pattern - highlighting the western U.S. where many large wildfires occurred in 2011 and in the southeast as well as for some of the middle states where many prescribed fires occurred in 2011.

# TRI National Analysis

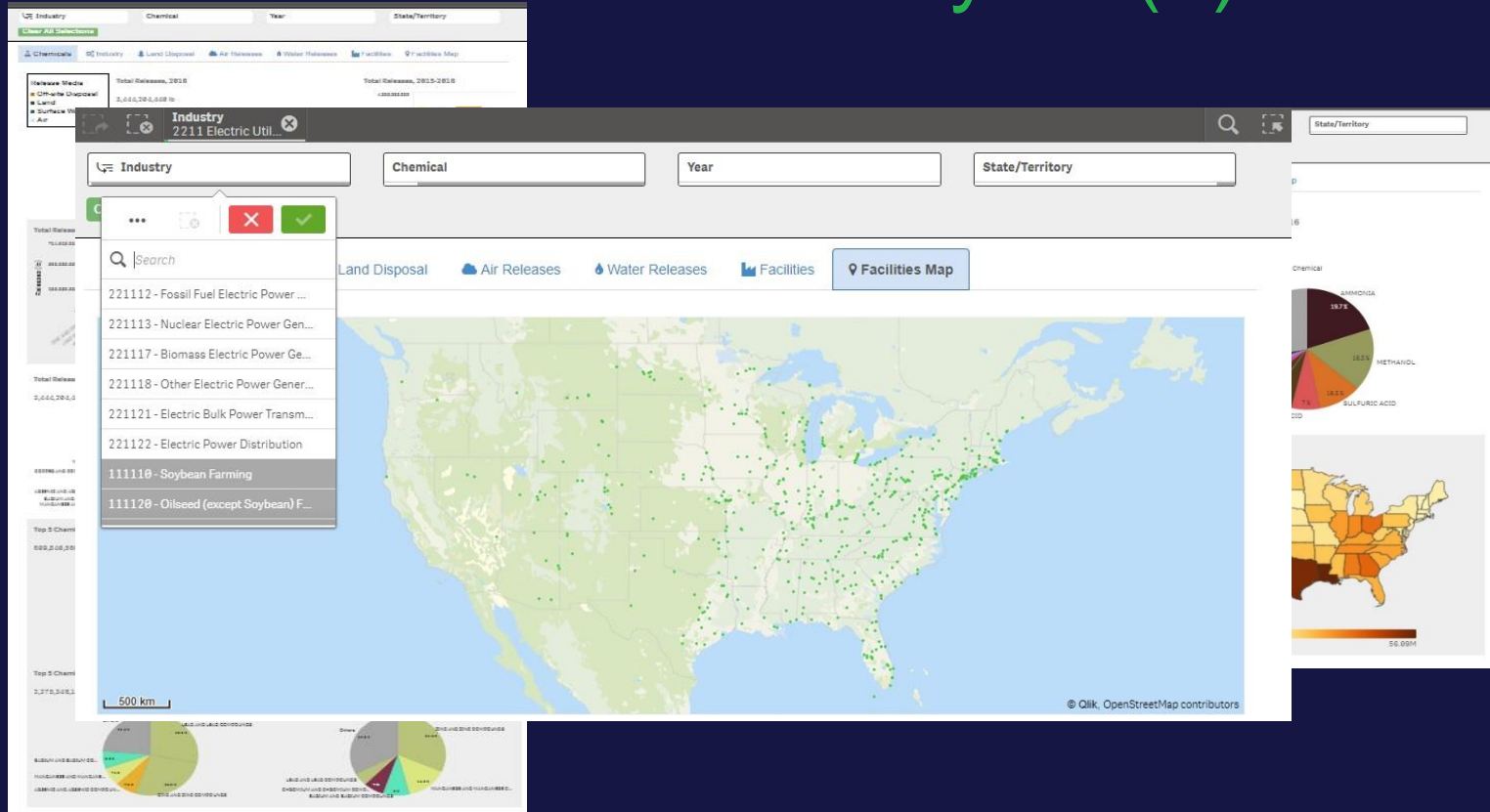
- Interactive graphic embedded in TRI National Analysis microsite
- Provides quick access to customized data output by industry, chemical, and/or location
- Links to full National Analysis App
- <https://www.epa.gov/trinationalanalysis/releases-chemicals-2016-tri-national-analysis>

## Releases in 2016

Use the interactive chart below to explore how total releases of chemicals that occurred in 2016 are associated with different industry sectors, specific chemicals, and geographies. [Visit the full TRI National Analysis Qlik dashboard](#) to explore even more information about releases of chemicals.



# TRI National Analysis (2)



# TRI and Tribal Communities

Streamlined set of Qlik Sense  
charts within a chart

## TRI for Tribal Communities

The Toxics Release Inventory (TRI) tracks the management of certain toxic chemicals that may pose a threat to human health and the environment. U.S. facilities in different industry sectors must report how much of each chemical is released to the environment and/or managed through recycling, energy recovery and treatment. (A "release" of a chemical means that it is emitted to the air or water, or placed in some type of land disposal.)

The information submitted by facilities is compiled annually by EPA. TRI helps support informed decision-making by industry, government, non-governmental organizations and the public. The information presented here is part of a larger effort to inform tribes of the availability of TRI data and other resources that may help assess tribal environmental and health concerns.

