Ask CAMD Session on CAMD Data Products

April 20, 2020

Overview of Agenda

1. Welcome from CAMD Director Reid Harvey
2. Allowance Data
3. Power Sector Emissions Data
4. Deposition and Environmental Effects Data
5. Wrap-Up

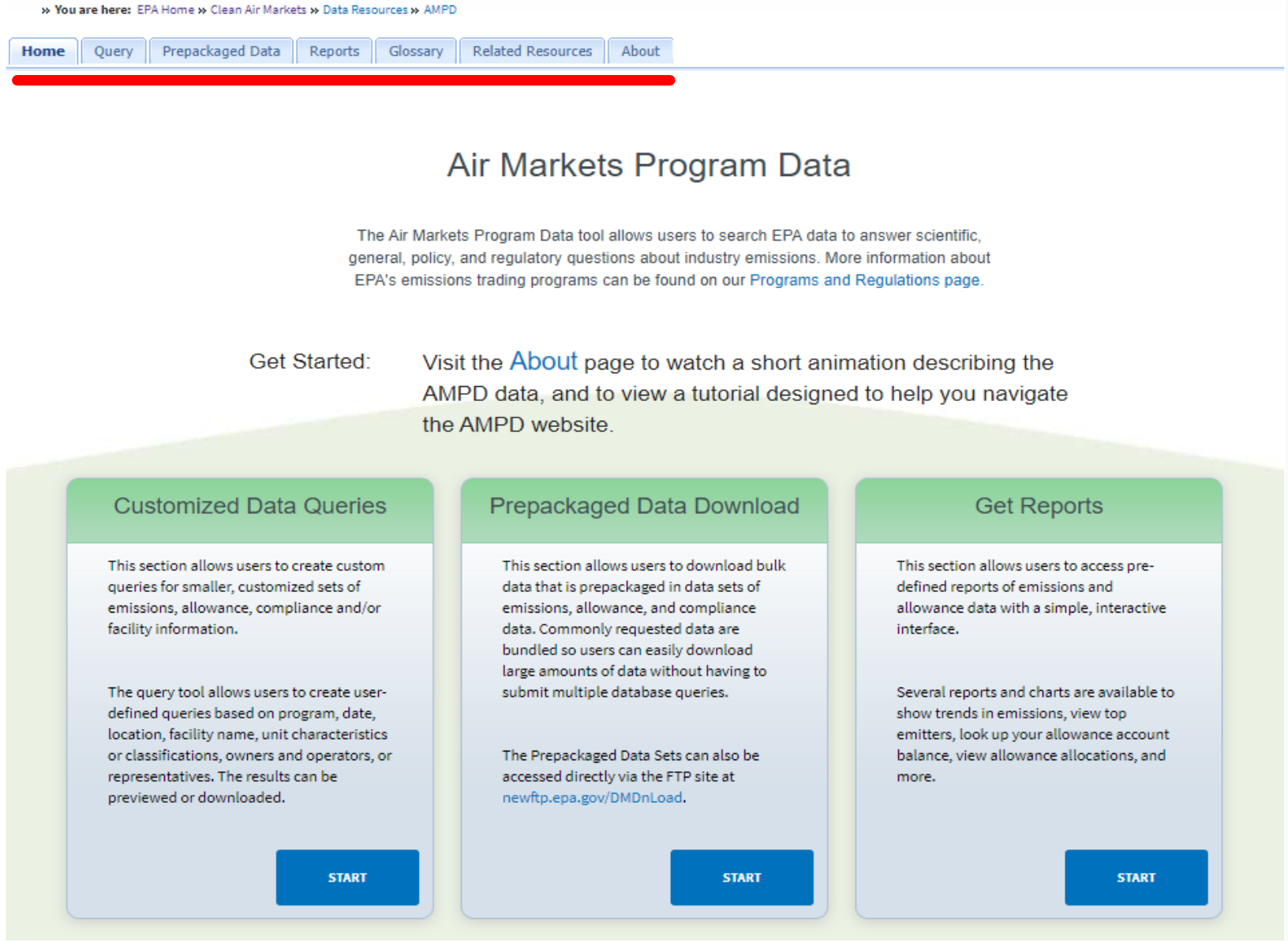
Allowance Data

AMPD: Allowance Data

Account Details	Account ownership details for all facilities in MD
Account Holdings	Number of allowances by vintage year held by a specific account
Transactions	All the private transactions for the CSOSG2 program during the 2019 compliance year
Compliance	Facility X's compliance information, emissions & allowances deducted for a given year

www.ampd.epa.gov/ampd

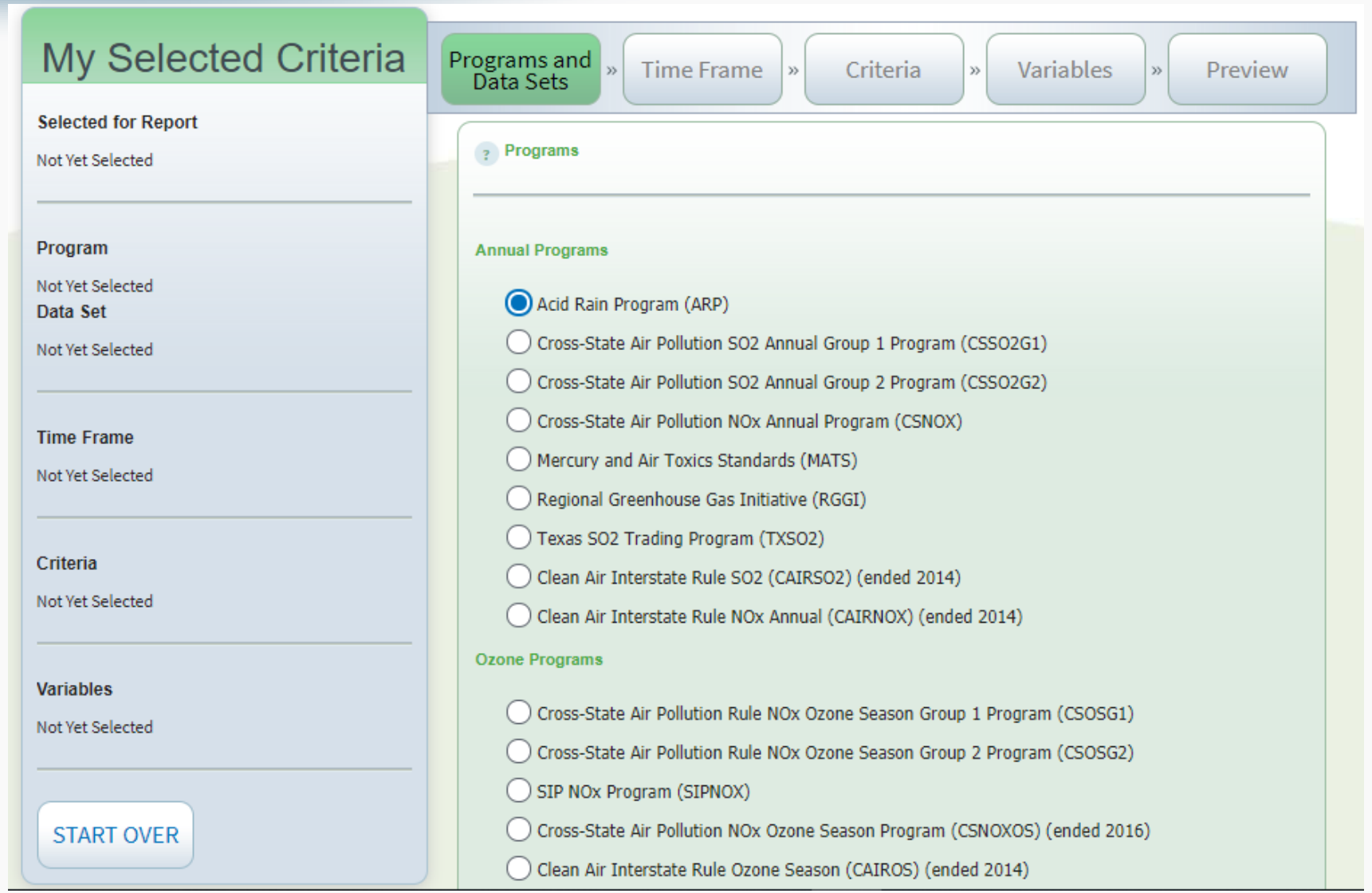
Air Markets Program Data



User Queries

Query:

- Account information
- Facilities in Maryland
- Participating in the ARP program



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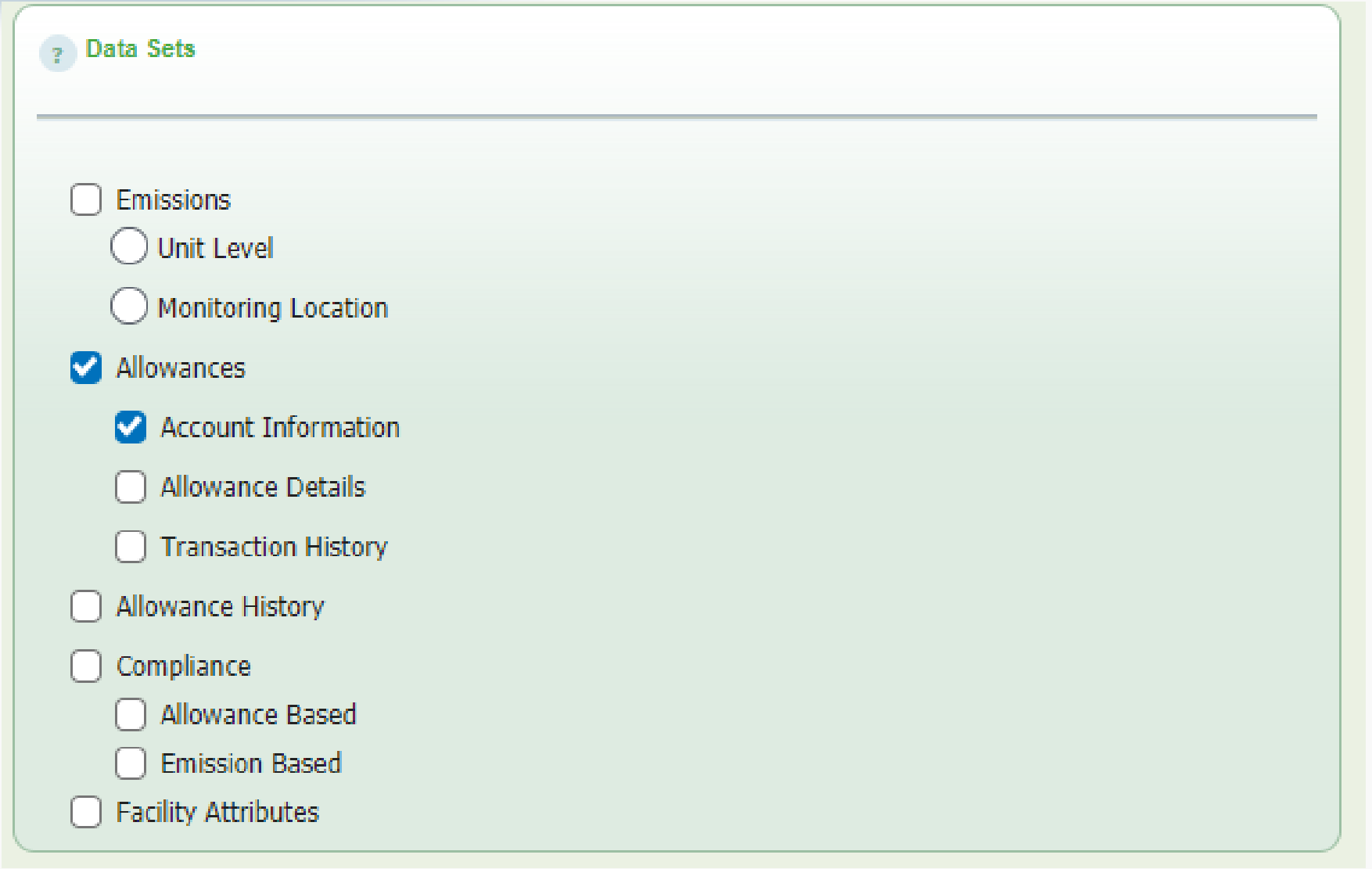

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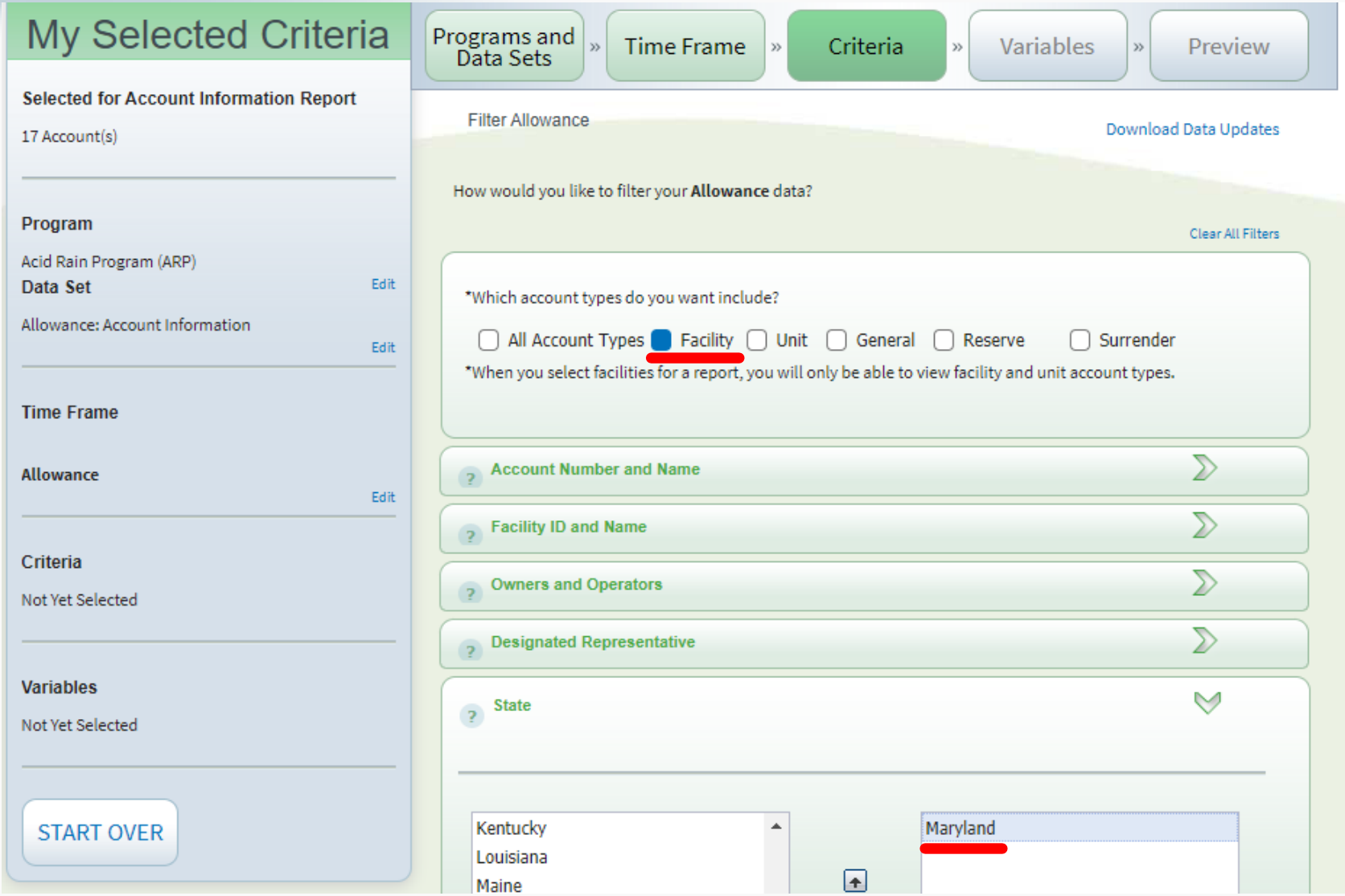

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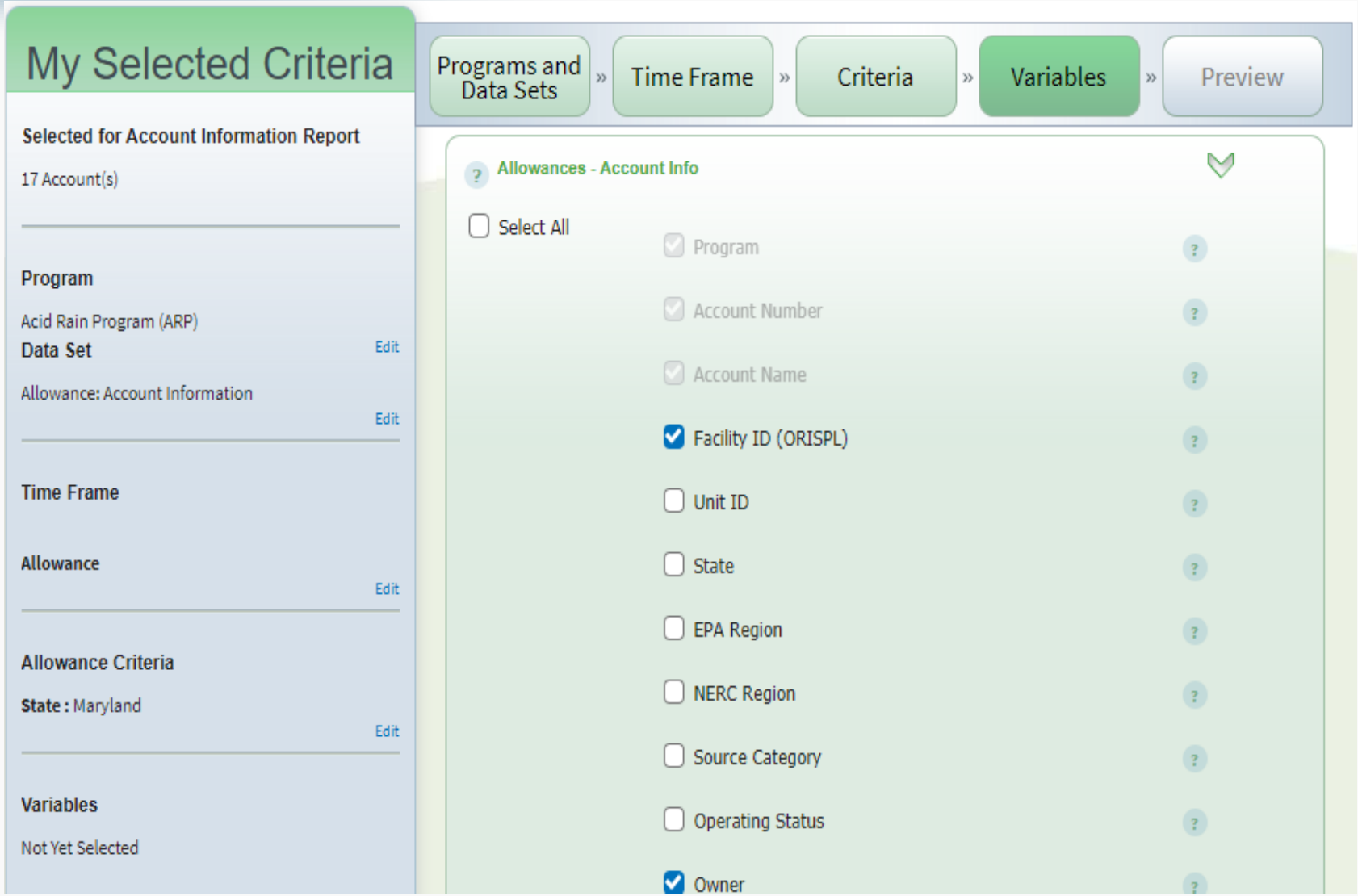

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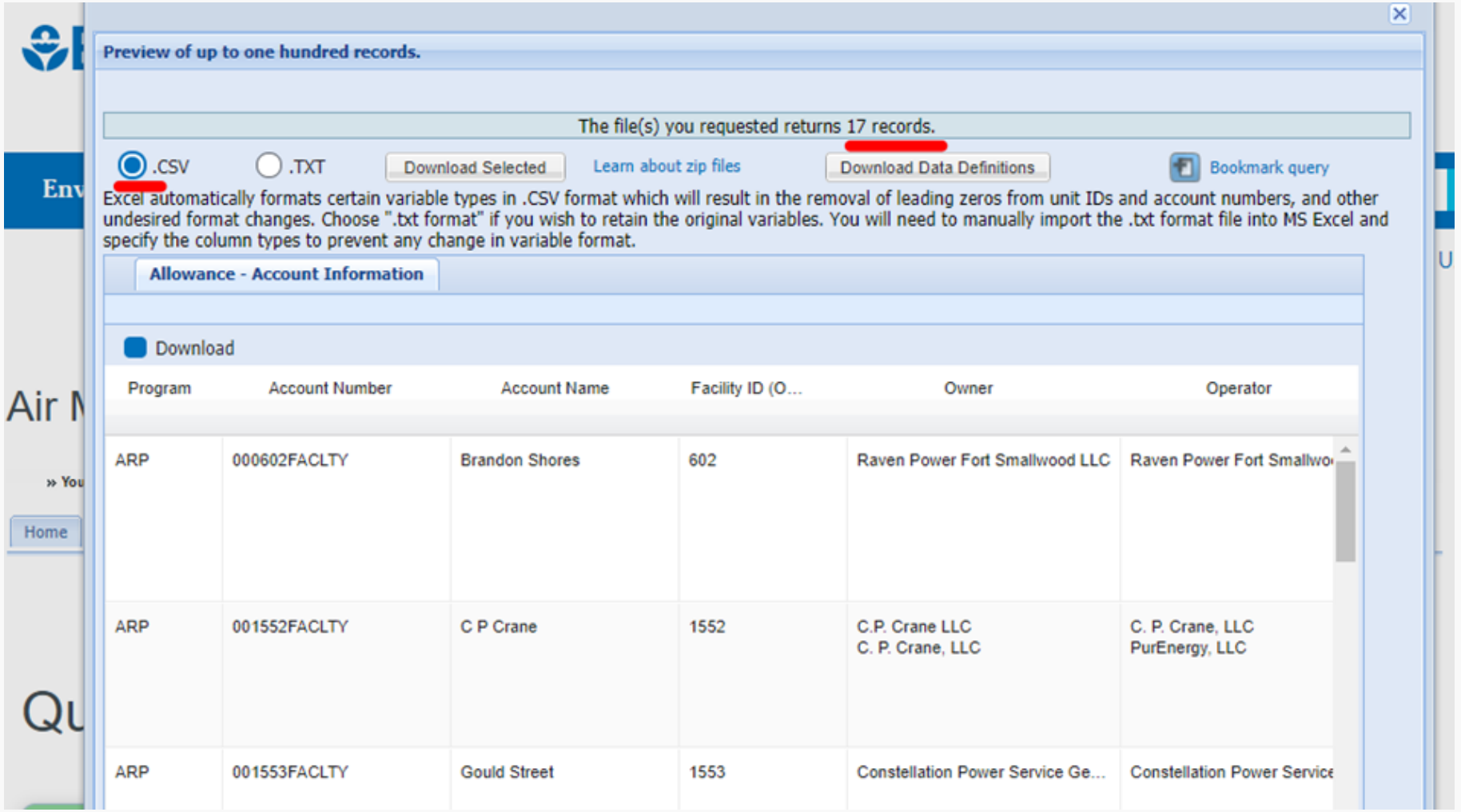


Pre-Packaged Datasets

*****Data at program level

Allowance Data — Clear Selection

Package Name	Date Upda…	Description	File Size
Texas SO2 Trading Program Allowances Held	Mar 19, 2020	Current Texas SO2 Trading Program allowance holdings.	2 KB
TXSO2 Transactions	Jan 21, 2020	Texas SO2 Trading Program allowance trades by year.	4 KB
Initial allocation of Acid Rain Program allowanc…	Sep 21, 2007	Initial allocation of Acid Rain Program allowances.	160 KB
ARP Transactions	Jan 24, 2018	Acid Rain Program allowance transfers by year.	12,196 KB
ARP Allowances Held	Mar 19, 2020	Current Acid Rain Program allowance holdings.	633 KB

Compliance Data — Clear Selection

Package Name	Date Upda…	Description
Acid Rain Program Annual Reconciliation Data	Jul 11, 2019	Acid Rain SO2 Program Allowance Holding
Acid Rain NOx Program Compliance Summary	Jul 11, 2019	Acid Rain NOx Program Rate-Based Comp
Acid Rain NOx Program Averaging Plan Summary	Jul 11, 2019	Acid Rain NOx Program Rate-Based Comp
CAIR NOx Annual Program Annual Reconciliation Data	Jul 11, 2019	CAIR NOx Annual Program Allowance Hold
CAIR NOx Ozone Season Program Annual Reconciliation Data	Jul 11, 2019	CAIR NOx Ozone Season Program Allowa
NOx Budget Trading Program Annual Reconciliation Data.	May 29, 2014	NOx Budget Trading Program Allowance H

Power Sector Emissions Data

CAMD's Power Sector Emissions Data

- CAMD collects its Power Sector Emissions Data according to requirements under 40 CFR Part 75 to ensure compliance with emissions trading and other air quality programs operated by EPA.
- 40 CFR Part 75 establishes requirements for EGUs to continuously measure emissions and report those measurements, along with facility, operation, and QA test data, to EPA. Requirements for monitoring vary depending on the size and type of unit, amount of operation, and type of fuel combusted.
- EGUs report data to CAMD if they are affected by one of these programs.
  - In general, EPA programs apply to EGUs that burn fossil fuels with a nameplate capacity of greater than 25 MW (with some exceptions).
- Data must be submitted to EPA within 30 days of the end of each calendar quarter.