On this page:

- [Why should tribes be interested in TRI?](#)
- [How many TRI facilities are on tribal lands?](#)
- [How can tribes access TRI data?](#)
- [Are tribes at risk from toxic chemical releases on or near their lands?](#)
- [Is there help available for tribes concerned about toxic chemical releases?](#)

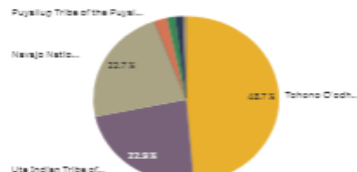
Select an Industry...	Select a Chemical
Select a Tribe	Distance Filter

Select charts from this menu ▾

Clear Selections

Total Releases by Tribe, 2016

Total Releases for 16 Tribes: 8,717,836 lbs



Distance Filter default displays "On Tribal Lands" data. Distance Filter for "Within 10 Miles of Tribal Lands" excludes data about facilities located on tribal lands. For data about facilities located on or within 10 miles of tribal lands, select both the "On Tribal Lands" and "Within 10 Miles of Tribal Lands" filter options.

[www.epa.gov/toxics-release-inventory-tri-program/tri-tribal-communities](http://www.epa.gov/toxics-release-inventory-tri-program/tri-tribal-communities)

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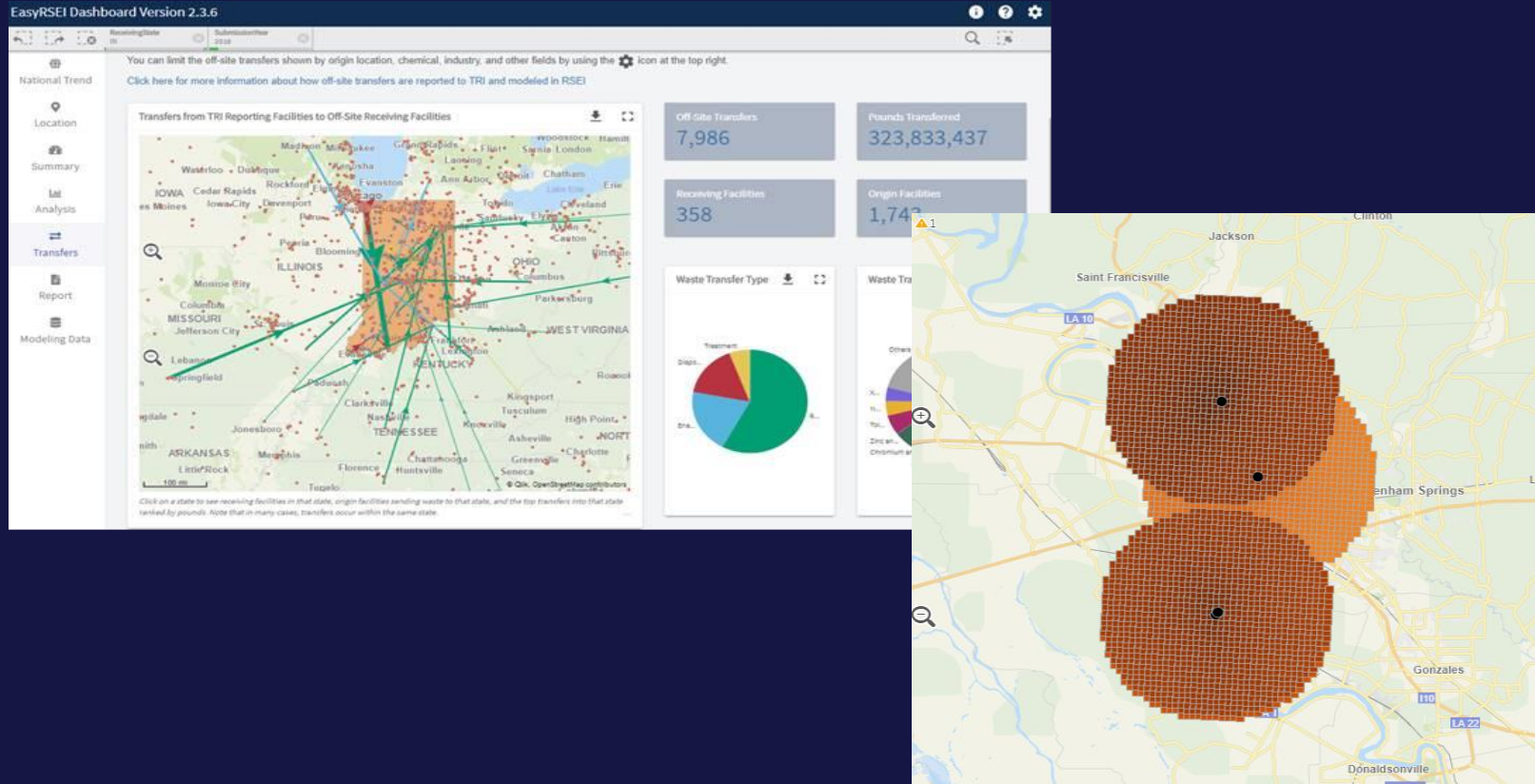
# TRI Pollution Prevention



<https://www.epa.gov/toxics-release-inventory-tri-program/tri-p2-industry-profile>

U.S. Environmental Protection Agency

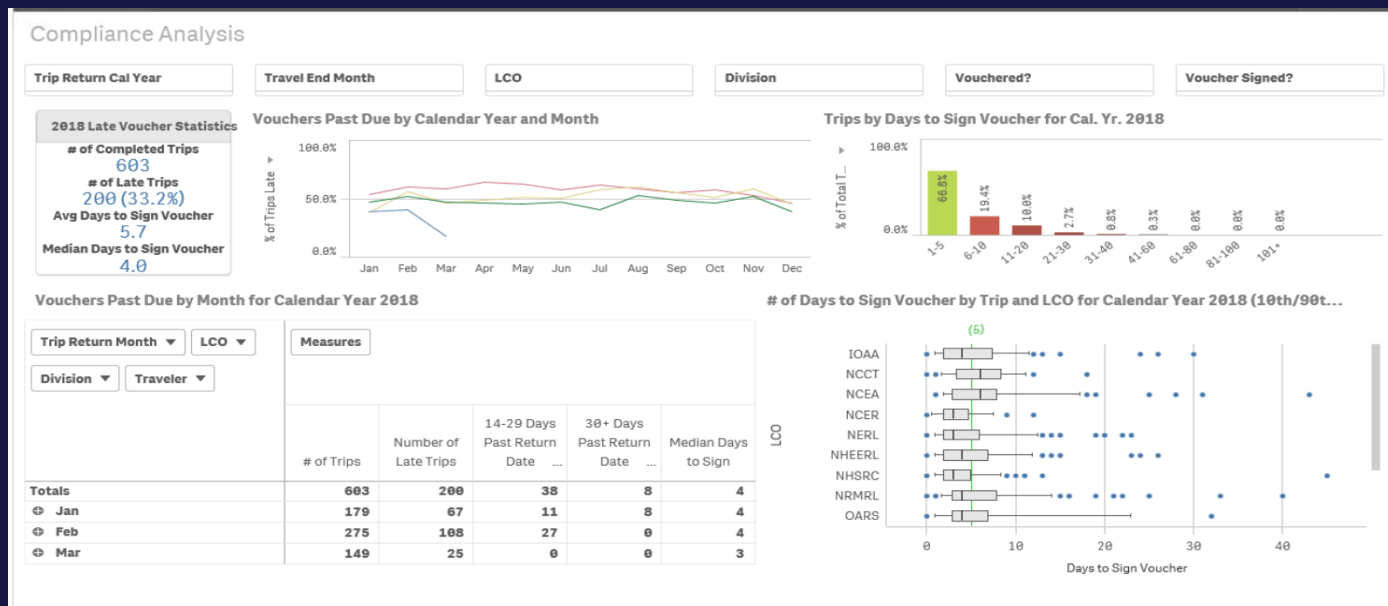
# Chemical Movement



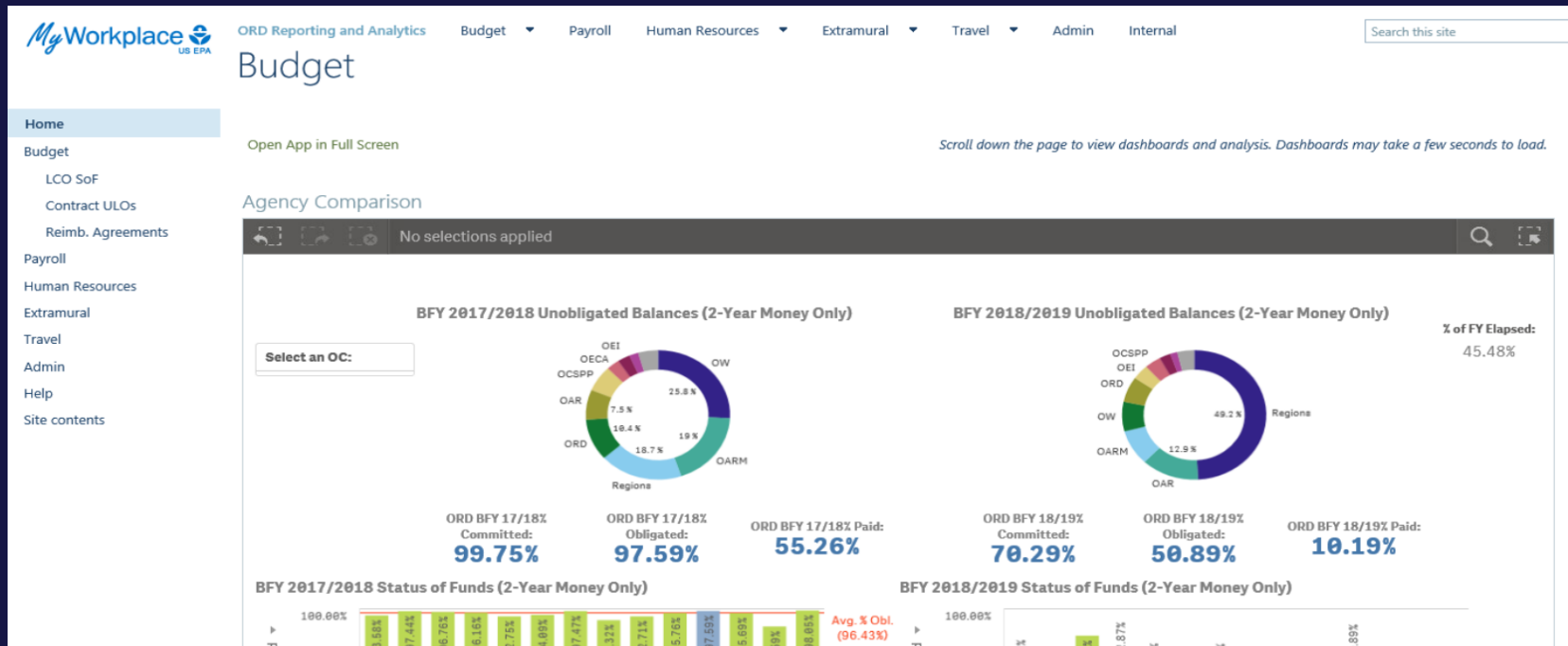
# Fill Needs...

Address administrative reporting and analytics gaps

- Timely data and analytics for decision-makers
- Centralize reports to deliver consistent answers
- Normalize formats, conventions & definitions



# Within Familiar Applications



A centralized hub for administrative reporting and analytics leveraging SharePoint and Qlik Sense. Serving timely data to decision-makers and managers on a familiar technology.