CAMD's Power Sector Emissions Data

- Emissions (short tons): hourly SO_2, NO_X, CO_2, Hg
- Facility information
  - Unit type (e.g., steam turbine, combustion turbine, combined cycle)
  - Source category (e.g., electric utility, industrial boiler)
  - Owner/operator
  - Location (latitude/longitude)
- Primary and secondary fuel type, including the begin and end dates of use

CAMD's Power Sector Emissions Data

- Emissions control devices and installation dates of those devices
- Hourly gross electricity generation (e.g., MWh)
- Type of monitoring method, including the begin and end dates of use
- Quality assurance (QA) test information used to validate hourly emissions data, such as the date of testing, type of test, and the difference in the readings between the monitor and the reference value

EPA Programs Relying on Power Sector Emissions Data

- Acid Rain Program (ARP)
  - SO_2, NO_X, CO_2 emissions
  - Some units began in 1995, all units required to report by 2000
- Cross-State Air Pollution Rule (CSAPR)
  - SO_2 and NO_X emissions
  - Program began in 2015, many affected units were already reporting under earlier programs like ARP and/or Clean Air Interstate Rule
- Mercury and Air Toxics Standard (MATS)
  - Hg emissions
  - Went into effect in April 2015; however, some EGUs received extensions to April 2016, and some to April 2017; 2018 is first full year for which the vast majority of sources affected by MATS reported emissions

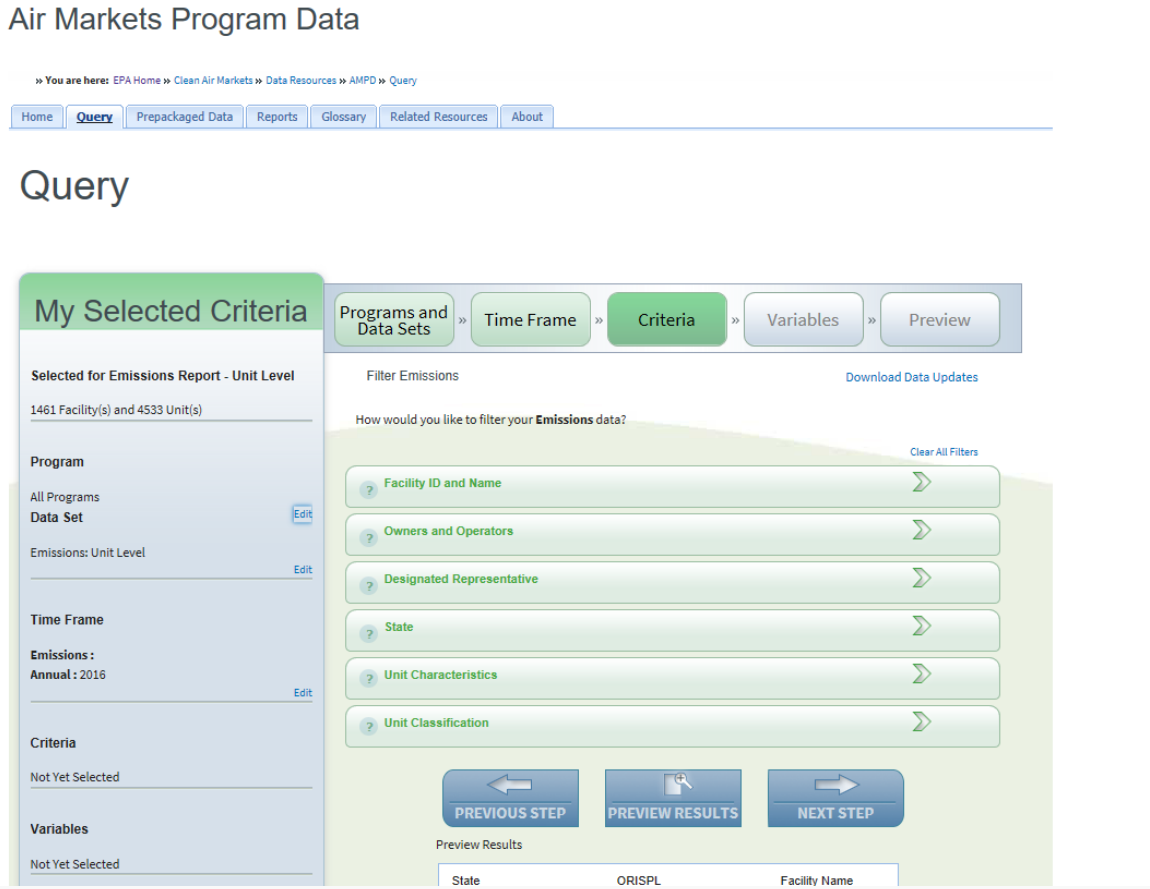
Quality Assurance/Quality Control of Power Sector Emissions Data

- QA tests are conducted at the source. Requirements vary based on the monitoring methodology.
- EPA also conducts periodic field audits to verify that monitors and data handling systems are performing properly.
- The software that sources use to submit data conducts thousands of electronic checks for completeness and proper formatting as well as consistency with program requirements and source's monitoring plan.
- EPA staff conduct additional checks, including statistical checks to detect anomalous data.

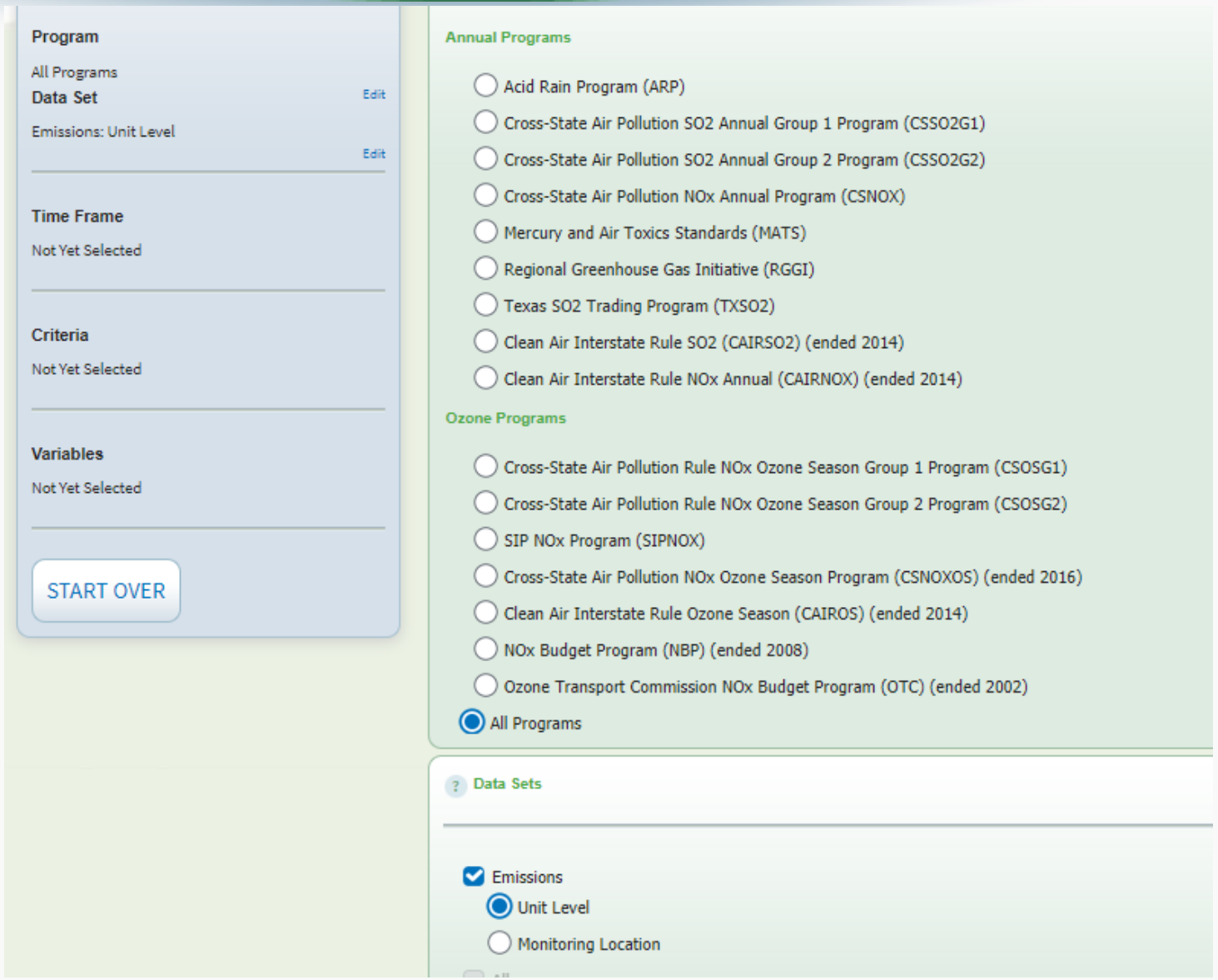
How to Download the Power Sector Emissions Data

- Air Markets Program Data (AMPD)
- FTP
- Field Audit Checklist Tool (FACT)
- FACT Application Programming Interface (API)
- Monitoring Plan Viewer

AMPD



- Web-based
- Create queries or view pre-packaged datasets and download
- Good at downloading data for more than one unit at a time
- Does not allow access to monitoring plan and QA test data
- Data back to the 1990s
- Note: AMPD only allows the user to pull 30 days of hourly data at a time.



AMPD: Query Example

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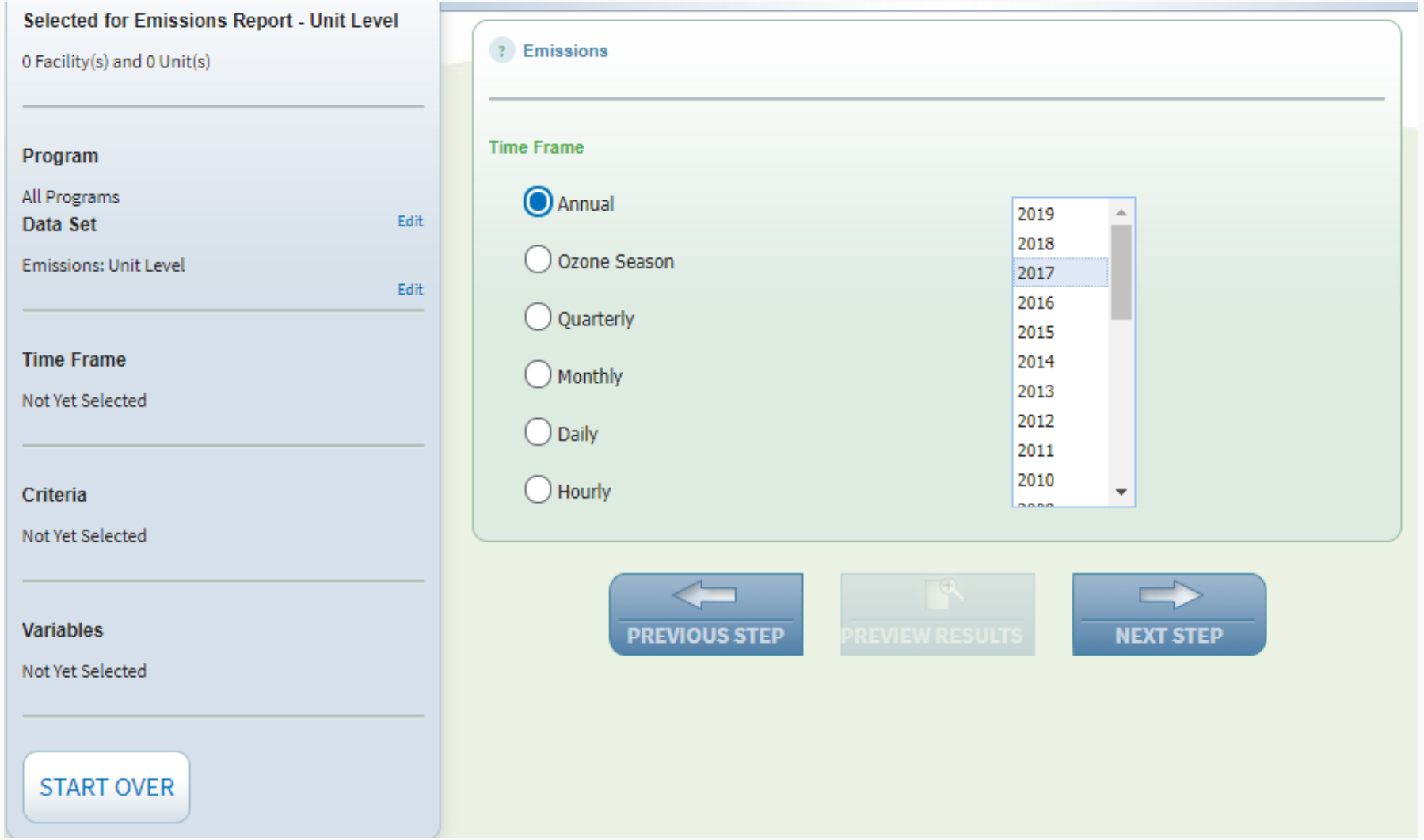