# Broaden and Advance

Expand Partnerships



More people can  
solve significant  
challenges

# Air Quality / Children's Health

## Environmental Health Data Visualization



1) Geography: States ▾

Data sources:

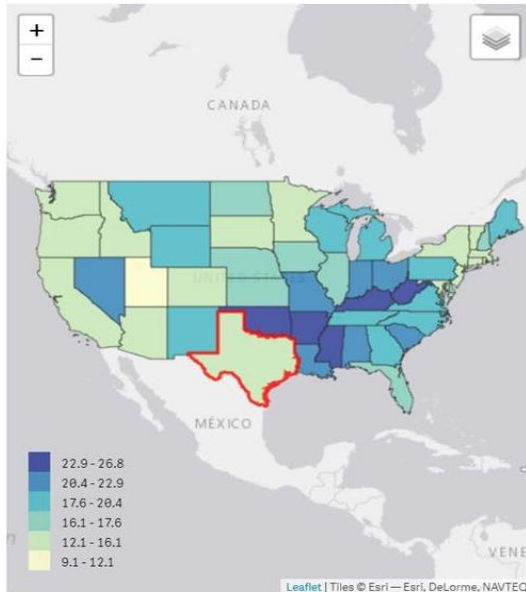
- EPA Environmental and Health Topics
- National Environmental Public Health Tracking Network

2) Variable X:

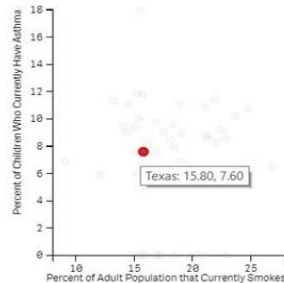
Percent of Adult Population that Currently Smokes ▾

Year:

2010 ▾



Location	Q	Var. X	Var. Y
Totals		17.92	8.92
Alabama		21.90	11.50
Alaska		20.40	-
Arizona		15.00	9.40
Arkansas		22.90	-
California		12.10	5.90
Colorado		16.00	-
Connecticut		13.20	11.30
Delaware		17.30	-

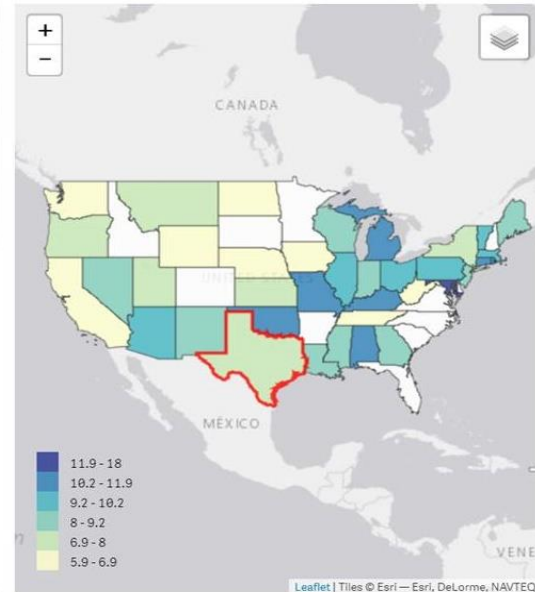


3) Variable Y:

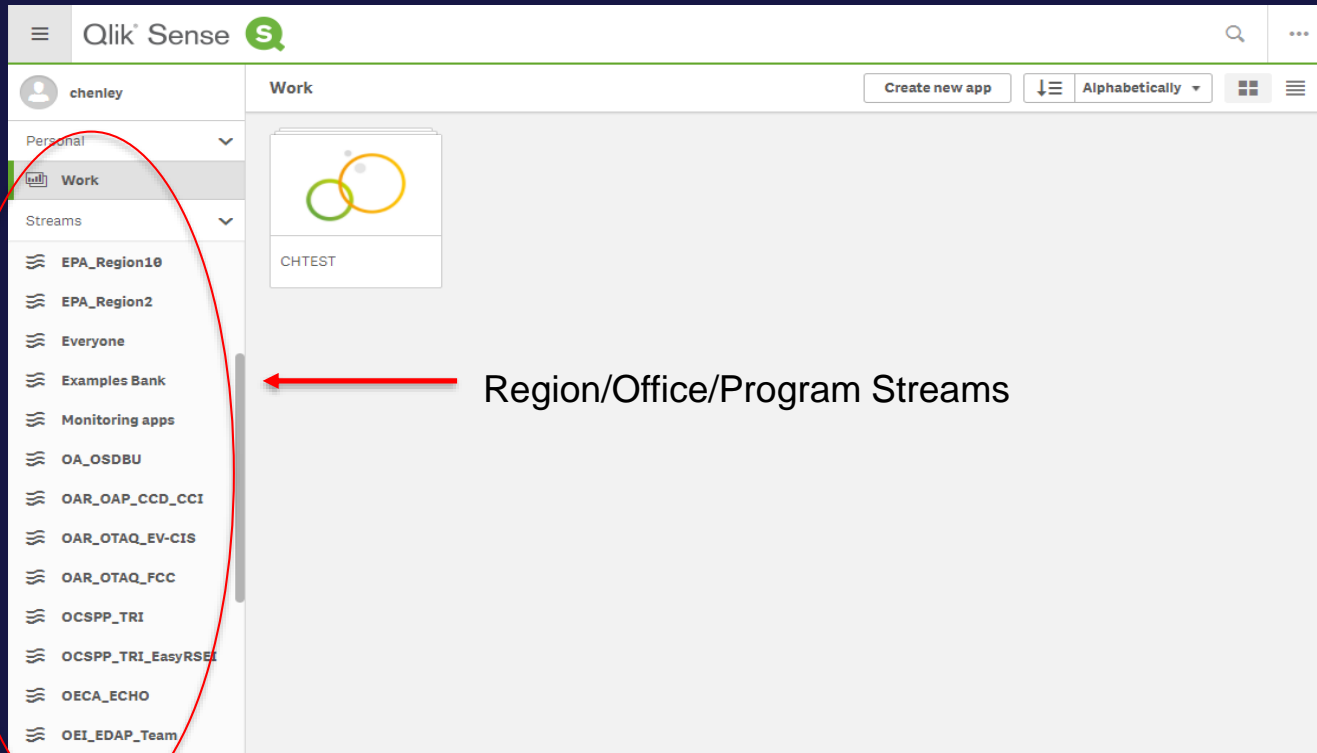
Percent of Children Who Currently Have Asthma ▾