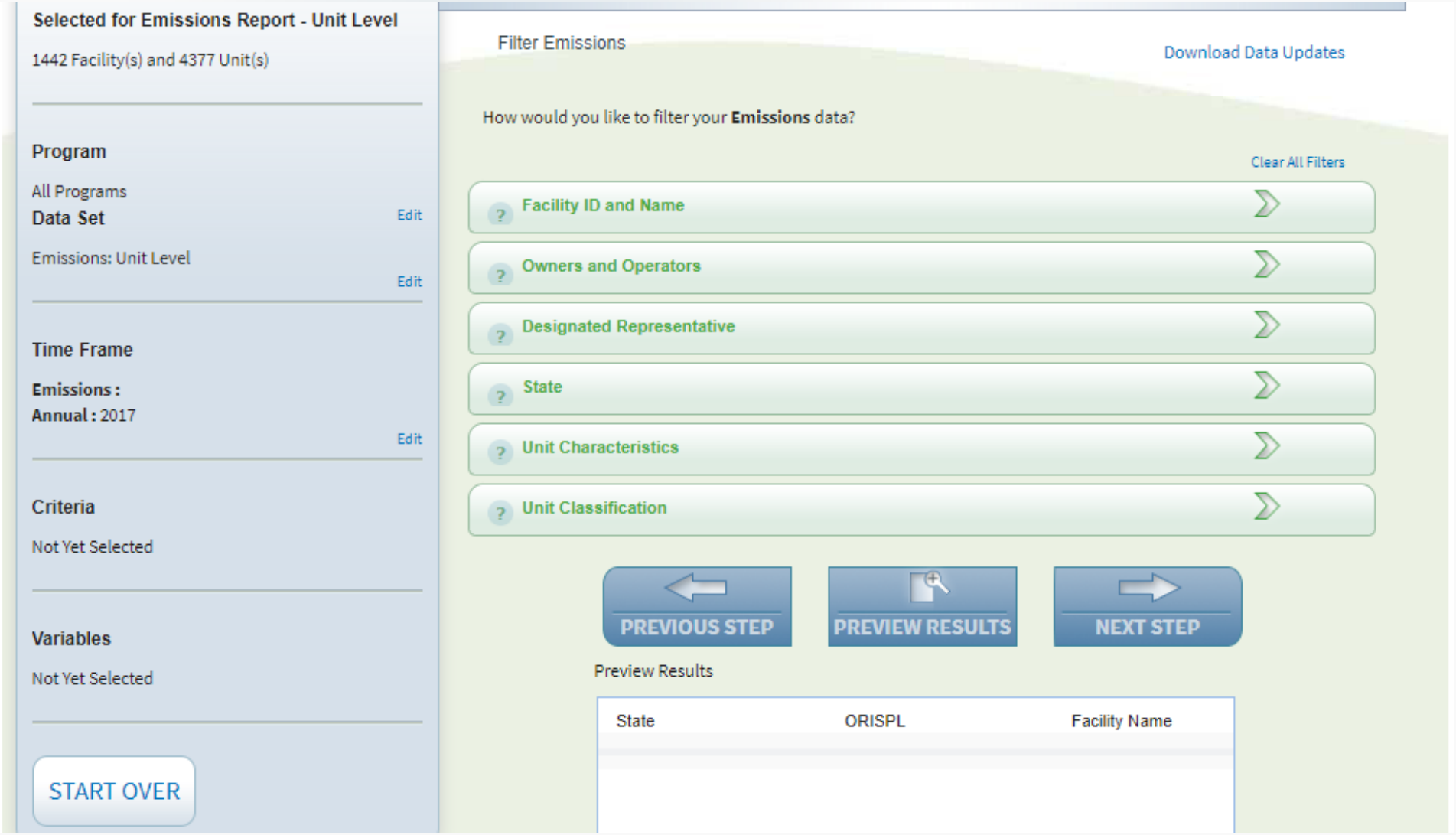

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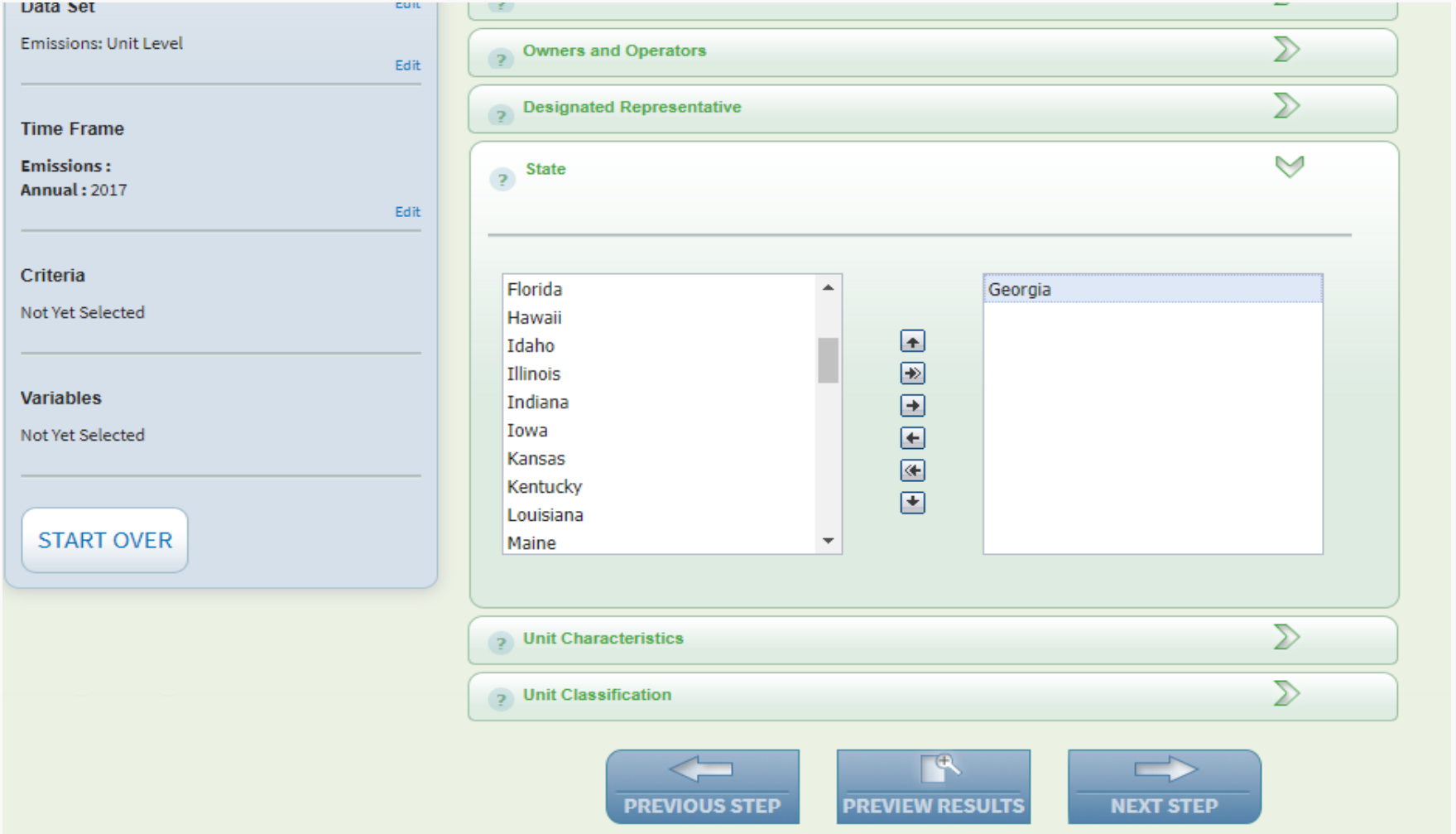
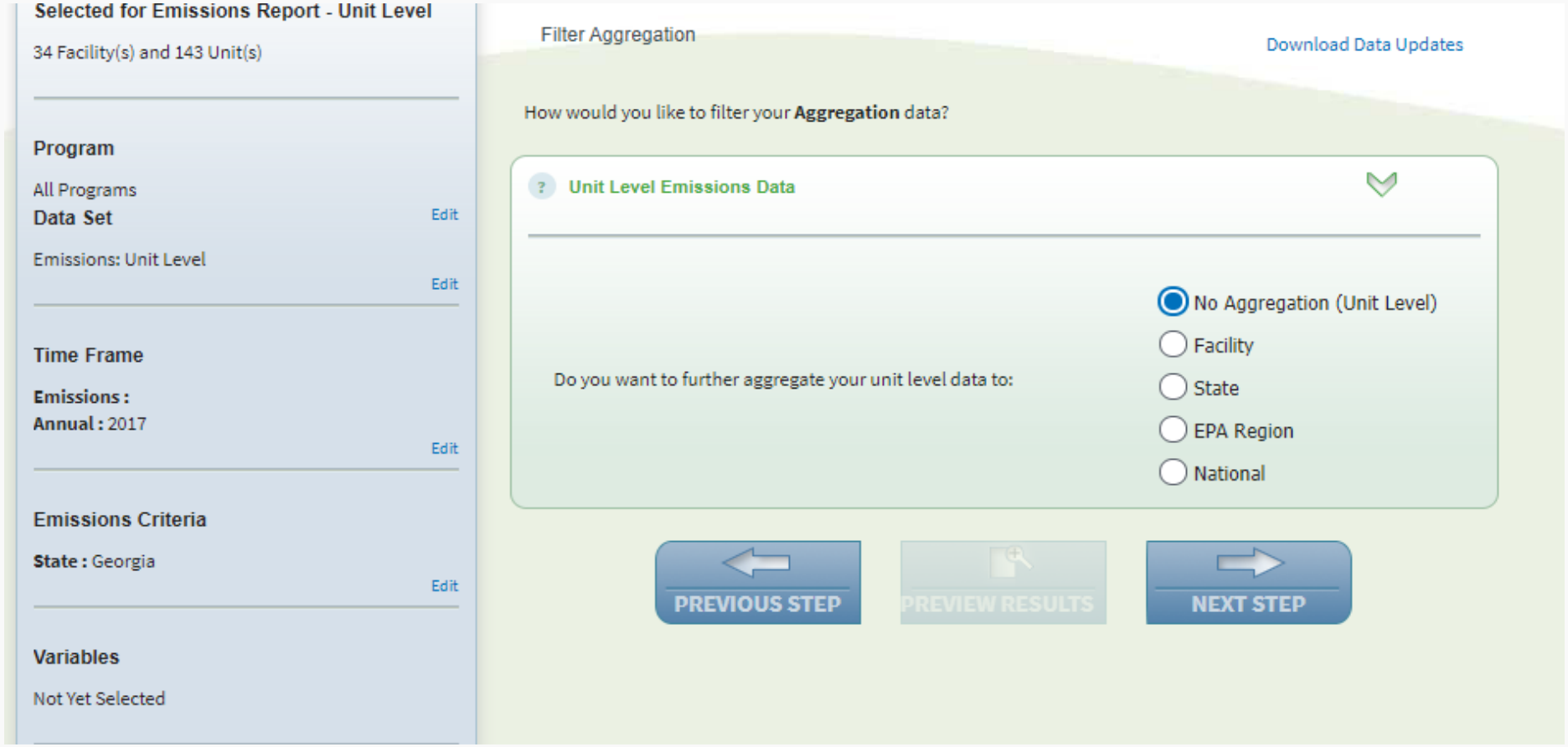
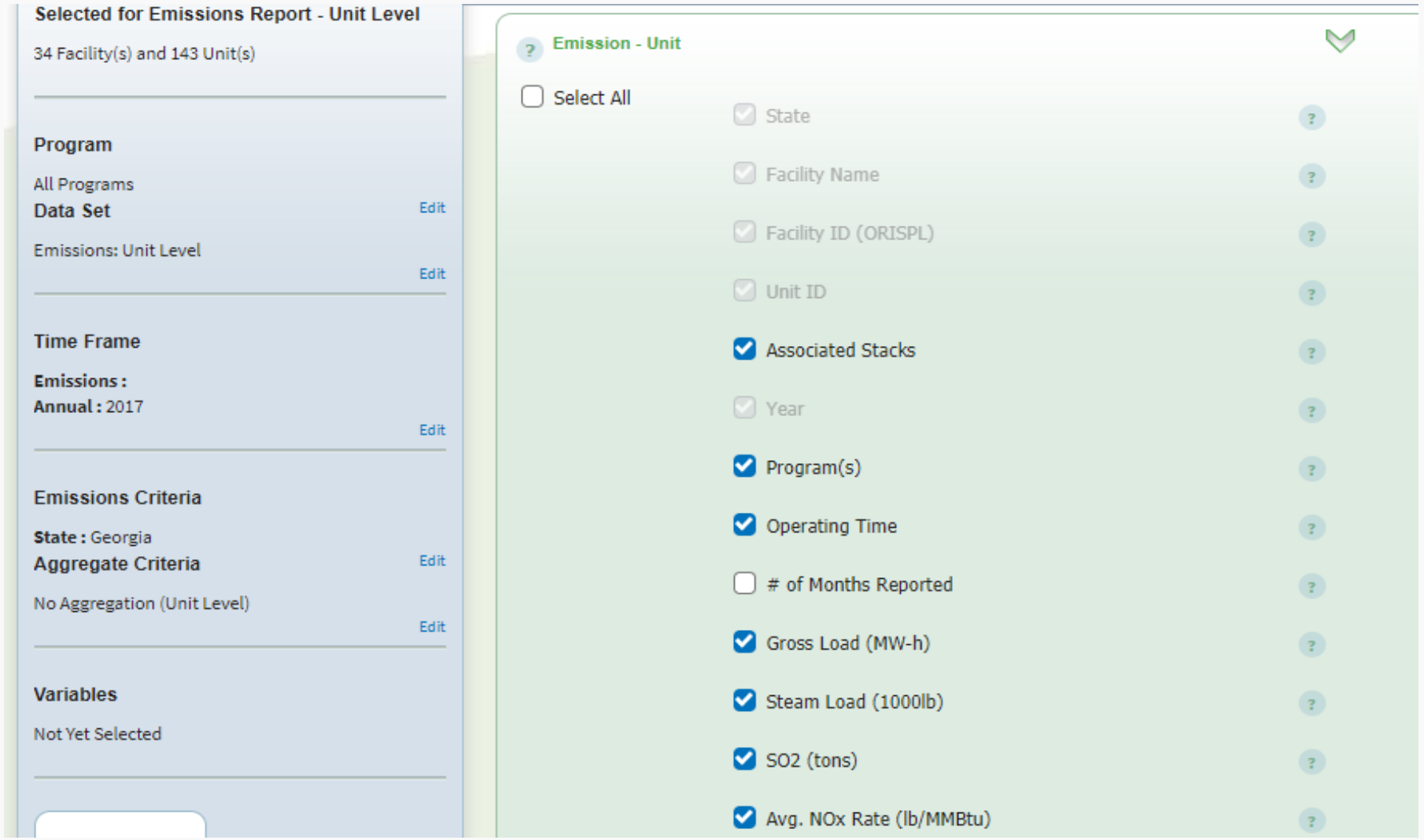


AMPD: Query Example





AMPD: Query Example

The file(s) you requested returns 143 records.

.CSV .TXT Download Selected Learn about zip files Download Data Definitions Bookmark query

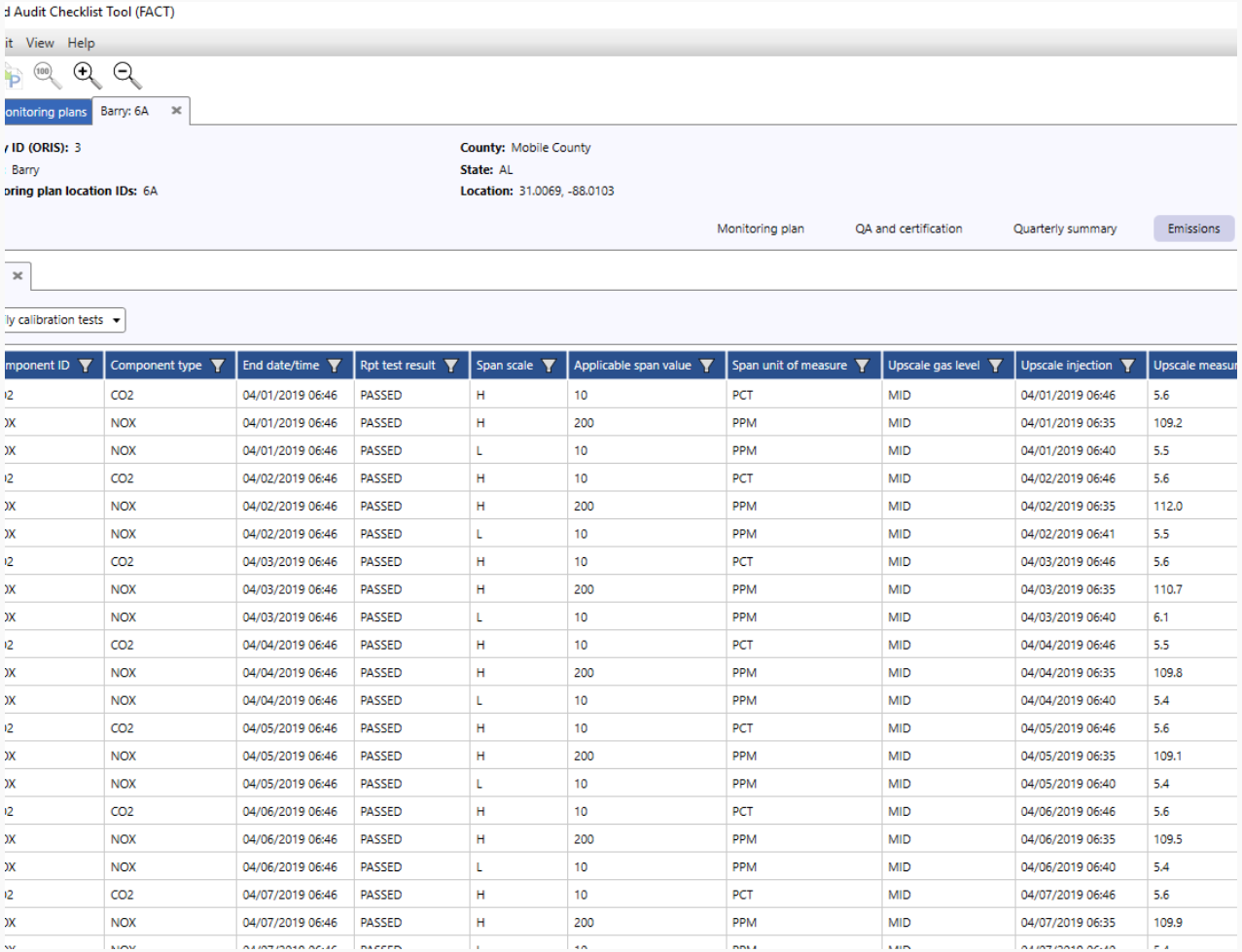
Excel automatically formats certain variable types in .CSV format which will result in the removal of leading zeros from unit IDs and account numbers, and other undesired format changes. Choose ".txt format" if you wish to retain the original variables. You will need to manually import the .txt format file into MS Excel and specify the column types to prevent any change in variable format.

Emissions - Unit Level Data | Data Caveats

Download

State	Facility Name	Facility ID (O...	Uni...	Associated Stacks	Year	Program(s)	Operating
GA	AL Sandersville Energy Facility	55672	CT1		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT2		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT3		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT4		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT5		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT6		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT7		2017	ARP, CSNOX, CSOSG1, ...	
GA	AL Sandersville Energy Facility	55672	CT8		2017	ARP, CSNOX, CSOSG1, ...	
GA	Albany Green Energy LLC	60340	B0004		2017	ARP, CSNOX, CSOSG1, ...	
GA	Allen B Wilson Combustion ...	6258	1A		2017	CSNOX, CSOSG1, CSSO...	
GA	Allen B Wilson Combustion ...	6258	1B		2017	CSNOX, CSOSG1, CSSO...	

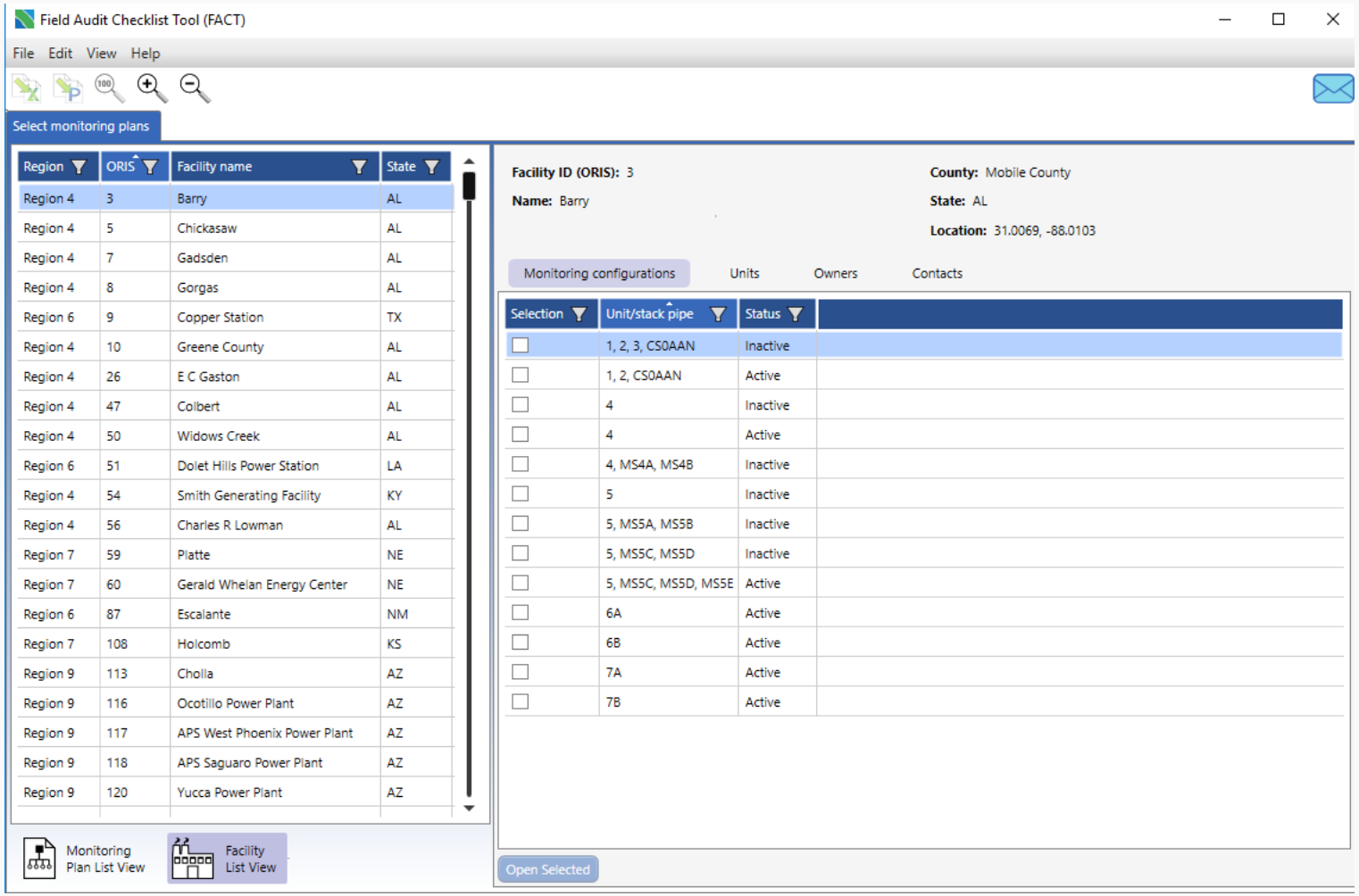
FACT



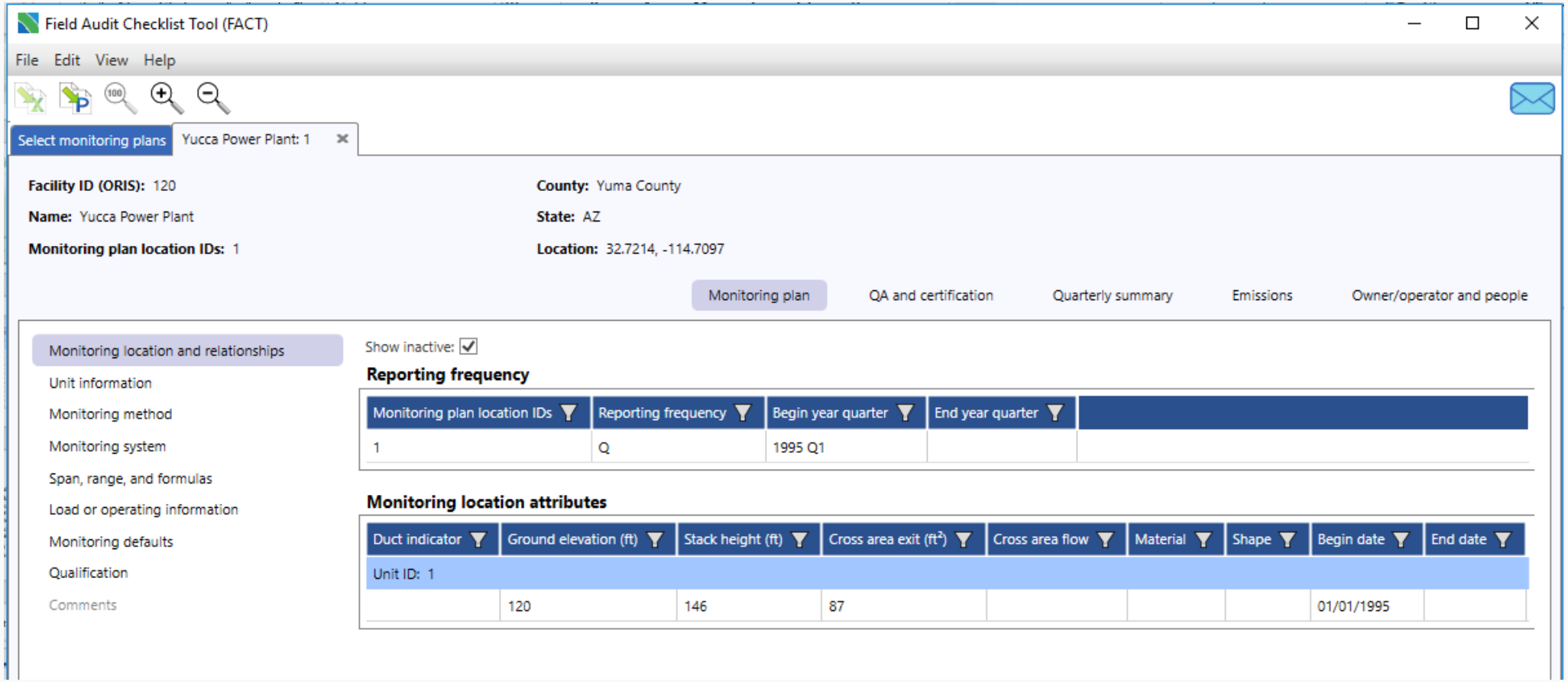
mponent ID	Component type	End date/time	Rpt test result	Span scale	Applicable span value	Span unit of measure	Upscale gas level	Upscale injection	Upscale measur
2	CO2	04/01/2019 06:46	PASSED	H	10	PCT	MID	04/01/2019 06:46	5.6
X	NOX	04/01/2019 06:46	PASSED	H	200	PPM	MID	04/01/2019 06:35	109.2
X	NOX	04/01/2019 06:46	PASSED	L	10	PPM	MID	04/01/2019 06:40	5.5
2	CO2	04/02/2019 06:46	PASSED	H	10	PCT	MID	04/02/2019 06:46	5.6
X	NOX	04/02/2019 06:46	PASSED	H	200	PPM	MID	04/02/2019 06:35	112.0
X	NOX	04/02/2019 06:46	PASSED	L	10	PPM	MID	04/02/2019 06:41	5.5
2	CO2	04/03/2019 06:46	PASSED	H	10	PCT	MID	04/03/2019 06:46	5.6
X	NOX	04/03/2019 06:46	PASSED	H	200	PPM	MID	04/03/2019 06:35	110.7
X	NOX	04/03/2019 06:46	PASSED	L	10	PPM	MID	04/03/2019 06:40	6.1
2	CO2	04/04/2019 06:46	PASSED	H	10	PCT	MID	04/04/2019 06:46	5.5
X	NOX	04/04/2019 06:46	PASSED	H	200	PPM	MID	04/04/2019 06:35	109.8
X	NOX	04/04/2019 06:46	PASSED	L	10	PPM	MID	04/04/2019 06:40	5.4
2	CO2	04/05/2019 06:46	PASSED	H	10	PCT	MID	04/05/2019 06:46	5.6
X	NOX	04/05/2019 06:46	PASSED	H	200	PPM	MID	04/05/2019 06:35	109.1
X	NOX	04/05/2019 06:46	PASSED	L	10	PPM	MID	04/05/2019 06:40	5.4
2	CO2	04/06/2019 06:46	PASSED	H	10	PCT	MID	04/06/2019 06:46	5.6
X	NOX	04/06/2019 06:46	PASSED	H	200	PPM	MID	04/06/2019 06:35	109.5
X	NOX	04/06/2019 06:46	PASSED	L	10	PPM	MID	04/06/2019 06:40	5.4
2	CO2	04/07/2019 06:46	PASSED	H	10	PCT	MID	04/07/2019 06:46	5.6
X	NOX	04/07/2019 06:46	PASSED	H	200	PPM	MID	04/07/2019 06:35	109.9

- Windows desktop application
- All data: emissions data, operation data, facility information, monitoring plans, QA test data
- Good when looking at a single monitoring configuration
- Only goes back to 2009
- Associated REST API