Year:

2010 ▾



# Challenge: Stream Overload



# Managing the Clutter

- EPA Office of Enforcement and Compliance wanted a clearer interface
- A hosting site for “in-production” dashboards created throughout the agency
- Searchable by keyword, owner, and topic
- Submission form allows users to add their work and metadata for context
- Version Notes capability will keep users updated on all changes
- Goal to outsource development to different Offices and Regions
  - Train representatives from each Office and Region for more content creation
  - Create community of practice where Regions can share ideas

# Improve Collaboration



## Data Visualization Gallery

ECHO has added the power of Qlik analytics to its suite of tools, making compliance-related data sets easier to explore. This page is for EPA review and will be opened for state access [in March 2018](#). [EPA HQ and Regions can also submit their own compliance-related data visualization projects to ECHO Gov.](#)

This page provides links to information maintained and displayed outside of ECHO. Clicking links may take you away from the ECHO website. Use the Provide Feedback link to submit questions about products displayed on this page.

[Help](#)

Media

No Restrictions

Owner Affiliation

No Restrictions

Search by Keyword



★ Featured

[ECHO Gov](#)

[EPA](#)



### CWA NPDES SNC + Category 1 Violations (by rolling year) ★

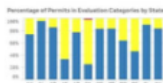
OECA is using this dashboard to track progress in meeting targets for reducing the SNC rate pursuant to OECA's related Agency Priority Goal (APG) metr... [Read more detail](#)

[Provide Feedback](#) [Edit Metadata](#)

Media: Water

Owner Affiliation: Headquarters

Keywords: NPDES, CWA, effluent, violatio...



### NPDES eRule Readiness and Data Completeness Dashboard ★

This dashboard provides EPA and states information on each state's readiness to implement electronic reporting based on ICIS-NPDES data. The purpose o... [Read more detail](#)

[Provide Feedback](#) [Edit Metadata](#)

Media: Water

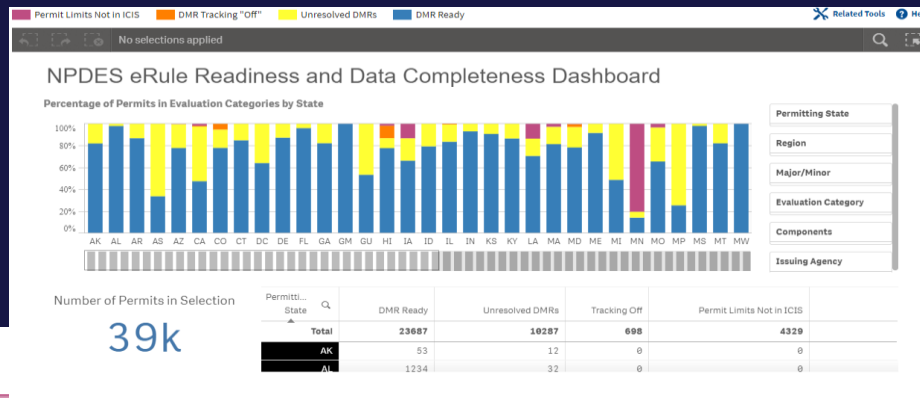
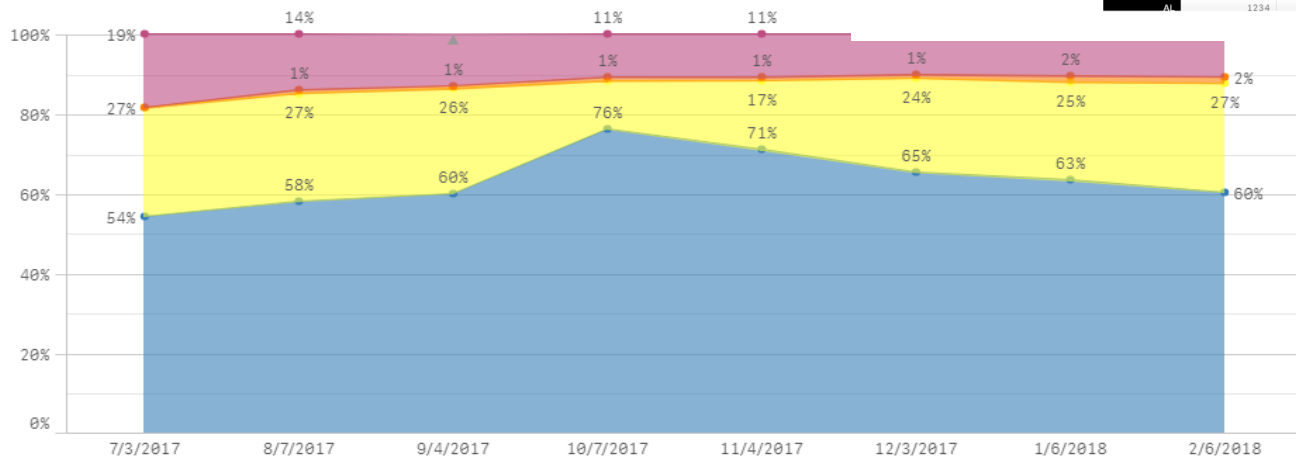
Owner Affiliation: Headquarters

Keywords: NPDES, eRule

# Sharing with States

- Began internally
- Shown to states to highlight areas for improvement in electronic reporting