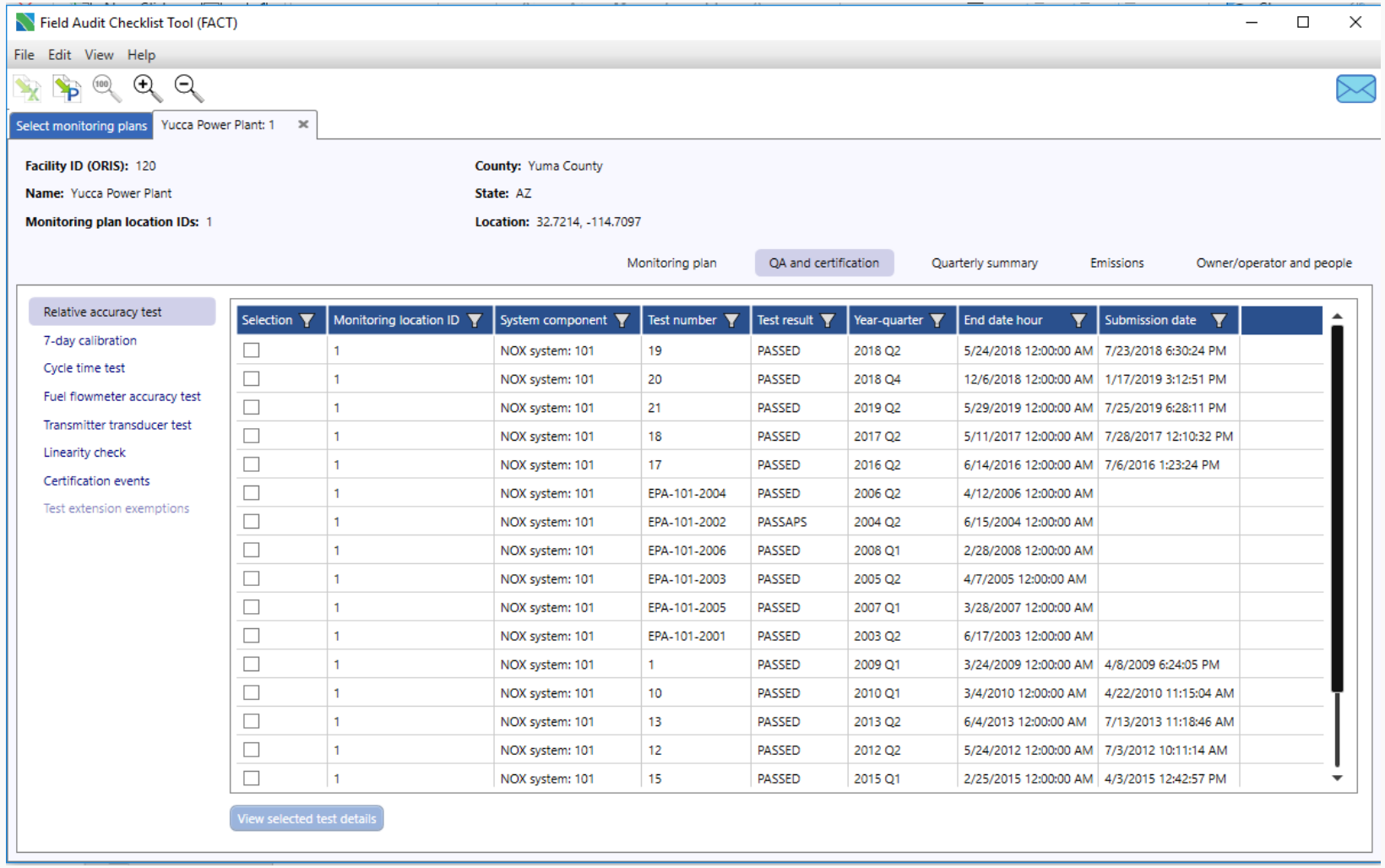
FACT: Example – Facilities List



FACT: Example – Monitoring Plan

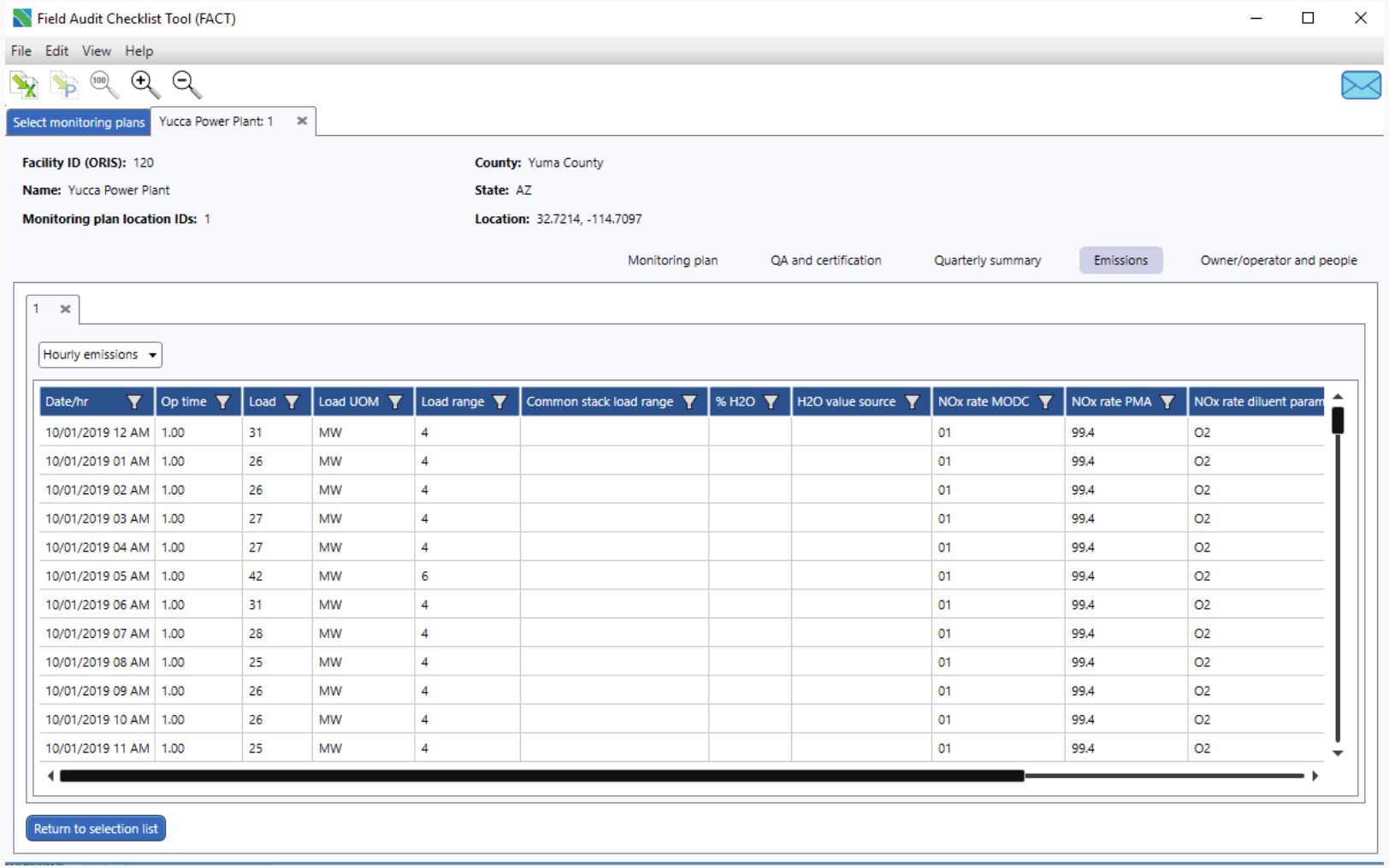


FACT: Example – QA and Certification



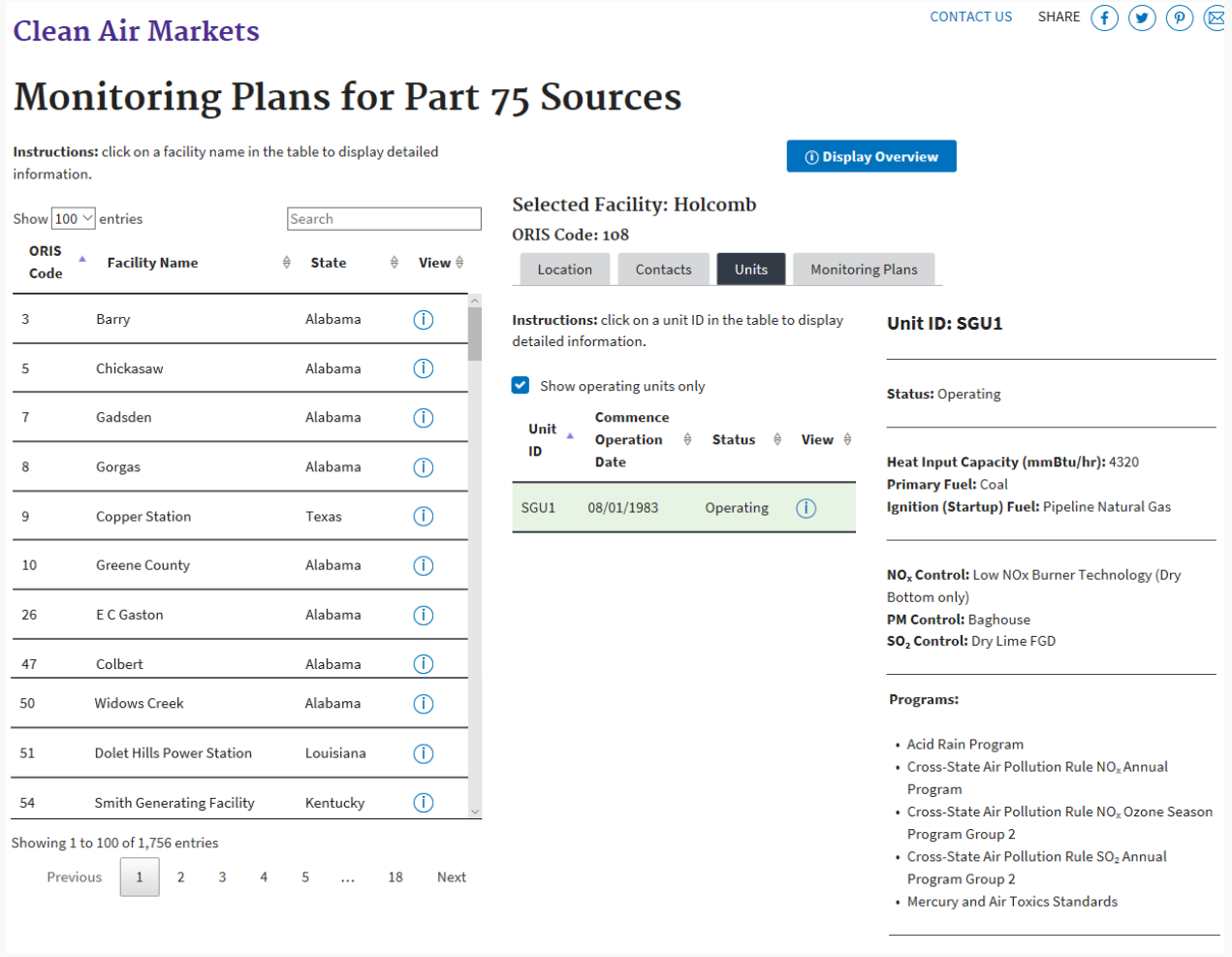
Selection	Monitoring location ID	System component	Test number	Test result	Year-quarter	End date hour	Submission date
☐	1	NOX system: 101	19	PASSED	2018 Q2	5/24/2018 12:00:00 AM	7/23/2018 6:30:24 PM
☐	1	NOX system: 101	20	PASSED	2018 Q4	12/6/2018 12:00:00 AM	1/17/2019 3:12:51 PM
☐	1	NOX system: 101	21	PASSED	2019 Q2	5/29/2019 12:00:00 AM	7/25/2019 6:28:11 PM
☐	1	NOX system: 101	18	PASSED	2017 Q2	5/11/2017 12:00:00 AM	7/28/2017 12:10:32 PM
☐	1	NOX system: 101	17	PASSED	2016 Q2	6/14/2016 12:00:00 AM	7/6/2016 1:23:24 PM
☐	1	NOX system: 101	EPA-101-2004	PASSED	2006 Q2	4/12/2006 12:00:00 AM	
☐	1	NOX system: 101	EPA-101-2002	PASSAPS	2004 Q2	6/15/2004 12:00:00 AM	
☐	1	NOX system: 101	EPA-101-2006	PASSED	2008 Q1	2/28/2008 12:00:00 AM	
☐	1	NOX system: 101	EPA-101-2003	PASSED	2005 Q2	4/7/2005 12:00:00 AM	
☐	1	NOX system: 101	EPA-101-2005	PASSED	2007 Q1	3/28/2007 12:00:00 AM	
☐	1	NOX system: 101	EPA-101-2001	PASSED	2003 Q2	6/17/2003 12:00:00 AM	
☐	1	NOX system: 101	1	PASSED	2009 Q1	3/24/2009 12:00:00 AM	4/8/2009 6:24:05 PM
☐	1	NOX system: 101	10	PASSED	2010 Q1	3/4/2010 12:00:00 AM	4/22/2010 11:15:04 AM
☐	1	NOX system: 101	13	PASSED	2013 Q2	6/4/2013 12:00:00 AM	7/13/2013 11:18:46 AM
☐	1	NOX system: 101	12	PASSED	2012 Q2	5/24/2012 12:00:00 AM	7/3/2012 10:11:14 AM
☐	1	NOX system: 101	15	PASSED	2015 Q1	2/25/2015 12:00:00 AM	4/3/2015 12:42:57 PM

FACT: Example – Emissions



Date/hr	Op time	Load	Load UOM	Load range	Common stack load range	% H2O	H2O value source	NOx rate MODC	NOx rate PMA	NOx rate diluent param
10/01/2019 12 AM	1.00	31	MW	4				01	99.4	O2
10/01/2019 01 AM	1.00	26	MW	4				01	99.4	O2
10/01/2019 02 AM	1.00	26	MW	4				01	99.4	O2
10/01/2019 03 AM	1.00	27	MW	4				01	99.4	O2
10/01/2019 04 AM	1.00	27	MW	4				01	99.4	O2
10/01/2019 05 AM	1.00	42	MW	6				01	99.4	O2
10/01/2019 06 AM	1.00	31	MW	4				01	99.4	O2
10/01/2019 07 AM	1.00	28	MW	4				01	99.4	O2
10/01/2019 08 AM	1.00	25	MW	4				01	99.4	O2
10/01/2019 09 AM	1.00	26	MW	4				01	99.4	O2
10/01/2019 10 AM	1.00	26	MW	4				01	99.4	O2
10/01/2019 11 AM	1.00	25	MW	4				01	99.4	O2

Monitoring Plan Viewer



- View monitoring plans and unit information (e.g., pollution controls)
- Intended for users to view the data in an easy-to-read format; not a download tool

Monitoring Plan Viewer: Example

Monitoring location attributes

Top of page

Duct indicator	Ground elevation (ft)	Stack height (ft)	Cross area exit (ft^2)	Cross area flow	Material	Shape	Begin date	End date
Unit ID: 4								
No	22	600	147	254	Brick	Oval or Circular	01/01/1995	

Stack/pipes and unit relationships

Top of page

Associated unit	Bypass stack indicator	Activation date	Retirement date	Begin date	End date
No data available in table					

Unit operations

Top of page

Commence operation date	Commercial operation date	Boiler/turbine type	Boiler/turbine begin date	Boiler/turbine end date	Max heat input (mmBtu)	Heat input begin date	Heat input end date
Unit ID: 4							
05/28/1969	12/31/1969	Tangentially-fired	05/28/1969		6372	10/31/2002	

Unit programs

Top of page

Program	Unit class	Certification begin date	Certification deadline
Unit ID: 4			
Acid Rain Program	Phase 2	01/01/1995	01/01/1995

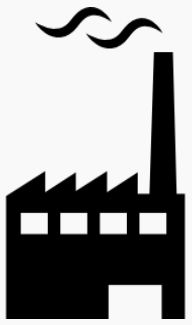
What is eGRID?

eGRID 2018

Emissions & Generation Resource Integrated Database

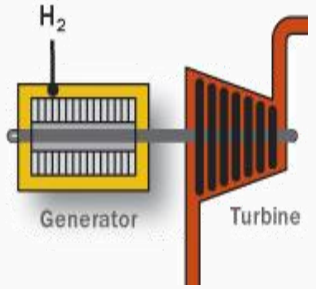
https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

- A comprehensive source of data on the environmental characteristics of the US power sector.
- An Excel spreadsheet which shows generation, emissions, and emission rates for all (almost) US power plants.



Plants
11k

Units
27k



Generators
28k

Data

- Emissions (EPA-CAMD)
  - Nitrogen oxide (NO_x), sulfur dioxide (SO_2), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and mercury (Hg)
- Net generation (EIA-923)
- Fuel use and heat input (EIA-923)
- Plant attributes (EIA-860)
  - Unit and generator type, nameplate capacity, capacity factor, emission controls, latitude and longitude, and NERC regions/balancing authorities
- Emissions rates
  - Input (lb/MMBtu), output (lb/MWh), fuel based, combustion/non-combustion, and nonbaseload
- Grid gross loss factors

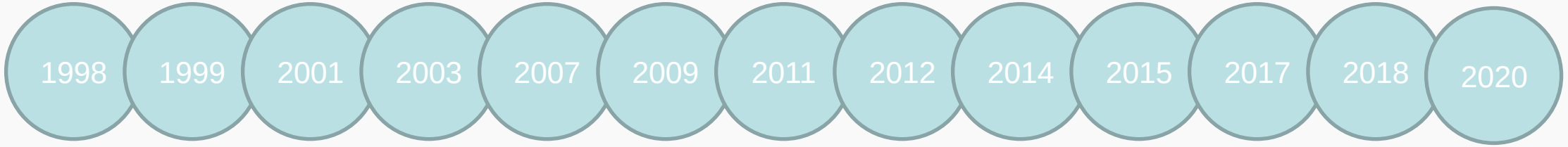
U.S. Energy Information Administration (DOE)

Fills data gaps through established methodologies

History

- First released in 1998 (1996 data)
- Current edition – eGRID2018 released in Jan 2020 (13th)
- Even year releases
- Production time
  - EIA data is finalized in September of following year
  - e.g. EIA 2018 data finalized in Sept 2019, eGRID released in January 2020

Released Year

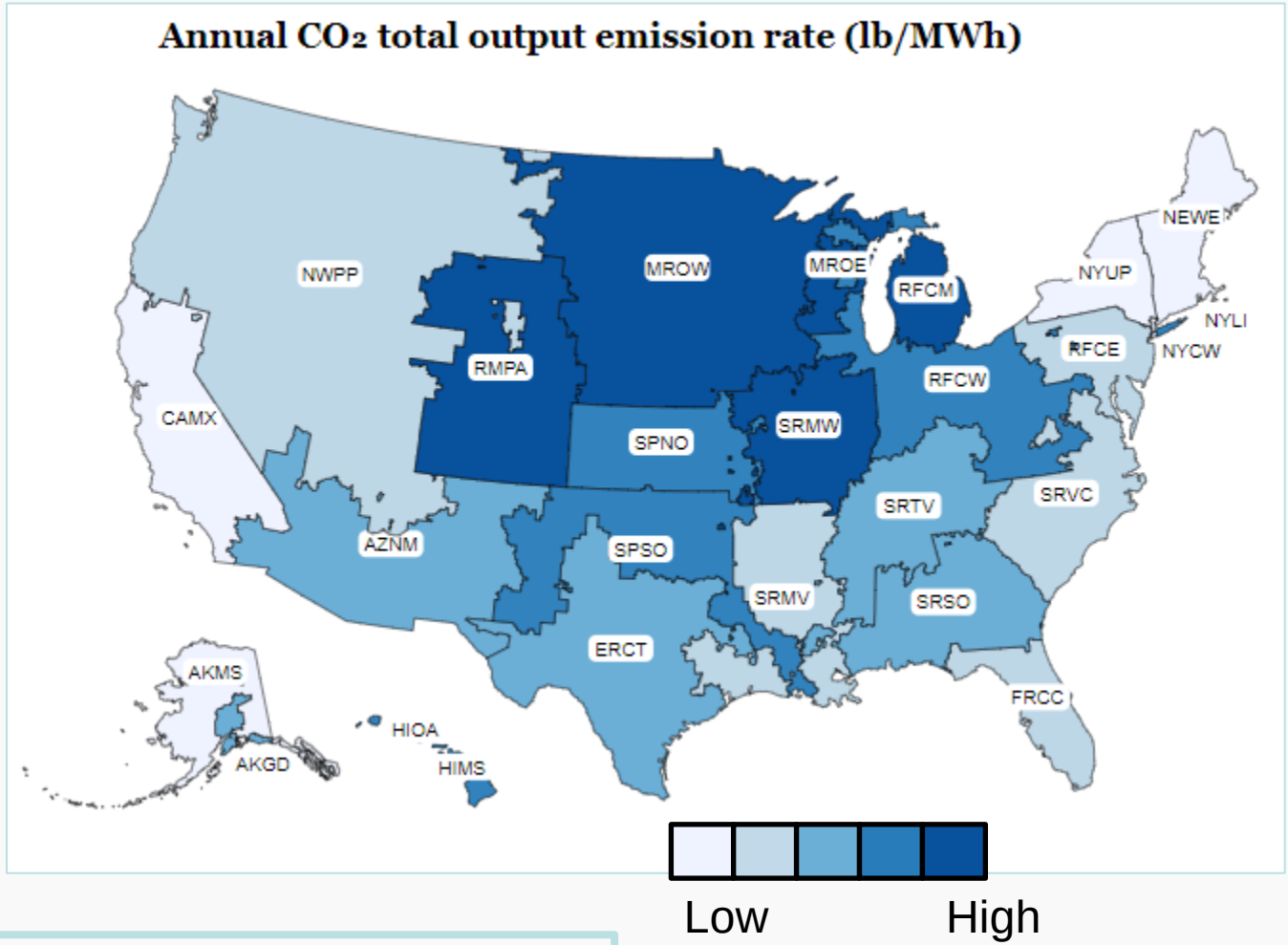


Data Year

1996 1997 1998 2000 2004 2005 2007 2009 2010 2012 2014 2016 2018

Who uses eGRID?

- Corporate GHG reporting (Scope 2)
- Federal, State, and local governments
- Utilities
- ISOs/RTOs
- General Public
- Environmental Groups
- Academia



Mainly used to determine emissions from electricity use.

Power Profiler

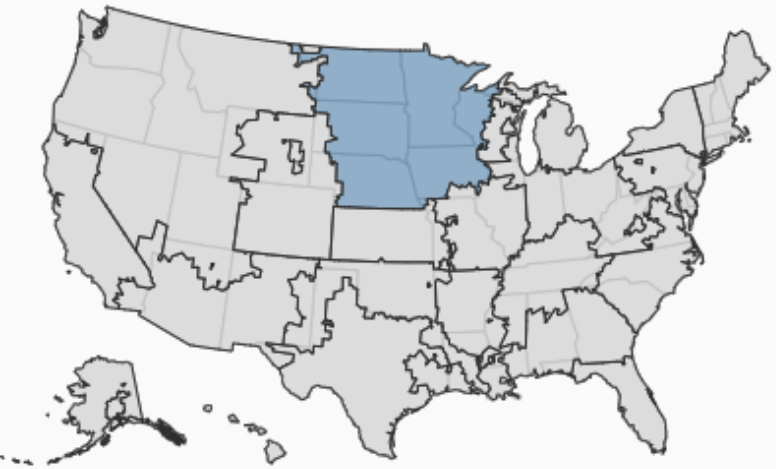
Enter zip code:

Zip code

Go

eGRID Subregions More Info

MROW (MRO West)



« Back to All Subregions

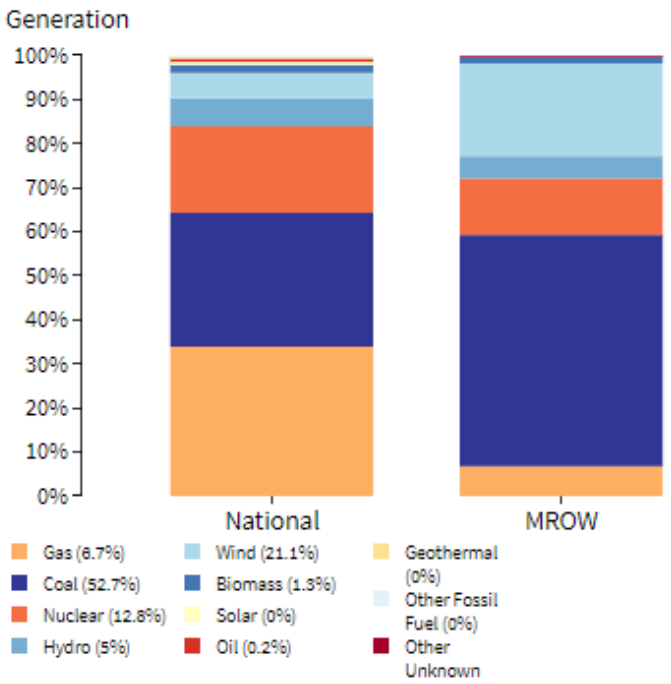
Fuel Mix

This chart compares fuel mix (%) of sources used to generate electricity in the selected eGRID subregion to the national fuel mix (%).

Emission Rates

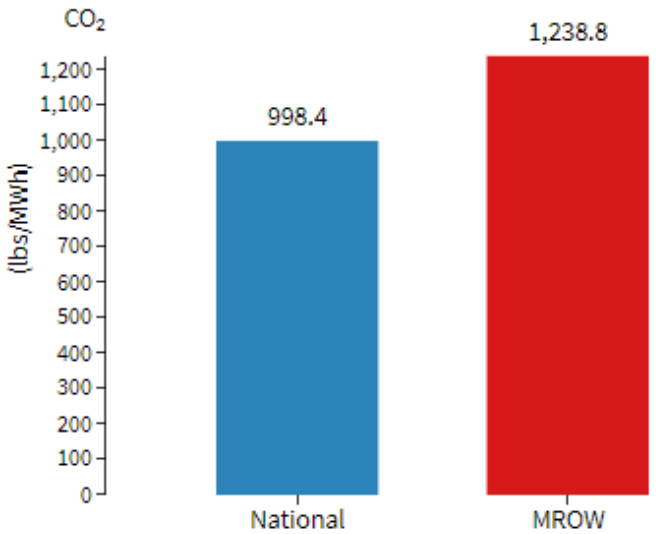
This chart compares the average emission rates (lbs/MWh) in the selected eGRID subregion to the national average emission rates (lbs/MWh) for carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen oxide (NO_X).

https://www.epa.gov/energy/power-profiler#/



Select:

CO_2 | SO_2 | NO_X



eGRID

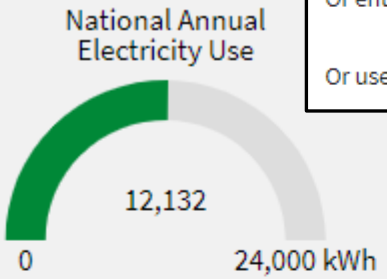
Estimate Your Emissions

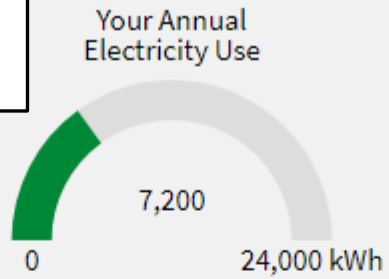
Enter your average monthly electricity use.

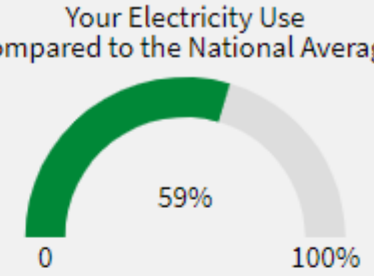
600 kWh **Go**

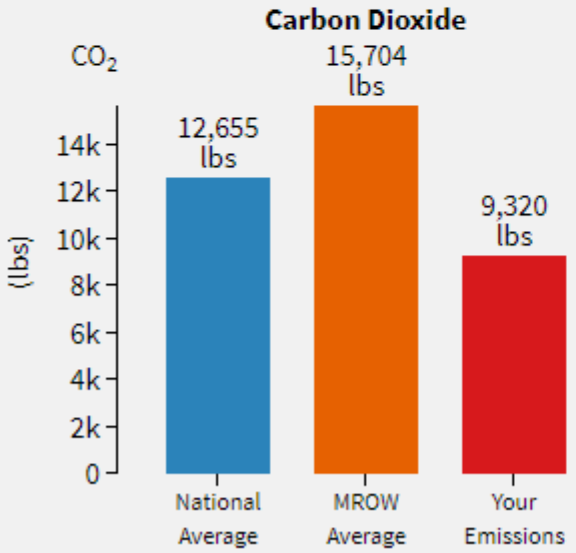
Or enter your actual electricity use for each month.

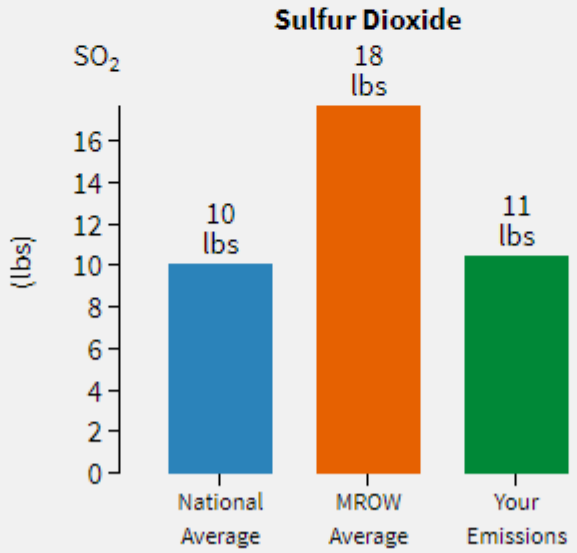
Or use the national average electricity use.

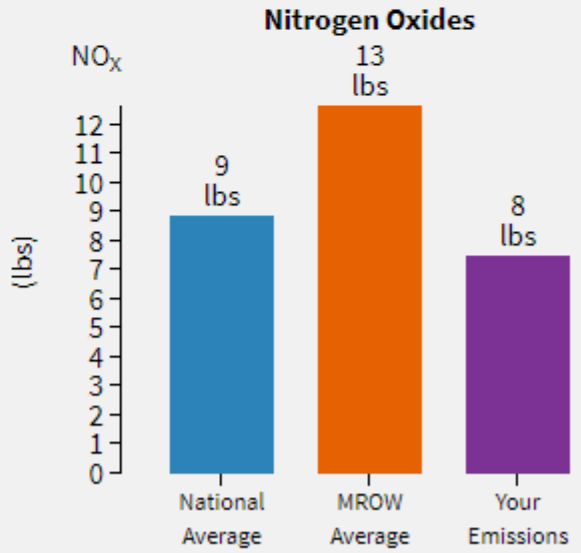










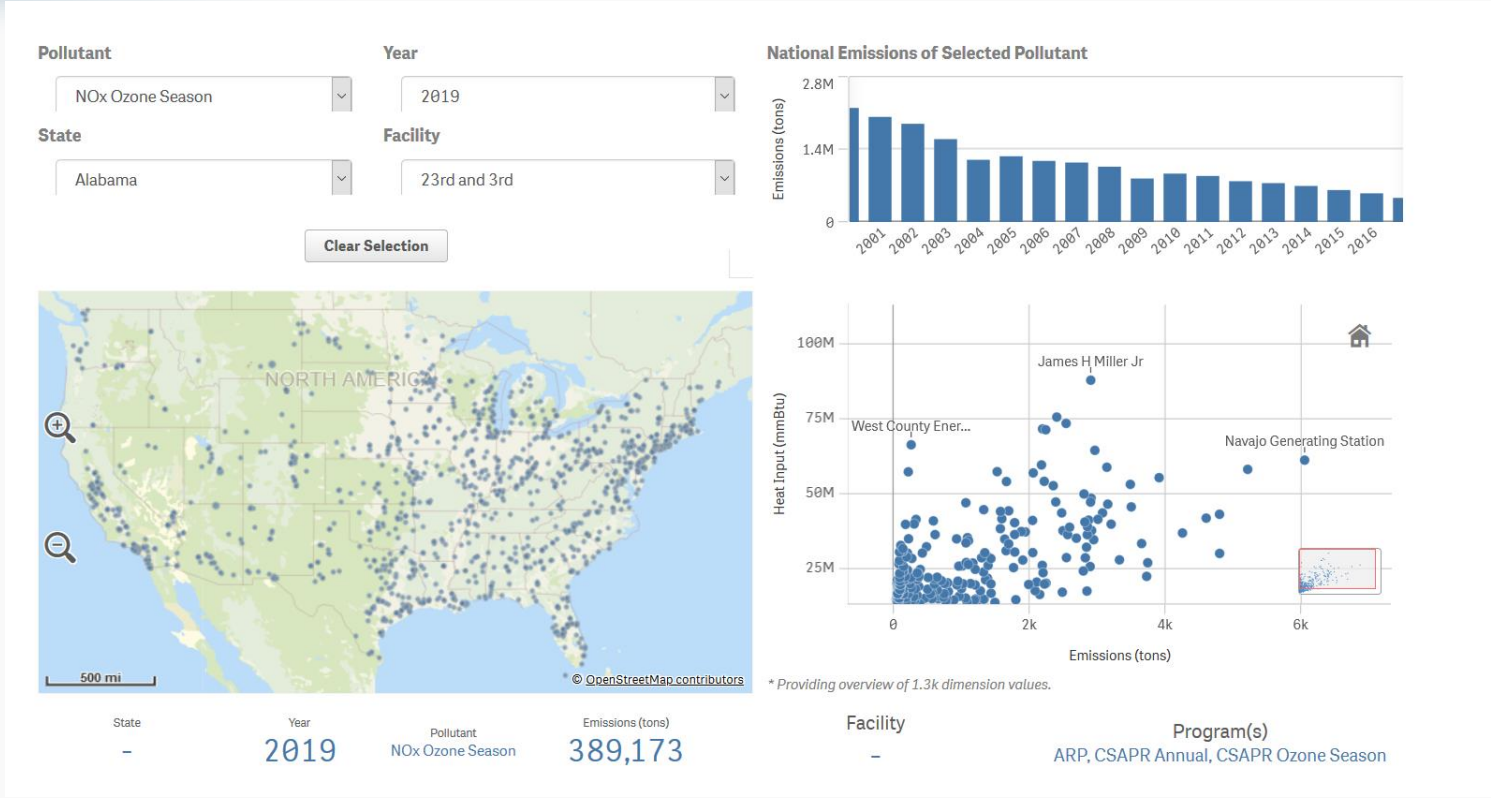


eGRID

Power Plant Data Viewer

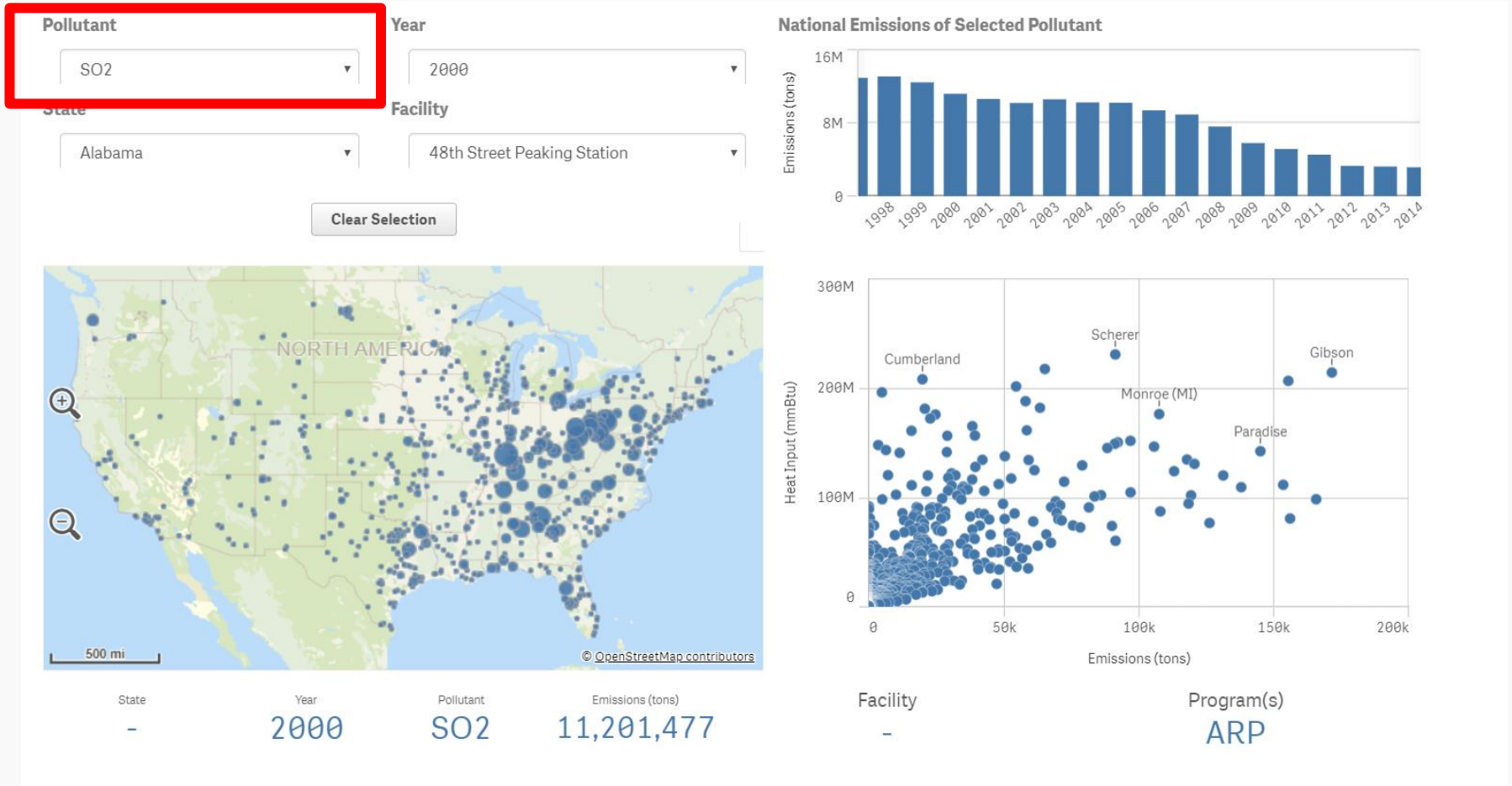
https://www.epa.gov/airmarkets/power-plant-data-viewer

Overview

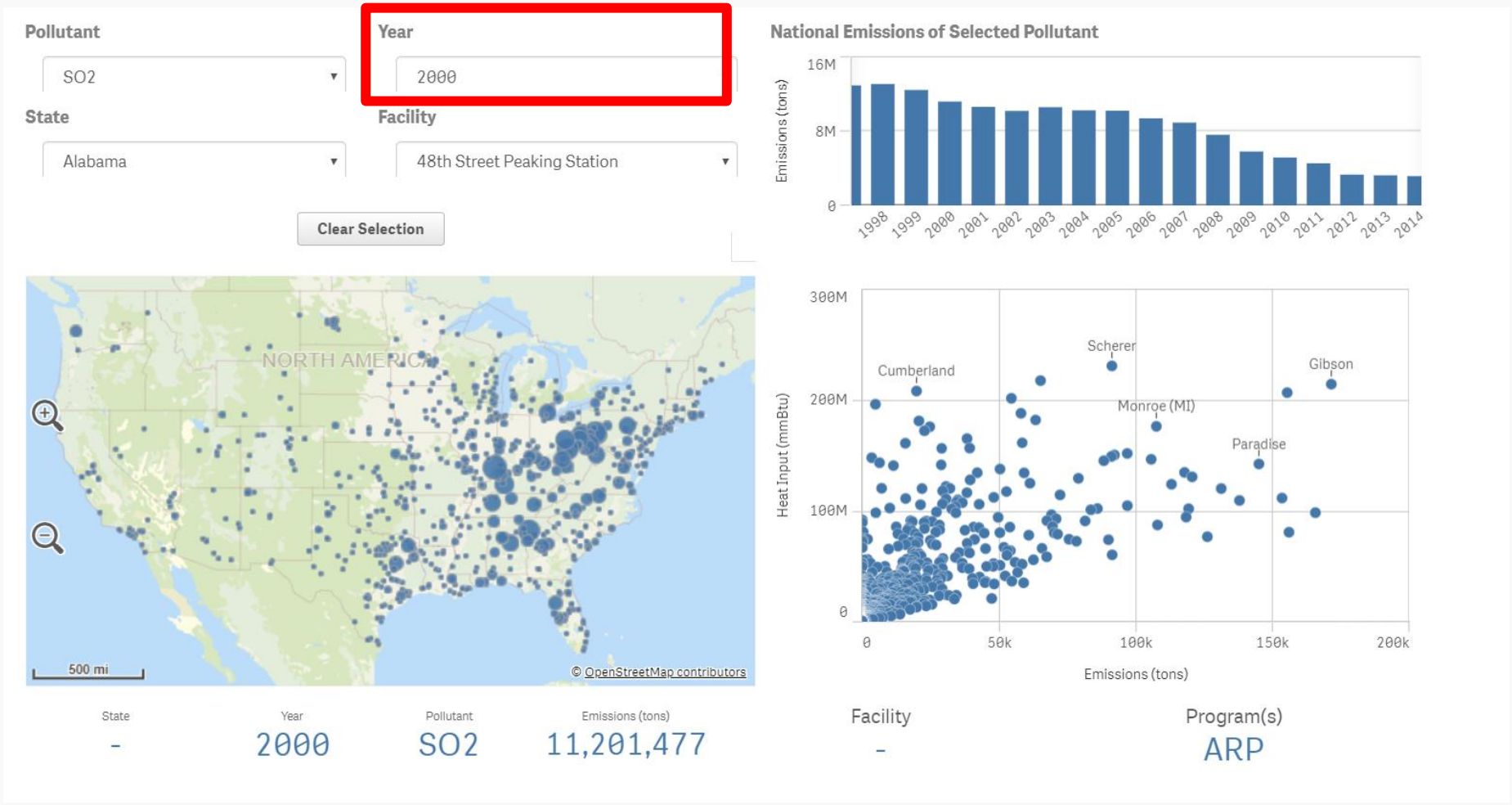


- Use the Power Plant Data Viewer to interactively explore emissions from power plants across the United States
- Click, zoom, and use selection tools to see different data perspectives
- Data are displayed at the facility level. A facility may contain multiple units, and individual units may be covered under different programs.

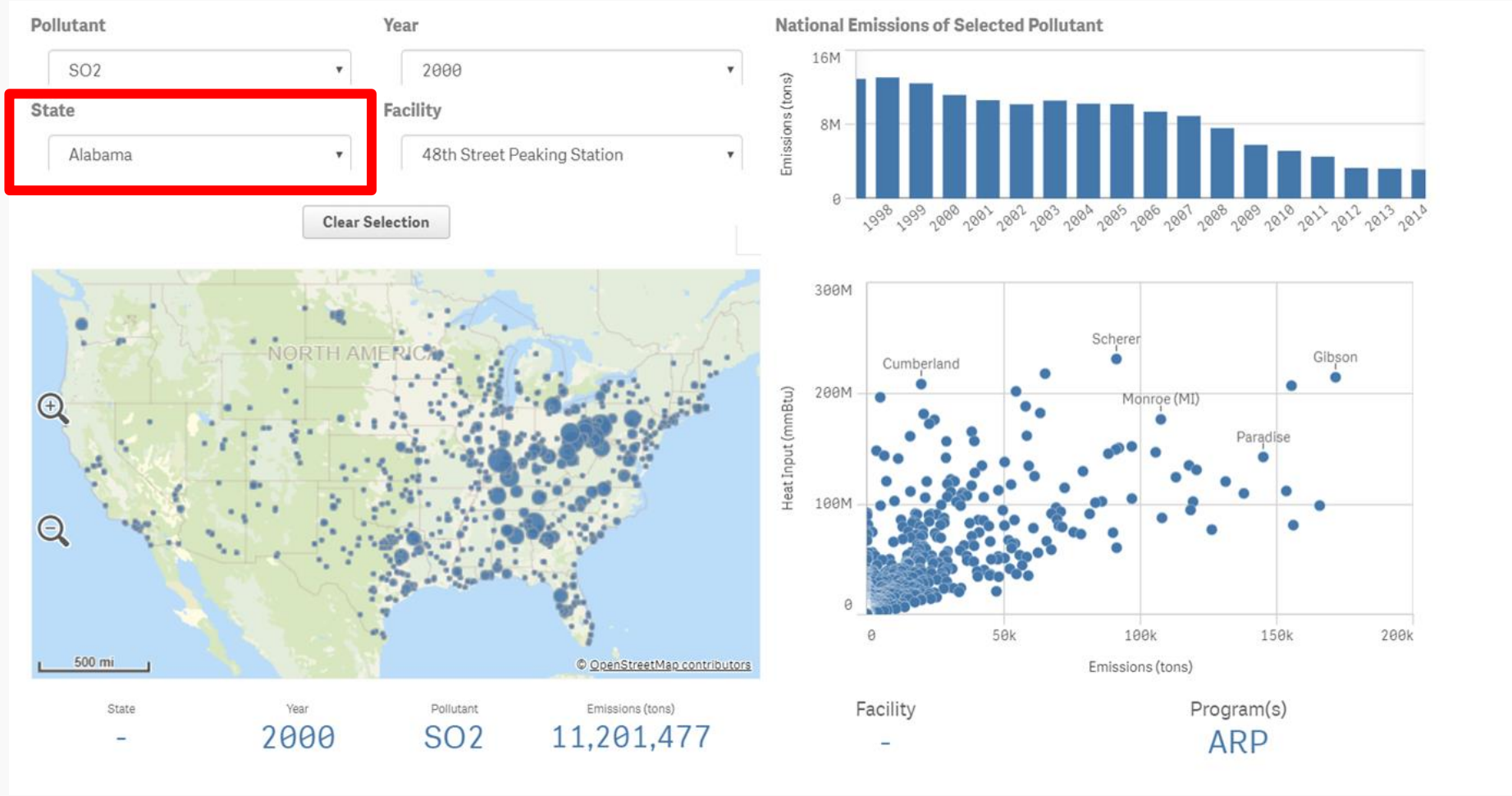
Select a pollutant from the pulldown list. Available choices are SO_2, NO_X, ozone season NO_X, and CO_2. The default choice is SO_2.