Percent in Category

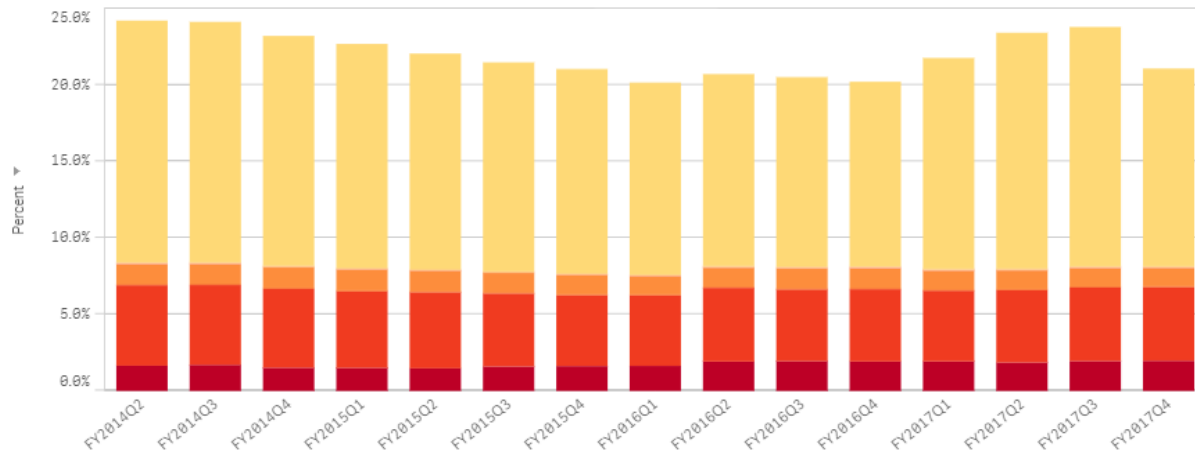


# Measuring Agency Goals

## Rolling SNC/Category 1 Rates

### Rolling SNC/Category 1 Rate

Combined Major and Non-Major Facilities in Region; and State:



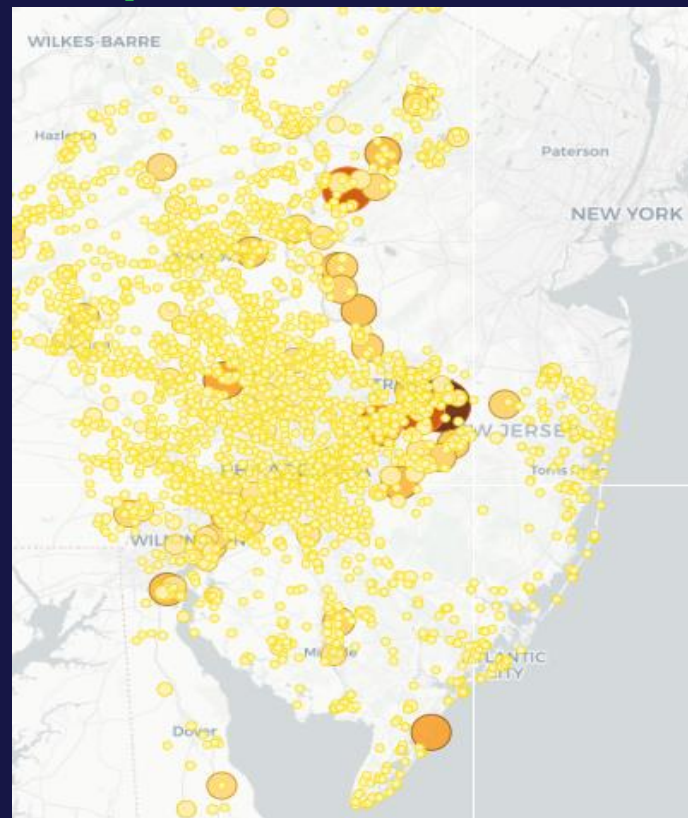
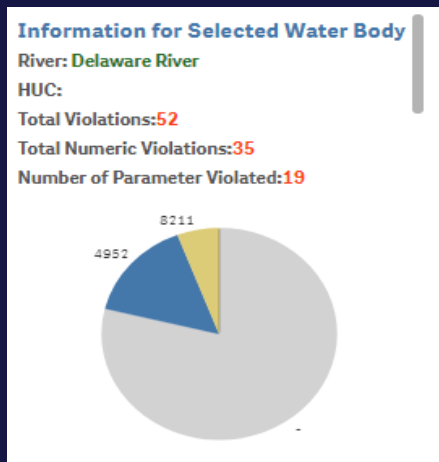
- EPA goal to reduce the serious noncompliance under the Clean Water Act by 50%, from 24% to 12%.

For each quarter, each facility's status is defined as being the highest non-compliance code (using the hierarchy below) in that quarter or any of the three previous quarters.

Code	Color	Status	Level	Description
S	Red	Noncompliant	SNC/Cat. 1	For Unachieved Schedule Milestone Violation
E	Red	Noncompliant	SNC/Cat. 1	For Monthly (e.g., 30-Day Average/Daily Average) Effluent Violation
X	Orange	Noncompliant	SNC/Cat. 1	For Non-Monthly (e.g., 7-Day Average/Daily Maximum) Effluent Violation
T	Pink	Noncompliant	SNC/Cat. 1	Permit Schedule Violation
D	Yellow	Noncompliant	SNC/Cat. 1	For DMR Non-Receipt Violation