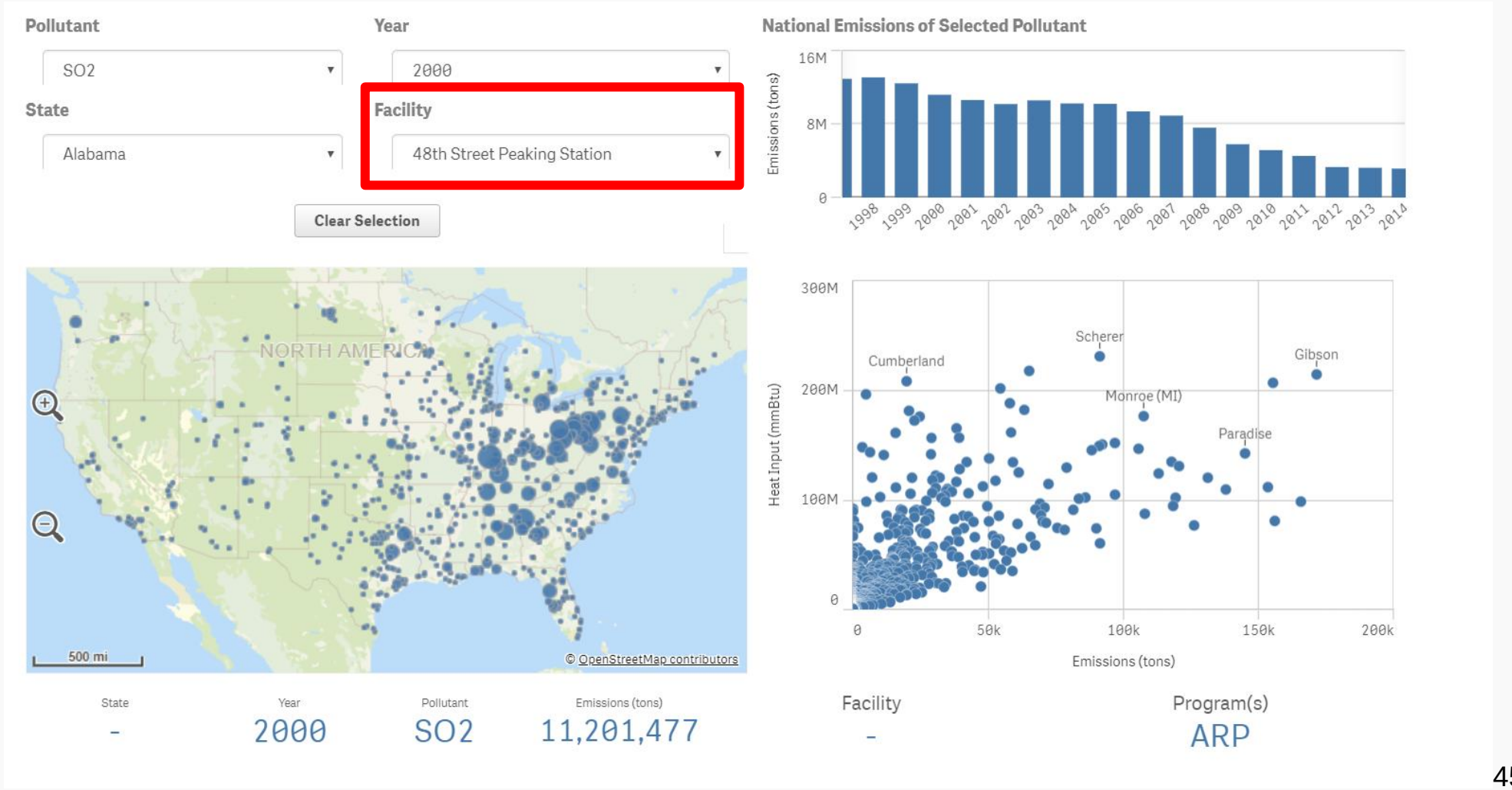
Select a year from the second pulldown list**.** Options include 1990 to 2019. Note that only SO_2 is available for 1990 and ozone season NO_X is not available until 1997. The default choice is 2000.



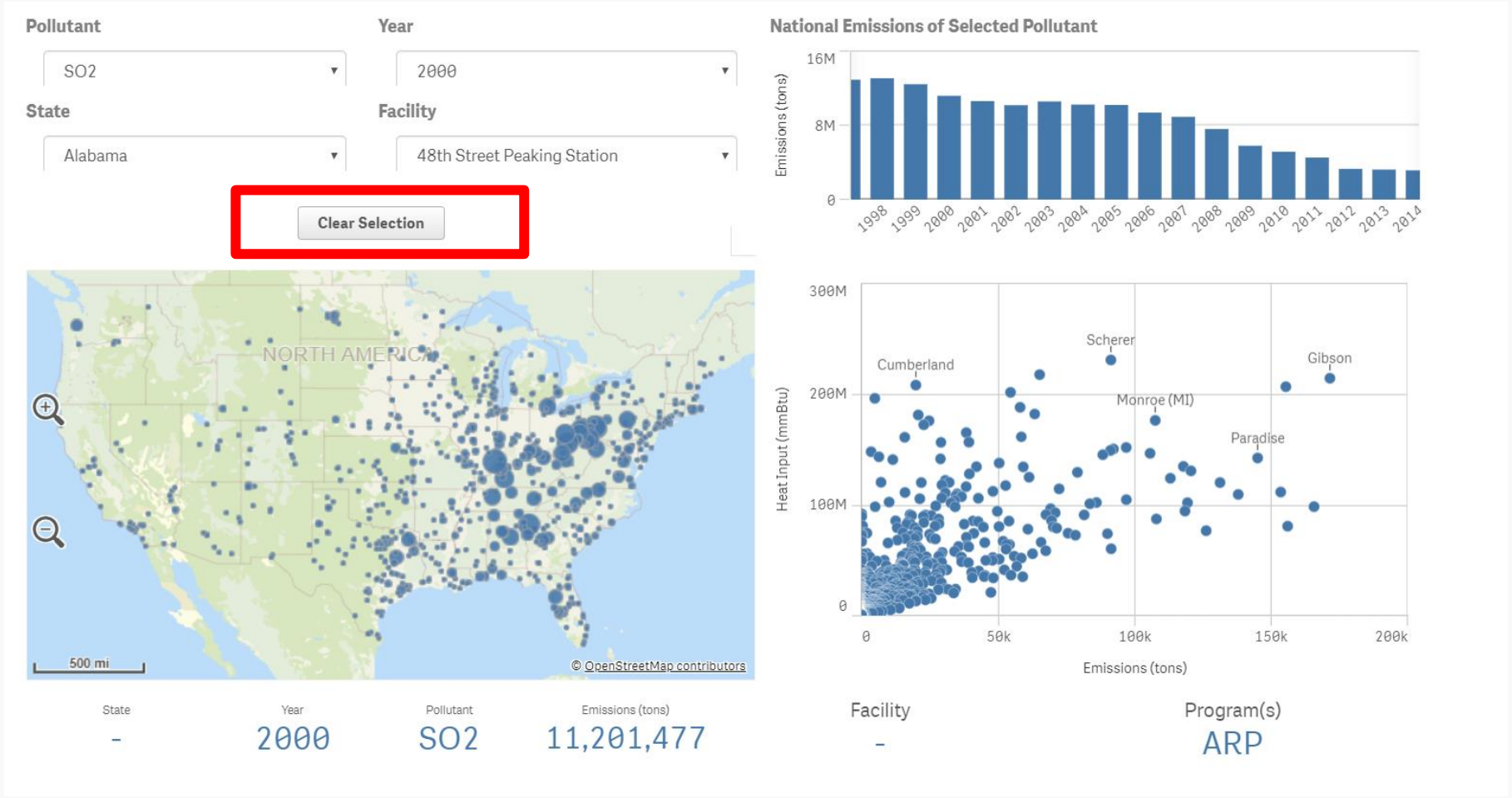
Select a state from the pulldown list. The default is all states.



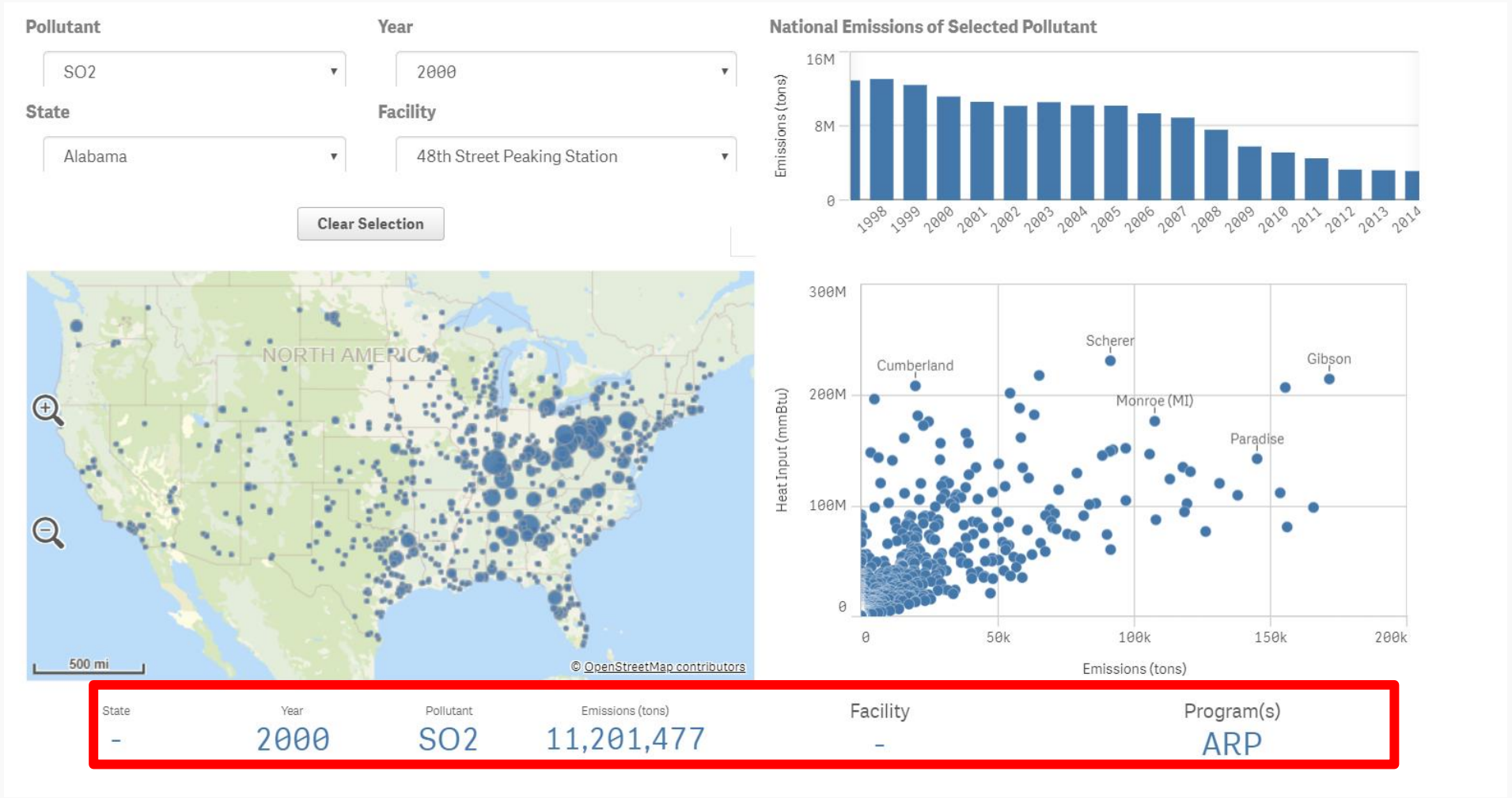
Select a facility from the pulldown list. The default is all facilities.



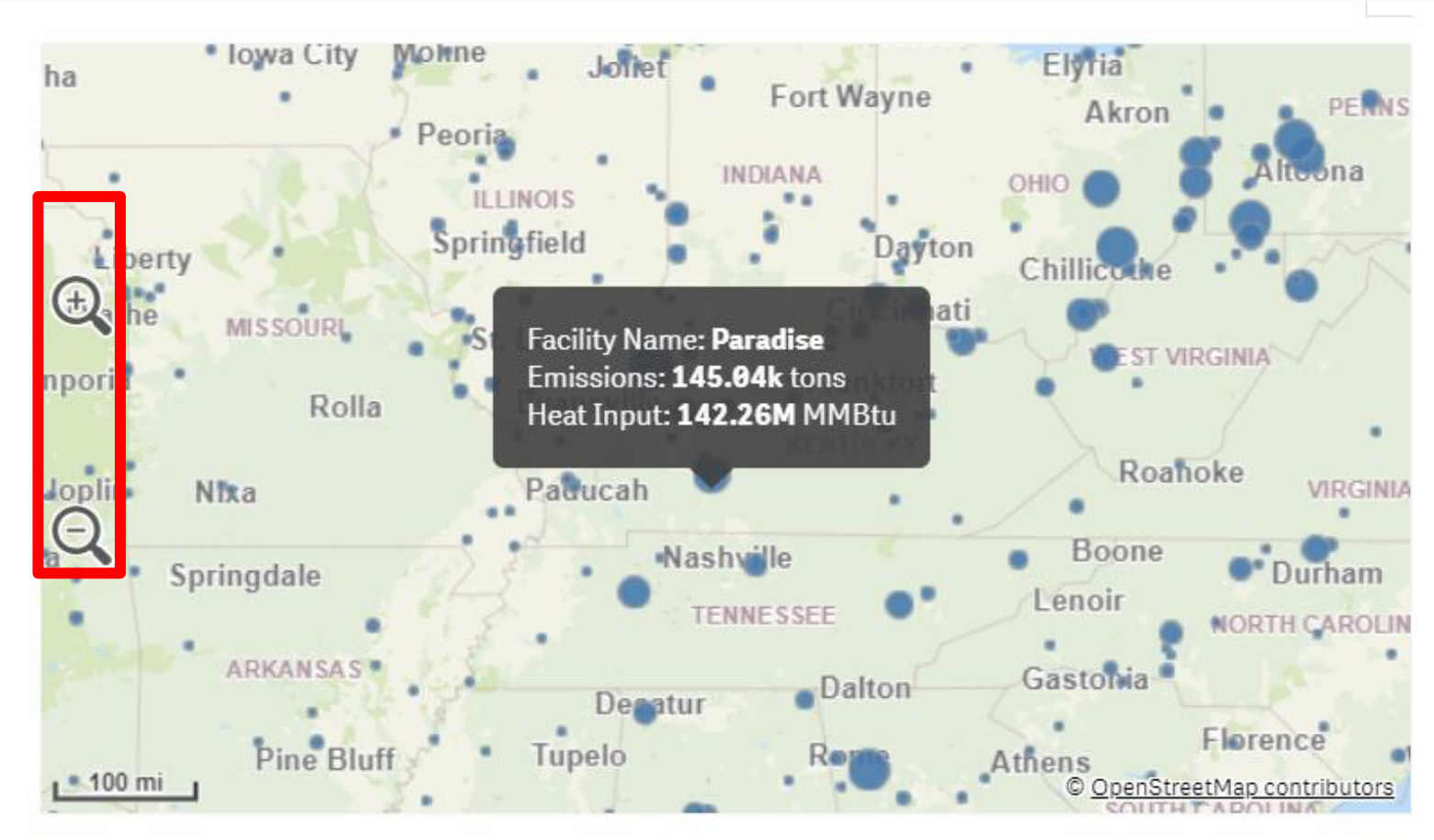
Click the Clear Selection button at any time to reset all selections to their defaults.



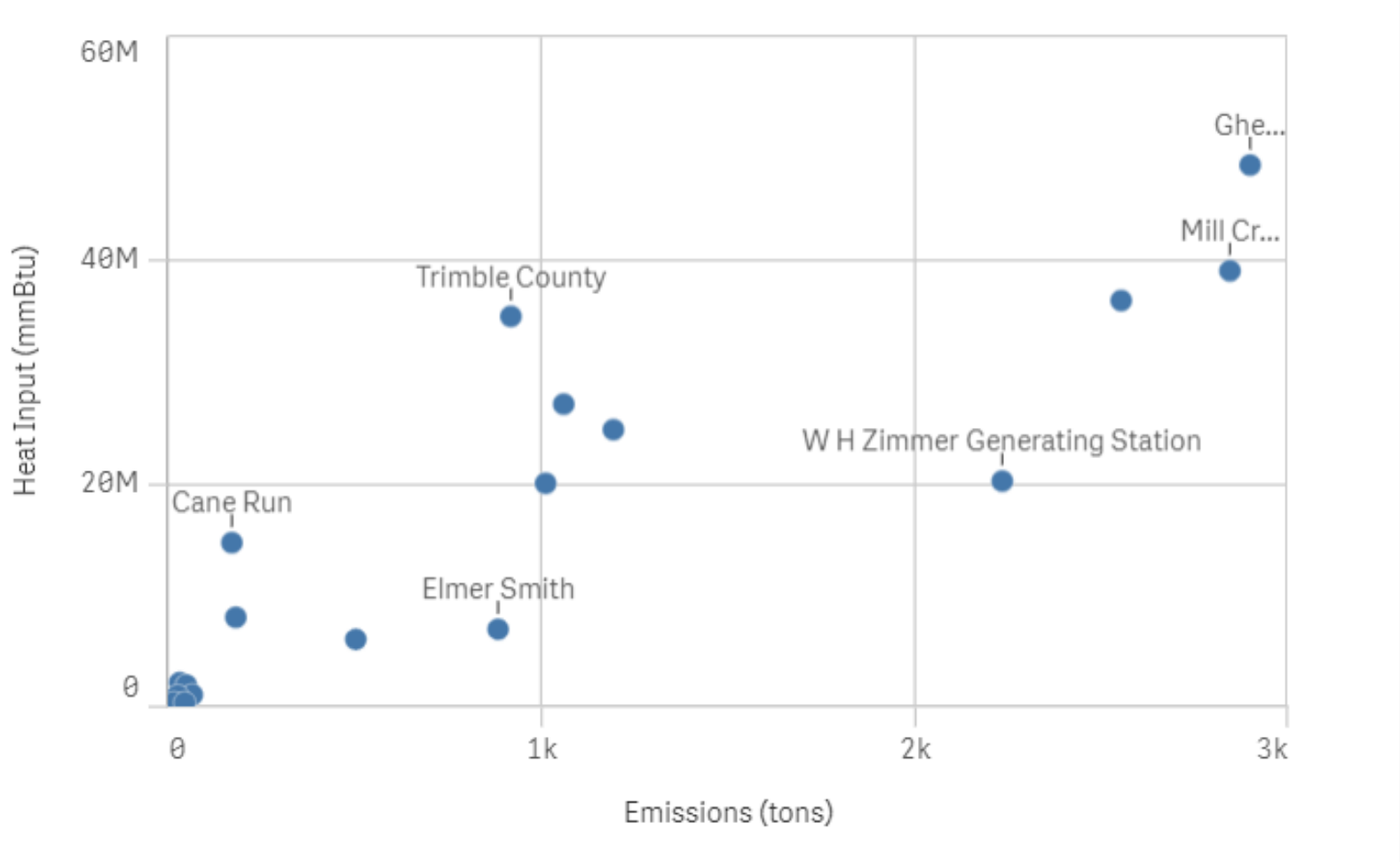
The selection summary is displayed at the bottom of the page.



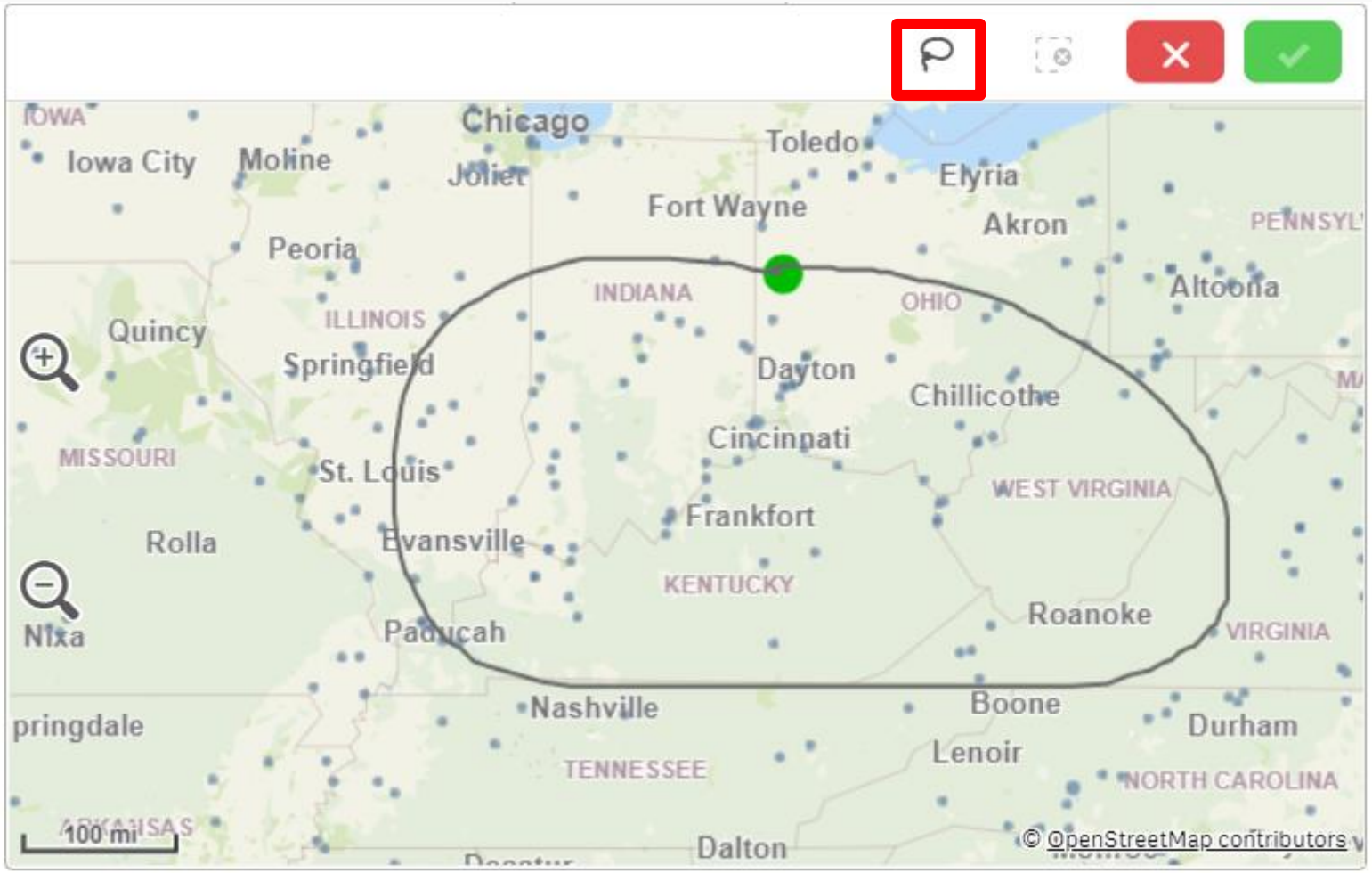
Explore the interactive map to navigate your area of interest by clicking and dragging. To zoom, click the + or – on the map or use your mouse scroll wheel.



Explore the scatterplot of facilities by clicking and dragging. To zoom, use your mouse scroll wheel.



Click on the map or the scatterplot and **select the lasso tool** to draw a freehand circle around specific areas for which you would like to see data.



IPM Results Viewer

IPM Results Viewer: What is it?

- The IPM Results Viewer is a tool to quickly visualize and explore IPM results.
- Data Types: Emissions, capacity, generation, and heat input; natural gas, coal, and electricity prices.
  - Does Not Include: Inputs, data on individual units (model plants only).
- Includes both national and state level data.
- Offers multiple options to display data:
  - State Map, Whisker Plot, Time Series, Stacked Bar.
- Calculates:
  - Absolute and percent changes between years and cases.
  - Emission rates and capacity factors.
- Filter Data by: fuel and plant type; existing, new, and retired status; controls and retrofits; and if fossil > 25 MW.
- Includes historic data for context and comparison.

IPM Results Viewer: Layout

User Controls

	Jan 2020 Ref Case
PRIMARY YEAR	2021
Regional Aggregation	State
PRIMARY DIMENSIONS	
Fuel Type	All Units
Fossil >25 MW	All Units
Existing/New/Retired	Existing and New
Plant Type	All Units
Plant Category	All Units
Control/Retrofit Types	All Units
Existing or New Controls	All Controls
PRIMARY MEASURE	NOX Emissions Summer Thousand
DISPLAY VALUE TYPE	Actual
COMPARISON CASE	Jan 2020 Ref Case
COMPARISON YEAR	2021
COMPARISON DIMENSIONS	
Fuel Type	All Units
Fossil >25 MW	All Units
Existing/New/Retired	Existing and New
Plant Type	All Units
Plant Category	All Units
Control/Retrofit Types	All Units
Existing or New Controls	All Controls
COMPARISON MEASURE	NOX Emissions Summer Thousand

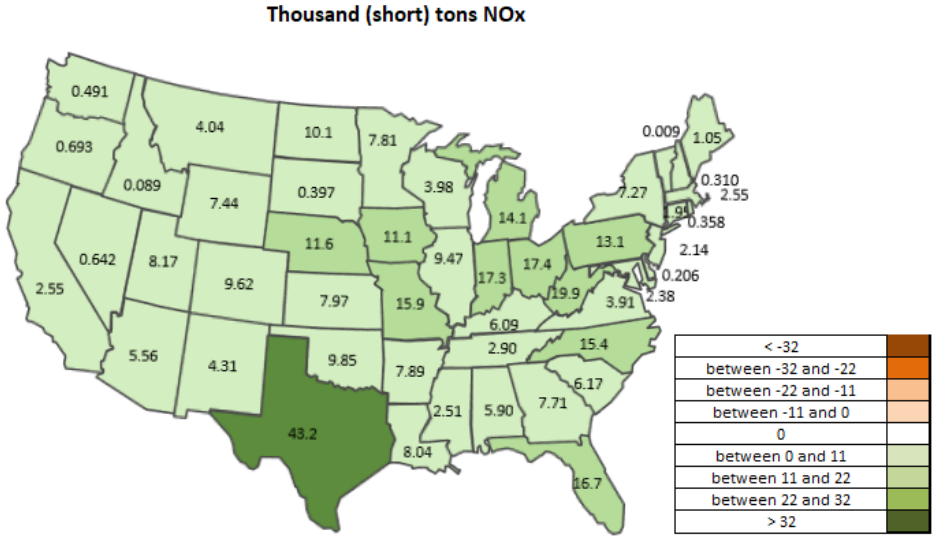
Update | Reset | Export Data

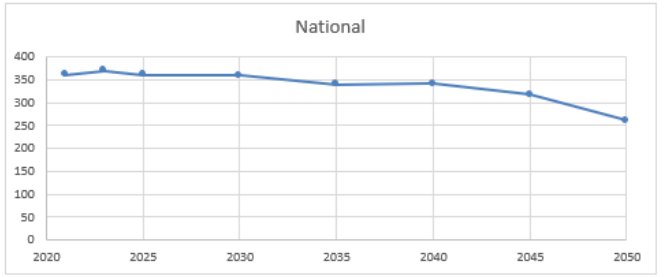
****You must click the update button to update the map*

Map | Whisker | Emissions

GWh, TBtu, MW | All Run | Read Me

Graphical Output

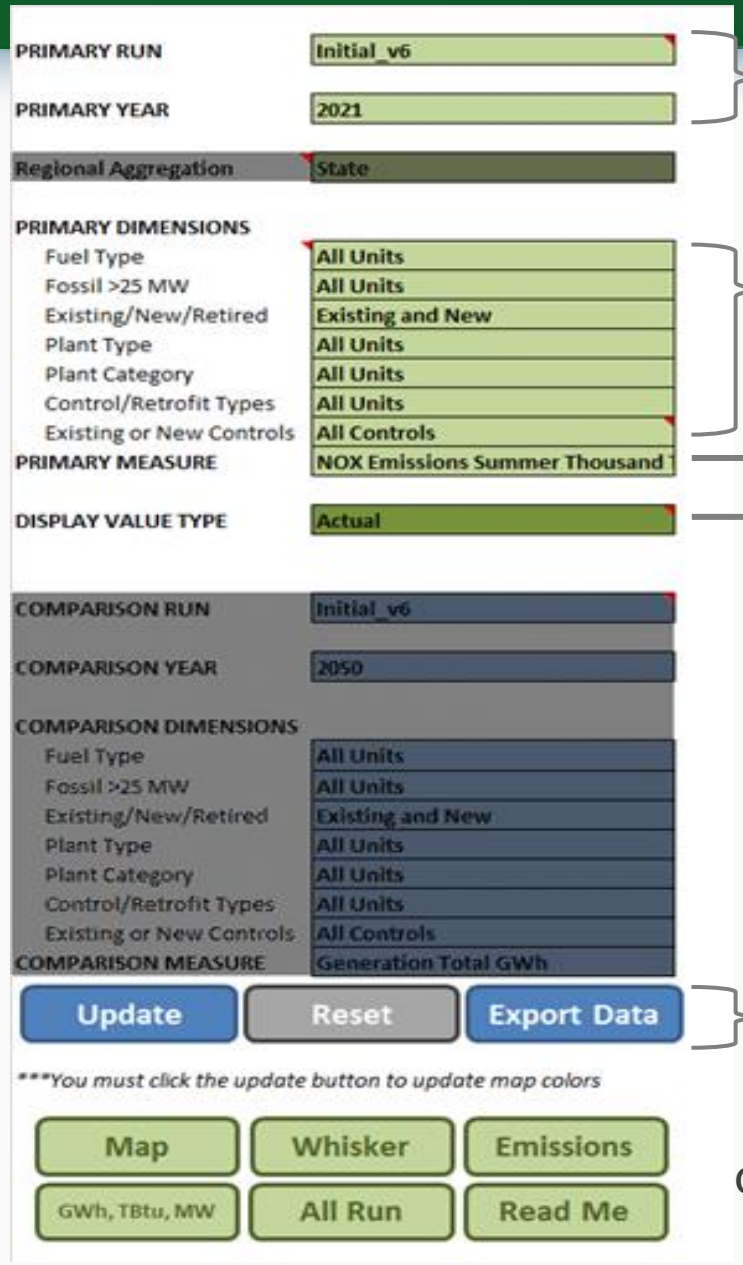




State: National Comparison Year: Parallel

*Historical data is still under development. It is approximate and may not always provide an apples-to-apples comparison to IPM outputs. See READ ME worksheet for more info.

User Controls: Overview



Case / Year

Data Filters
- Fuel Type
- Plant type
- Existing/New/Retired
- Controls/Retrofits

Metric to Display

Actual or Compared to Something
- Use the set of blue controls/filter to calculate comparisons
- Absolute or Percent Change, Fractions, Emission Rates, Capacity Factors

Update Graph, Reset Filters, Export Data

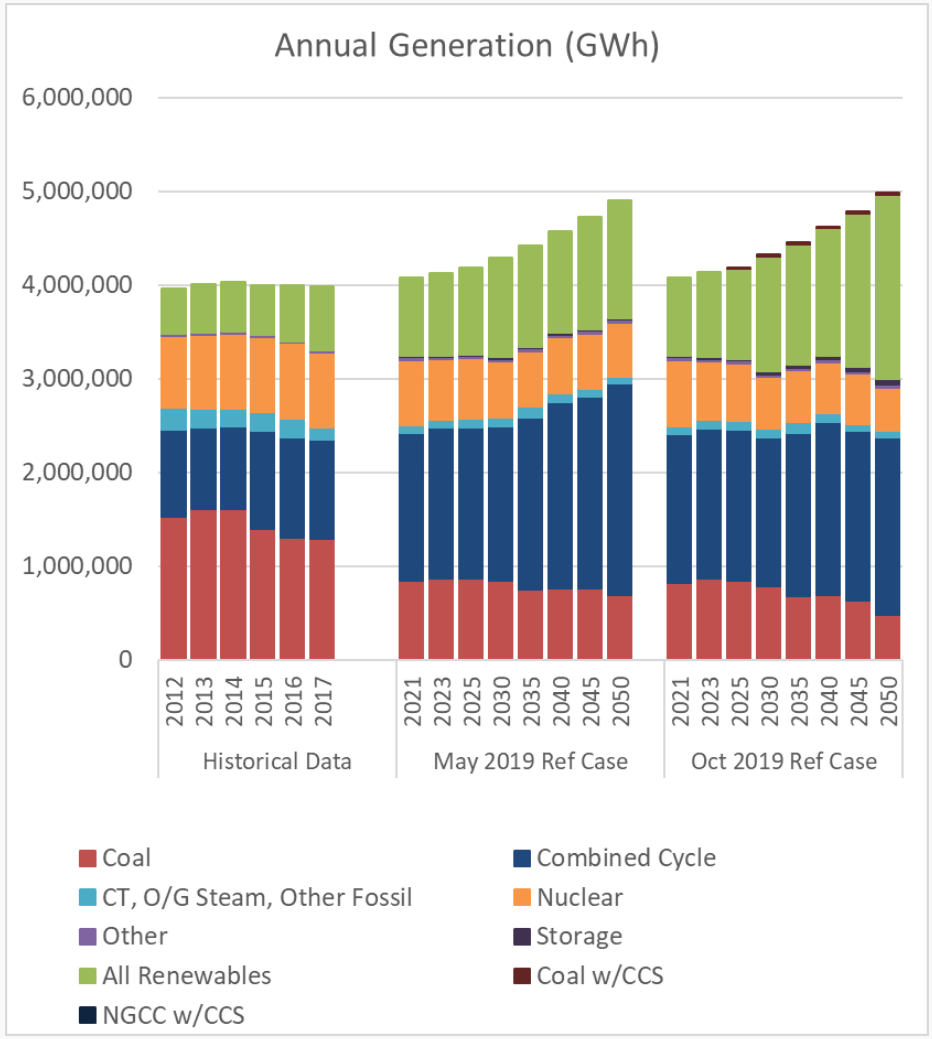
ontrols to navigate to other graphs

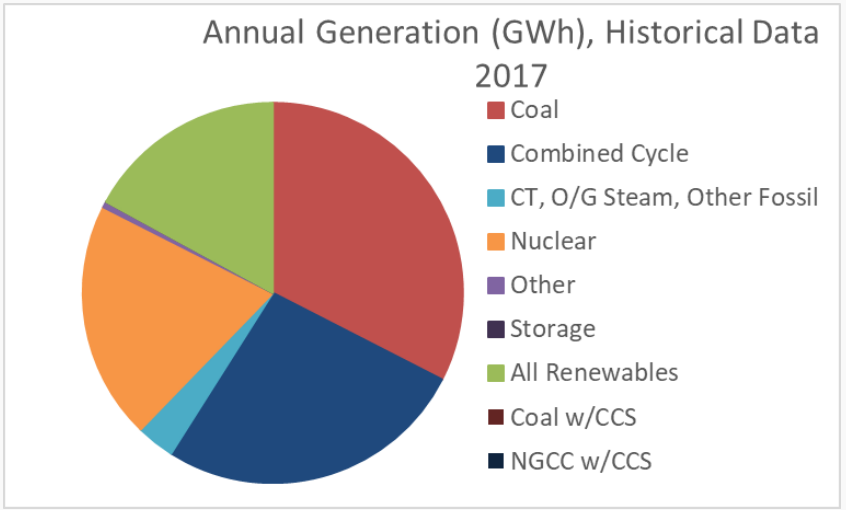
Sample Outputs

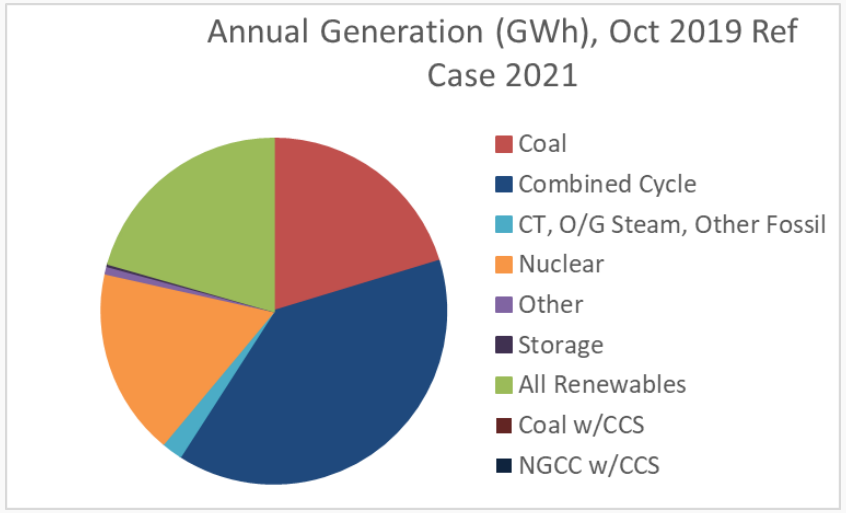
- The next few slides contain some samples of Results Viewer output to demonstrate its capabilities.
  - **These example are not intended to highlight or indicate the importance of any specific results; they simply illustrate functionality of the viewer.**
- October 2019 Reference Case has the following updated from the May 2019 Reference Case:
  - Updated Renewable Costs and Capacity Credits
    - May 2019 Reference Case with battery storage, solar PV, solar CSP and onshore wind technology cost assumptions from NREL ATB 2019 mid case. The offshore wind technology cost assumptions from NREL ATB 2019 mid case are approximately modeled by scaling the capital costs and FOM in May 2019 Reference Case . The capacity credit assumptions for solar and wind technologies were also updated.
  - Implemented the following mandates.
    - Offshore wind requirements in MD. NJ, CT, MA and NY.
    - Clean energy standards in CA, NM, NV, NY and WA,
    - RPS updates in CA, DC, MD, ME, NM, NV, NY, OH and WA.
  - Implemented ACE rule and 45Q.
  - Implemented NEEDS updates from “NEEDS Quarterly Update for September 2019”.

Sample Output: Bar and Pie Charts

National Annual Generation (Historic, May 2019 Ref Case, and Oct 2019 Ref Case)

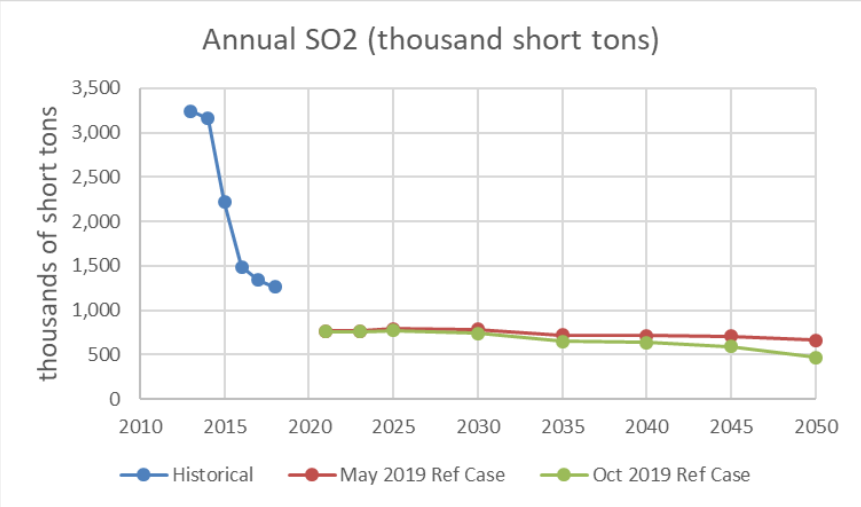


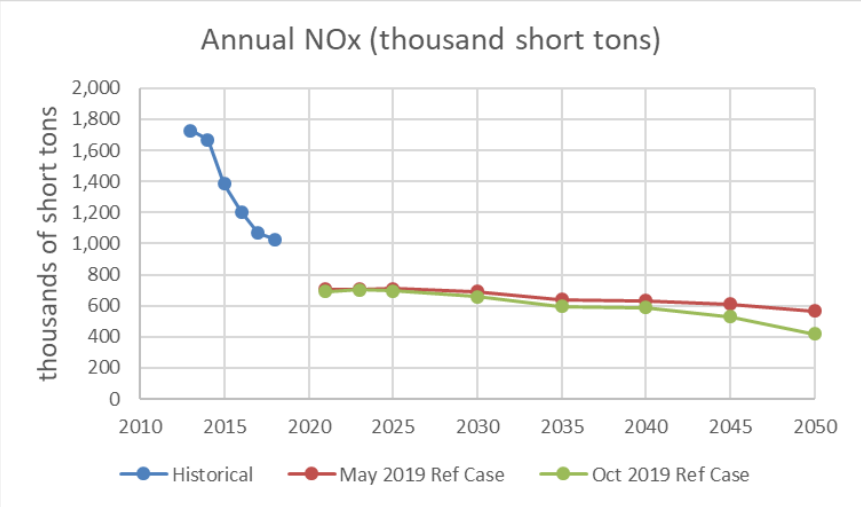


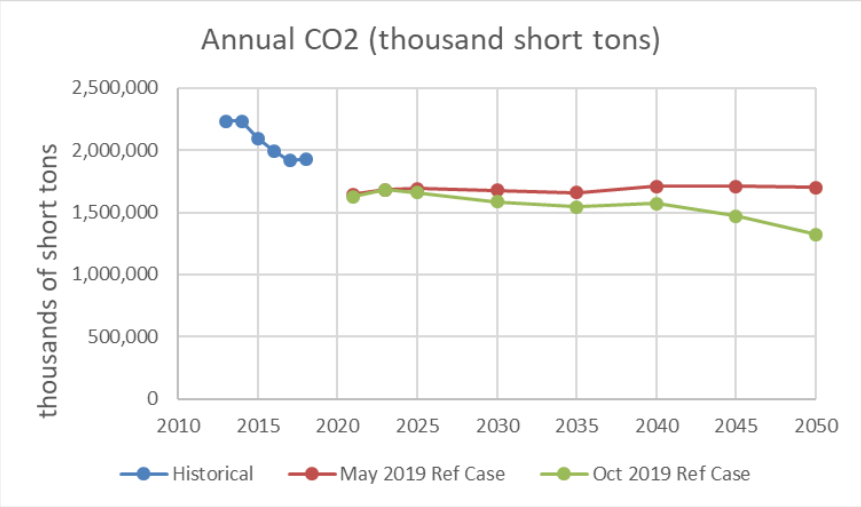


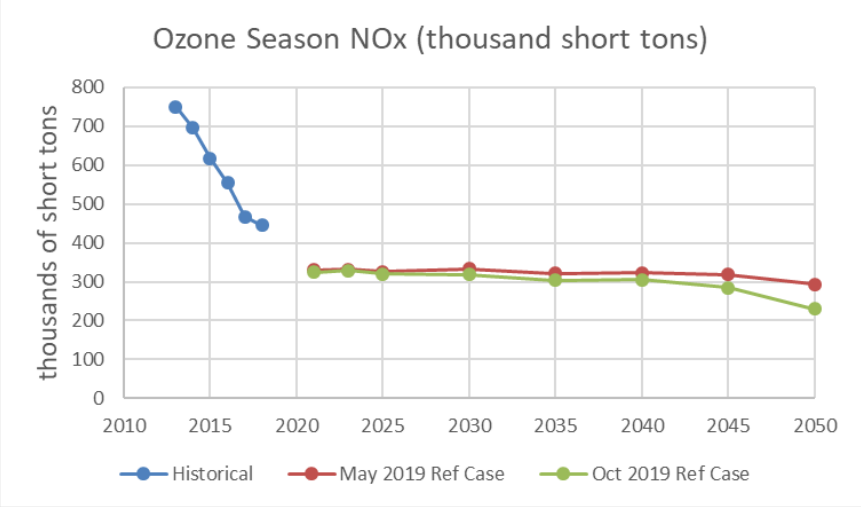
Sample Output: Emissions Time Series

SO2, NOx, and CO2 Emissions for the May and Oct 2019 Ref Cases



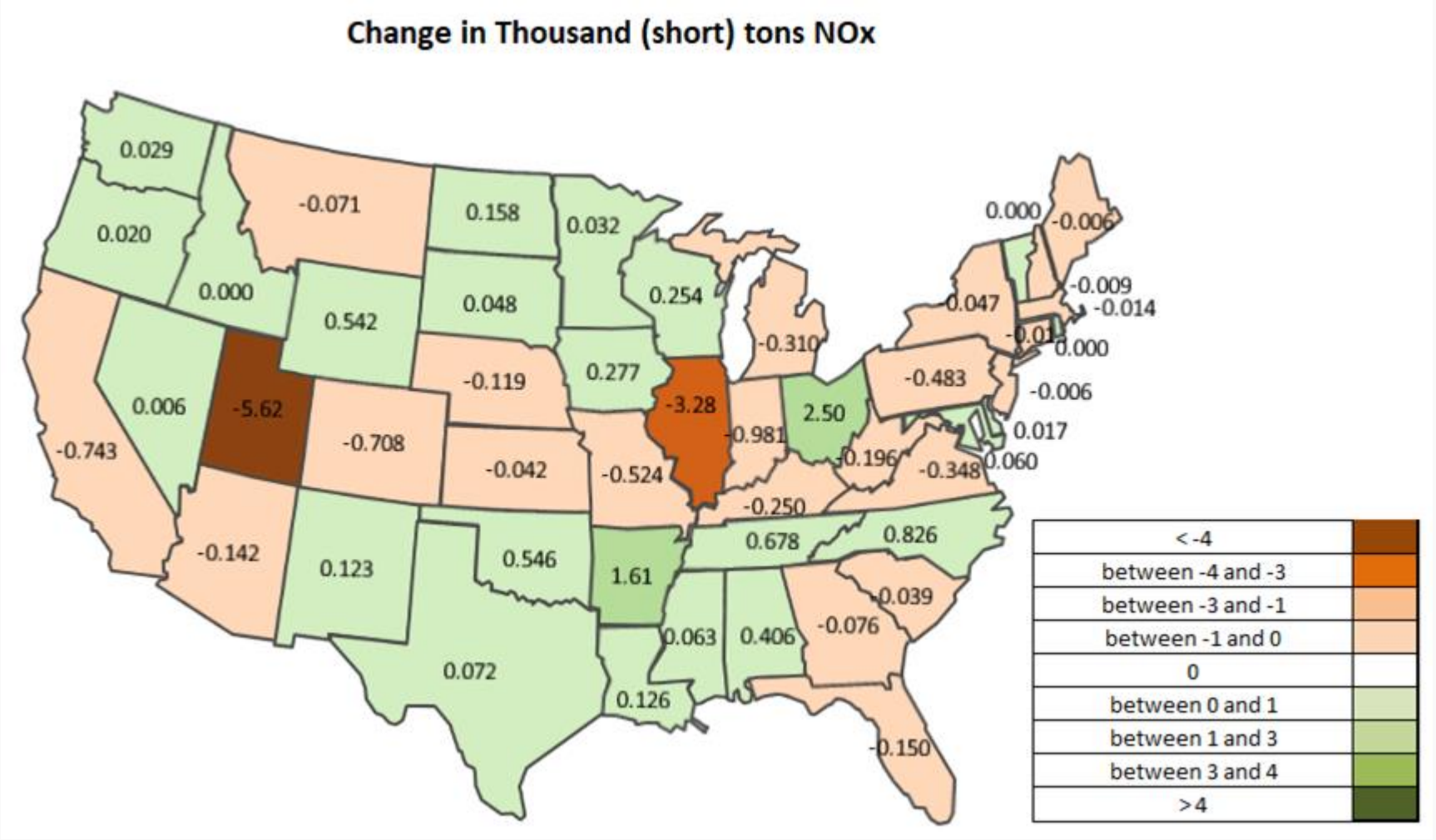






Sample Output: Map

Change in Ozone Season NO_X in 2025 between the Oct 2019 Ref Case and the May 2019 Ref Case, by state



Sample Output: Whisker Plot

Fraction of generation in 2025 from renewable sources in the May (blue) and Oct (orange) 2019 Ref Cases.