# Modular Web Service Implementation

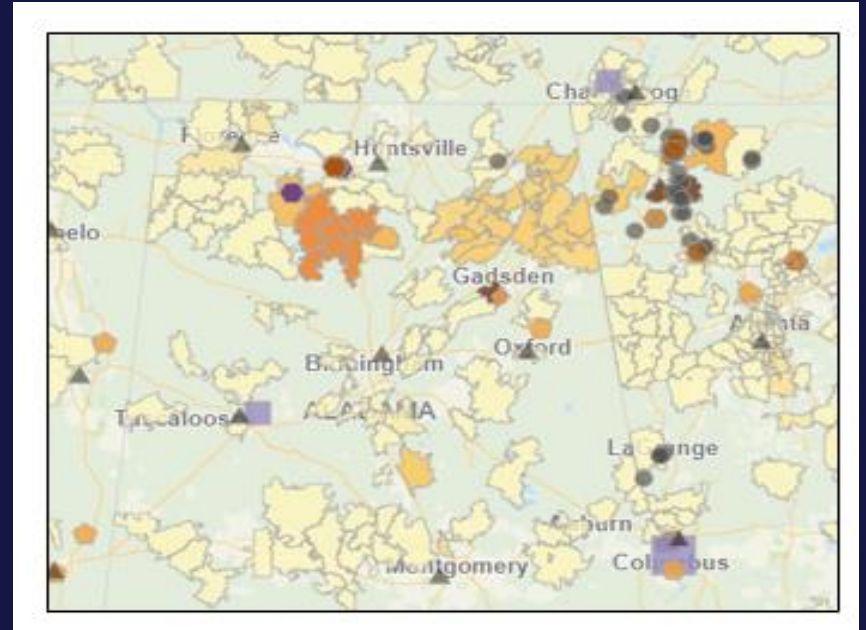
EPA's public ECHO database has web services - developers can pull in live data



# Increasing Complexity

EPA is looking at chemical categories and their distributions and concentrations, using Qlik visualizations as part of a comprehensive analysis

- Join unrelated databases
- Display this data together
- Overlay on the same maps
- Allow for new connections to be drawn

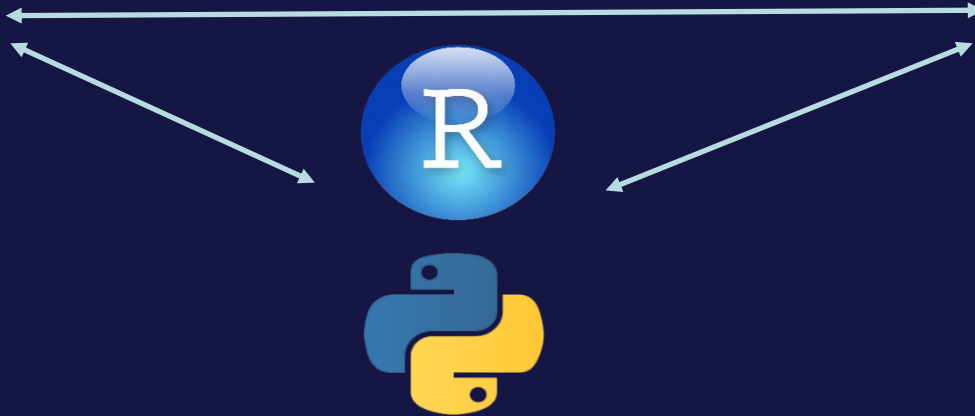


# Capturing Scientists?

Traditional Visualization



Geo Based Visualizations



# Hurricane Maria: Story Maps

## Hurricane Maria Operational Story Map

No issues detected x Story not shared x Edit x

Overview

Hazardous Debris

Superfund Assessments

Drinking Water and Wastewater Operations

Fixed Facility Assessments

Marine Operations

Edit x

No issues detected x Story not shared x

### Overview

On September 20, 2017, Hurricane Maria struck the U.S. Virgin Islands as a Category 5 and then Puerto Rico as a Category 4 storm, just two weeks after Hurricane Irma struck the Caribbean islands. The storms left devastation in their wake, with the power distribution severely damaged, drinking water and wastewater treatment plants rendered inoperable, and buildings damaged or destroyed.

Hurricane animation credit: NY Times, 2017

### Photos of Initial Damage:



## Hurricane Maria Operational Story Map

No issues detected x Story not shared x Edit x

Overview

Hazardous Debris

Superfund Assessments

Drinking Water and Wastewater Operations

Fixed Facility Assessments

Marine Operations

Legend

Edit x

No issues detected x Story not shared x

### Fixed Facility Assessments

This task requires EPA teams to assess facilities that are permitted under five different federal programs. The purpose of these assessments is to identify any release or threat of a release into the environment of chemicals and/or oil associated with recent storm damage. The five programs and their criteria are:

- **Risk Management Plan (RMP):** These facilities typically hold large quantities of hazardous materials and pose substantial threats to surrounding populations. The



Esri  
Earthstar Geographics | Esri, IBM, Garmin

## Hurricane Maria Operational Story Map

Overview

Hazardous Debris

Superfund Assessments

Drinking Water and Wastewater Operations

Fixed Facility Assessments

Marine Operations

PR Superfund Map

St Croix Superfund Map

VI Superfund Map



# Maria – Response

## Hurricane Maria Operational Story map

Overview

Hazardous Debris

Superfund Assessments

Drinking Water and Wastewater Operations

Fixed Facility Assessments

Marine Operations

Daily Situational Briefing

MARIA Situation Briefing

Edit

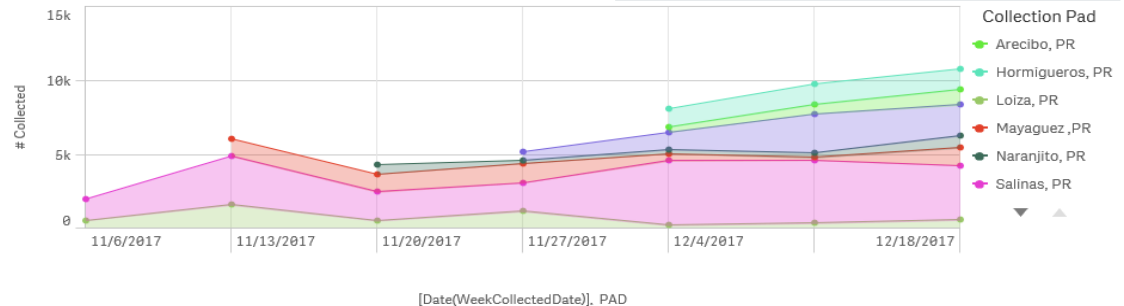
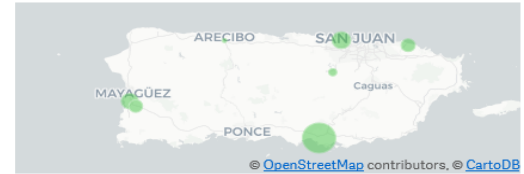
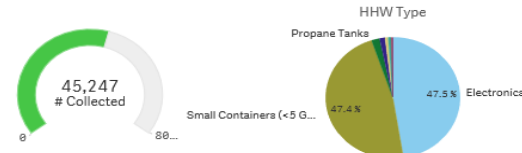
### Maria Situational Briefing

No issues detected

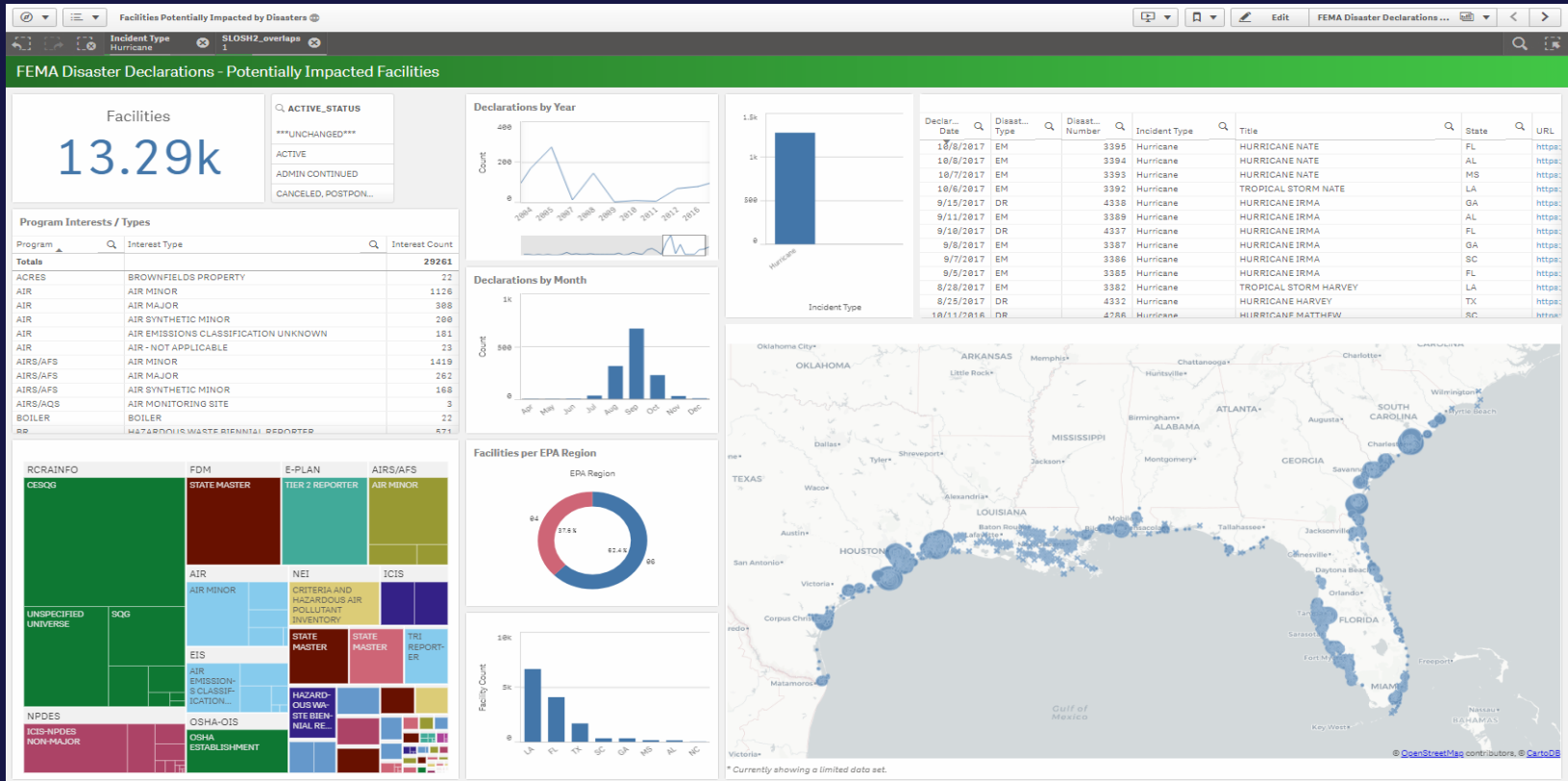
### Puerto Rico - OPS

- Continue HHW operations
- ACI Thermal Reduction
- PRASA and non-PRASA
- Abandoned Vessel Recovery
- EQB Lab

USVI - Ops



# Hurricane Harvey / Irma



# California - Wildfires



Josh Edelson | AFP | Getty Images



Jeff Chiu | AP



# Drivers of Our Success

- Start-up work from core team
- Entrepreneurship by us and others
- Partnerships
- Community Building
- Leveraging – people, process, projects
- Connecting to tools we love
- Dedication to the mission



Thank You

Richard G. Allen, PhD  
[Allen.Richard@epa.gov](mailto:Allen.Richard@epa.gov)

U.S. Environmental Protection Agency