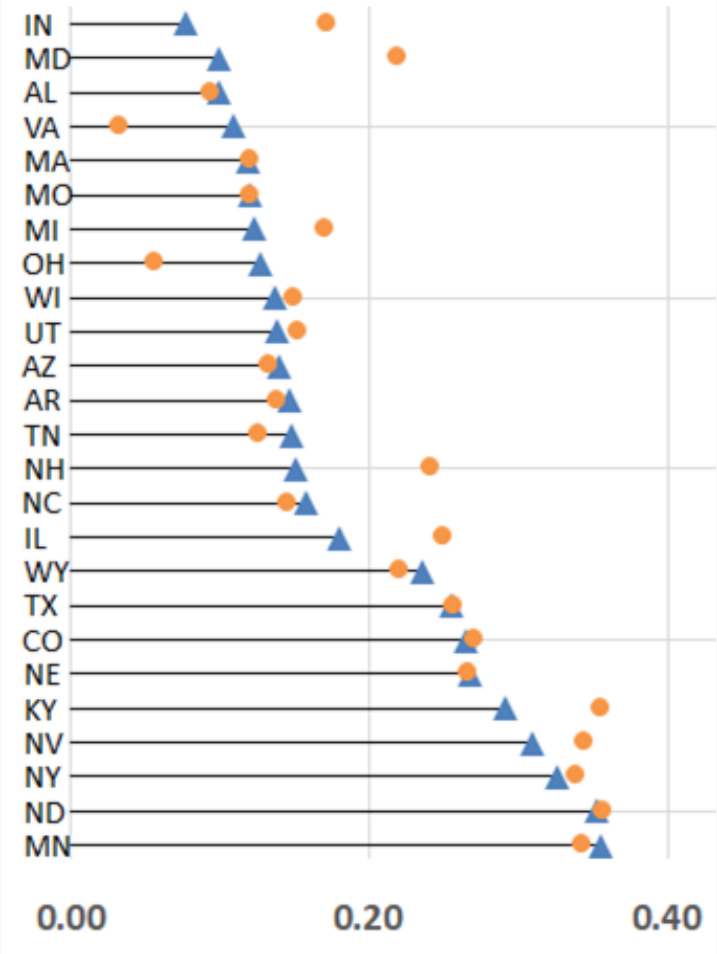
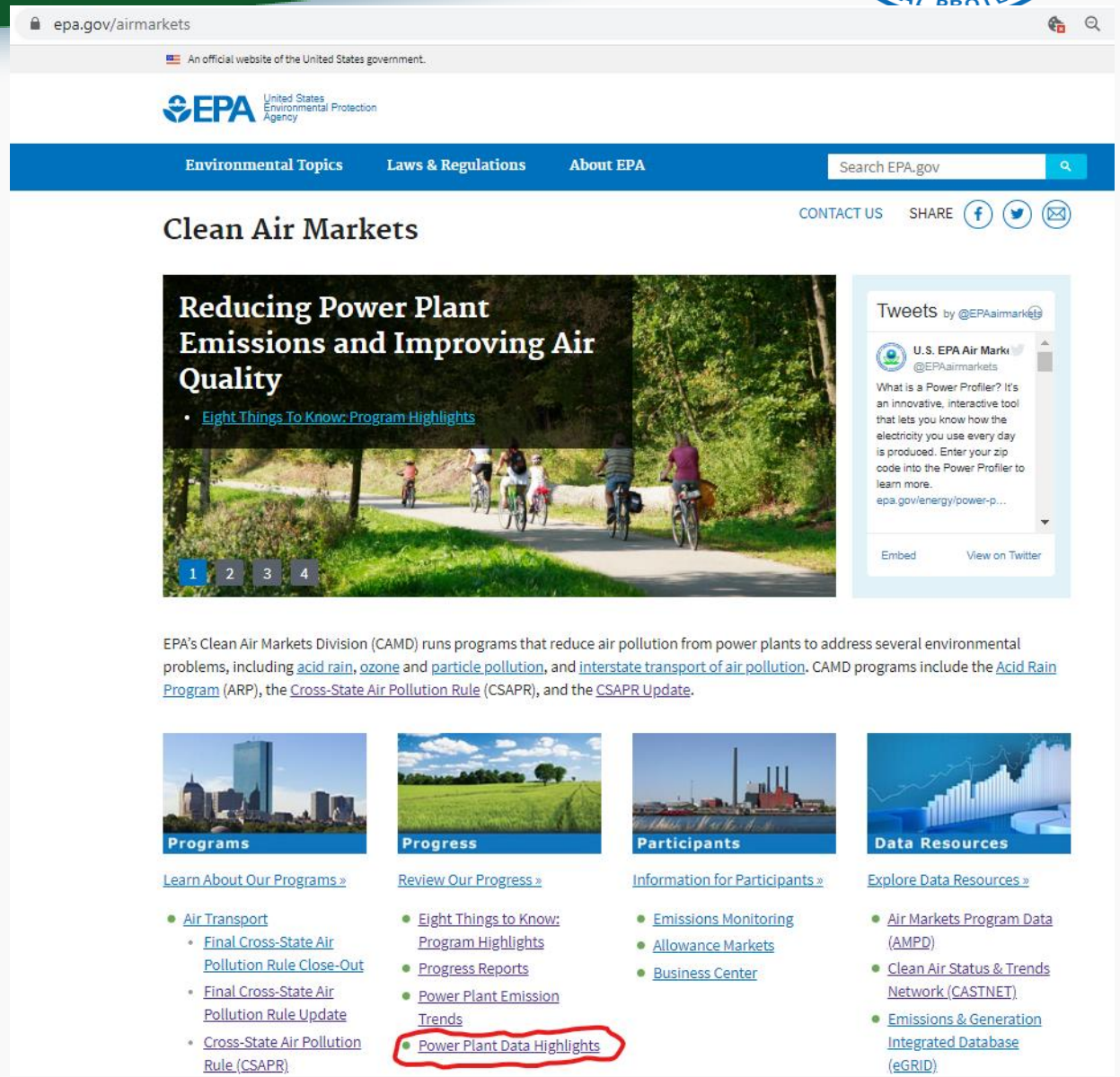


**Chart clipped for display purposes*

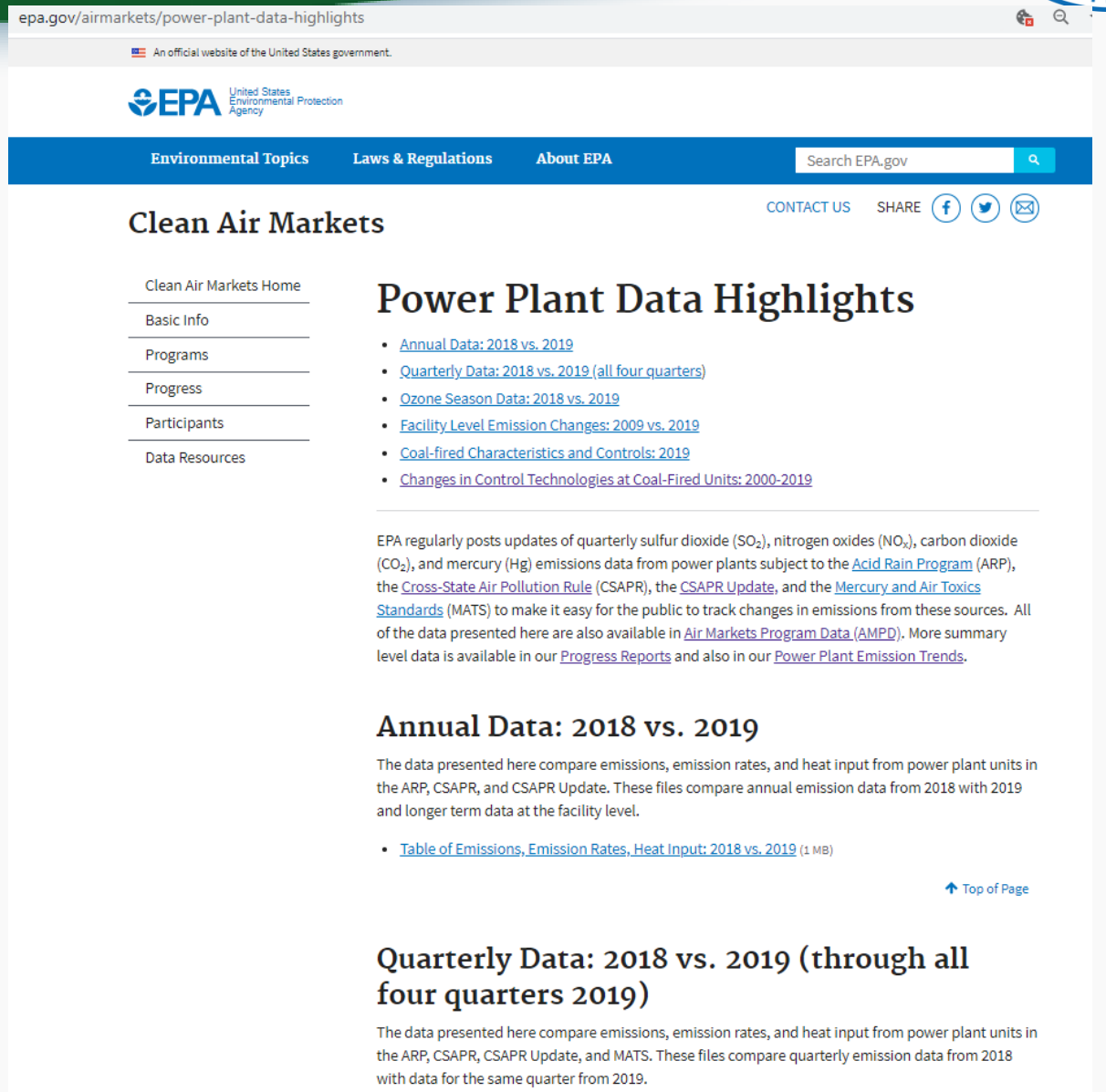
Power Plant Data Highlights

Power Plant Data Highlights can be found on CAMD's main web page in the Progress section



Power Plant Data Highlights

EPA posts quarterly updates of SO_2, NO_X, CO_2, and Hg emissions data from power plants.



Quarterly Data

- The Quarterly Data file compares each facility, for the respective quarter, for 2018 vs 2019
- This file is updated each quarter
- The Annual Data and Ozone Season Data files contain similar information and are updated annually

2018 and 2019 Quarterly Power Plant Emissions, Coal Only, SO_2

EPA's Clean Air Markets Division, Data Current as of February 10, 2020

Facility Name	State	Calendar Quarter	2018 Heat Input (mmBtu)	2019 Heat Input (mmBtu)	2018 vs 2019 Heat Input (mmBtu)	2018 vs 2019 Heat Input (%)	2018 SO_2 Emissions (tons)	2019 SO_2 Emissions (tons)	2018 vs 2019 SO_2 Emissions (tons)	2018 vs 2019 SO_2 Emissions (%)	2018 SO_2 Emission Rate (lb/mmBtu)	2019 SO_2 Emission Rate (lb/mmBtu)	2018 vs 2019 SO_2 Emission Rate (lb/mmBtu)	2018 vs 201 SO_2 Emission Rate (%)
Healy Power Plant	AK	1		495,590										
Healy Power Plant	AK	2		426,459										
Healy Power Plant	AK	3												
Healy Power Plant	AK	4												
Barry	AL	1	12,532,850	10,582,276	-1,950,574	-16%	1,256.4	979.8	-276.6	-22%	0.20	0.19	-0.02	-8
Barry	AL	2	13,960,788	11,746,445	-2,214,343	-16%	1,613.0	681.6	-931.5	-58%	0.23	0.12	-0.12	-50
Barry	AL	3	15,439,673	11,552,603	-3,887,070	-25%	1,856.1	1,079.4	-776.6	-42%	0.24	0.19	-0.05	-22
Barry	AL	4	1,923,817	12,125,128	10,201,311	530%	509.9	734.1	224.2	44%	0.53	0.12	-0.41	-77
Charles R Lowman	AL	1	2,880,448	1,681,188	-1,199,261	-42%	240.4	87.0	-153.4	-64%	0.17	0.10	-0.06	-38
Charles R Lowman	AL	2	1,552,813	2,650,467	1,097,655	71%	63.5	166.5	103.0	162%	0.08	0.13	0.04	54
Charles R Lowman	AL	3	7,061,973	3,462,682	-3,599,292	-51%	372.5	183.7	-188.8	-51%	0.11	0.11	0.00	1
Charles R Lowman	AL	4	2,780,101	2,661,499	-118,602	-4%	131.9	120.4	-11.5	-9%	0.09	0.09	0.00	-5
E C Gaston	AL	1	12,882,310	10,935,165	-1,947,146	-15%	744.8	430.4	-314.4	-42%	0.12	0.08	-0.04	-32
E C Gaston	AL	2	11,460,636	11,087,804	-372,832	-3%	623.8	276.2	-347.6	-56%	0.11	0.05	-0.06	-54
E C Gaston	AL	3	6,950,540	10,709,212	3,758,672	54%	420.9	262.5	-158.4	-38%	0.12	0.05	-0.07	-60
E C Gaston	AL	4	2,294,567	2,126,214	-168,353	-7%	142.9	64.7	-78.2	-55%	0.12	0.06	-0.06	-51
Gorgas	AL	1	17,438,696	5,833,139	-11,605,557	-67%	514.8	142.7	-372.1	-72%	0.06	0.05	-0.01	-17
Gorgas	AL	2	16,425,974				453.6				0.06			
Gorgas	AL	3	16,469,164				444.6				0.05			
Gorgas	AL	4	10,326,593				282.2				0.05			
James H Miller Jr	AL	1	45,214,712	48,937,792	3,723,080	8%	183.7	229.7	46.1	25%	0.01	0.01	0.00	16
James H Miller Jr	AL	2	44,288,371	38,535,885	-5,752,486	-13%	180.5	204.8	24.3	13%	0.01	0.01	0.00	30
James H Miller Jr	AL	3	56,233,173	57,774,377	1,541,204	3%	243.2	245.5	2.2	1%	0.01	0.01	0.00	-2
James H Miller Jr	AL	4	46,442,770	54,648,501	8,205,731	18%	242.0	286.0	44.0	18%	0.01	0.01	0.00	0
Flint Creek Power Plant	AR	1	6,130,936	9,078,072	2,947,136	48%	234.0	264.9	30.9	13%	0.08	0.06	-0.02	-24
Flint Creek Power Plant	AR	2	4,386,681	4,637,949	251,268	6%	118.6	132.1	13.6	11%	0.05	0.06	0.00	5

About | SO2 - Coal Only | NOx - Coal Only | CO2 - Coal Only | Hg - Coal Only | SO2 - All Units | NOx - All Units | CO2 - All Units | Hg - All Units

Power Plant Data Highlights

- Facility Level Emission Changes shows facility level changes of SO_2 and NO_X over a longer time period.
- Coal-fired Characteristics and Controls provides a compiled set of information on all coal units
- Changes in Control Technologies at Coal-Fired Units the progress of SO_2 and NO_X controls on a mapped time series

Facility Level Emission Changes: 2009 vs. 2019

The data presented here compare emissions and emission rates from power plants in the ARP, CSAPR, and CSAPR Update. These files compare longer-term annual data at the facility level.

- Table of Long-term Emission Changes: 2009 vs. 2019

Top of Page

Coal-fired Characteristics and Controls: 2019

The data presented here provide detailed information about coal-fired power plants, including emissions of SO_2, NO_X, and CO_2; heat input; capacity; on-line year; and emission controls.

- Table of Coal Unit Characteristics: 2019 (250 K)

Top of Page

Changes in Control Technologies at Coal-Fired Units: 2000-2019

The following figures display where particular control technologies have been installed between 2000 and 2019 based on the information obtained from major company contacts and industry sources.

- Control technologies installed, 2000-2019 (Figures 1-5)

Top of Page

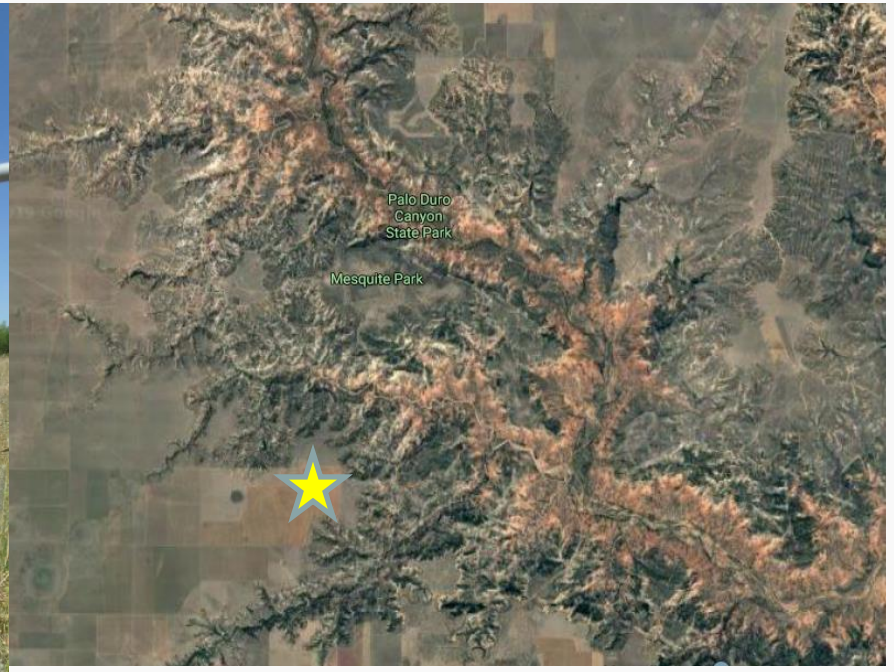
Deposition and Environmental Effects Data

CLEAN AIR STATUS AND TRENDS NETWORK (CASTNET) DATA

Provides ambient air quality data from 97 monitoring sites across the U.S. to assess regional air quality and deposition

Overview of the Clean Air Status and Trends Network (CASTNET)

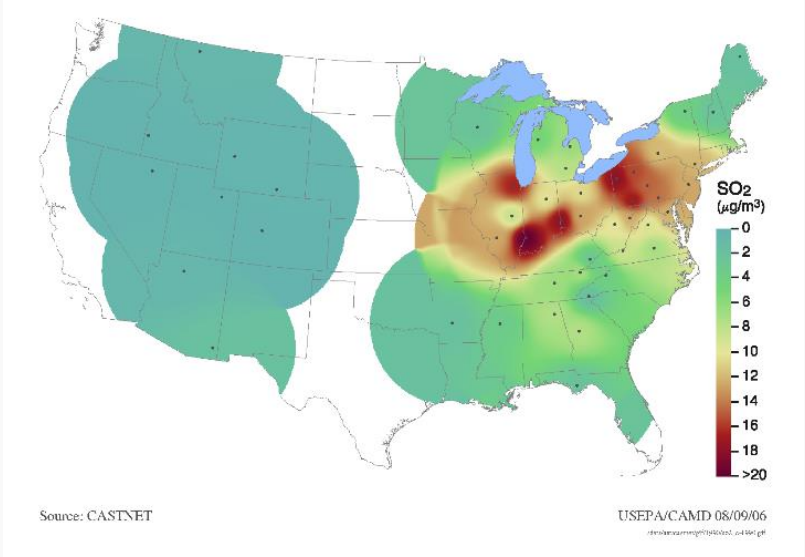
- What is CASTNET?
- What data are available?
- Downloading CASTNET data



Palo Duro Canyon (PAL190), TX is located between the Palo Duro Canyon State Park to the east and agricultural land to the west. The site is operated by Texas A&M Agrilife Research & Extension Center at Amarillo.

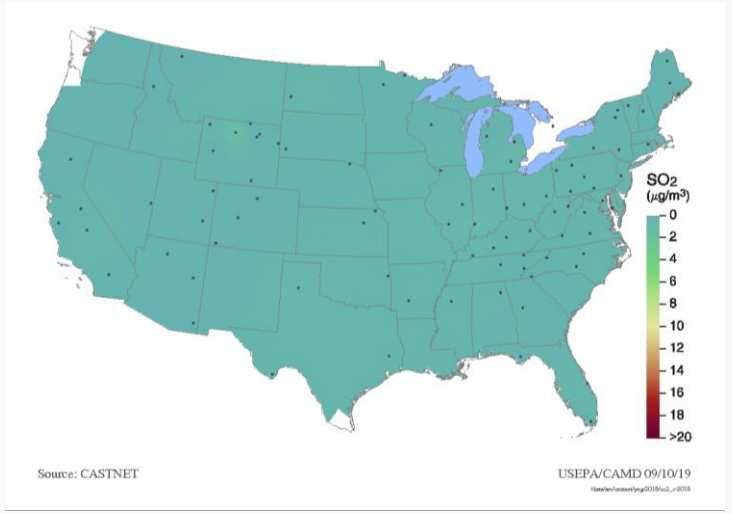
CASTNET Monitoring

- CASTNET is managed by EPA's CAMD. Sites are operated by EPA, National Park Service and BLM-WY.
- 39 sites have operated continuously for 30+ years. Sites are located in rural areas, typically away from emission point sources.
- Most sites measure concentrations of sulfur and nitrogen, ozone, and temperature.
- Data are used by EPA to assess long-term trends in air quality and deposition, determine NAAQS compliance, evaluate stratospheric ozone intrusion events, and calculate critical load exceedances.



SO_2 concentrations measured at CASTNET in 1990 (left) and 2018 (below). Large reductions in SO_2 concentrations are a direct result of SO_2 EGU emission reductions.

2019 CASTNET Factsheet

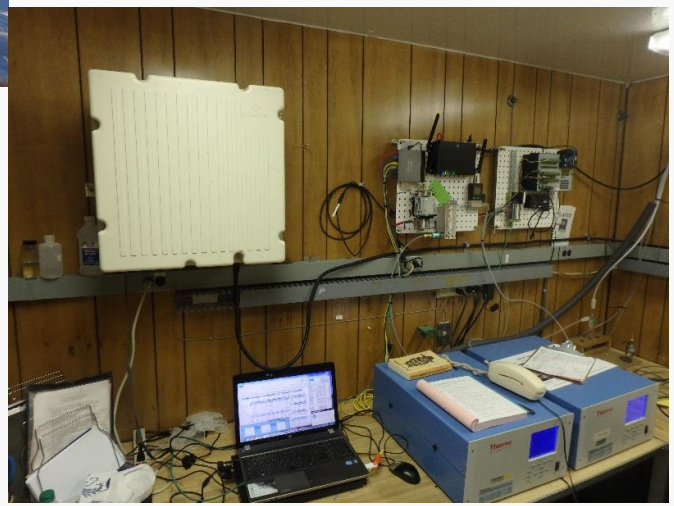


CASTNET Sites

- Site operators visit each site every Tuesday morning to change filter packs, perform routine quality assurance checks, and maintain site (i.e. mowing).
- A contractor prepares, ships, receives, and analyzes the filters.
- Most sites are co-located with the National Atmospheric Deposition Program's National Trends Network (precipitation chemistry) and Ammonia Monitoring Network (ambient ammonia concentrations).

Centennial, WY CASTNET site (CNT169)

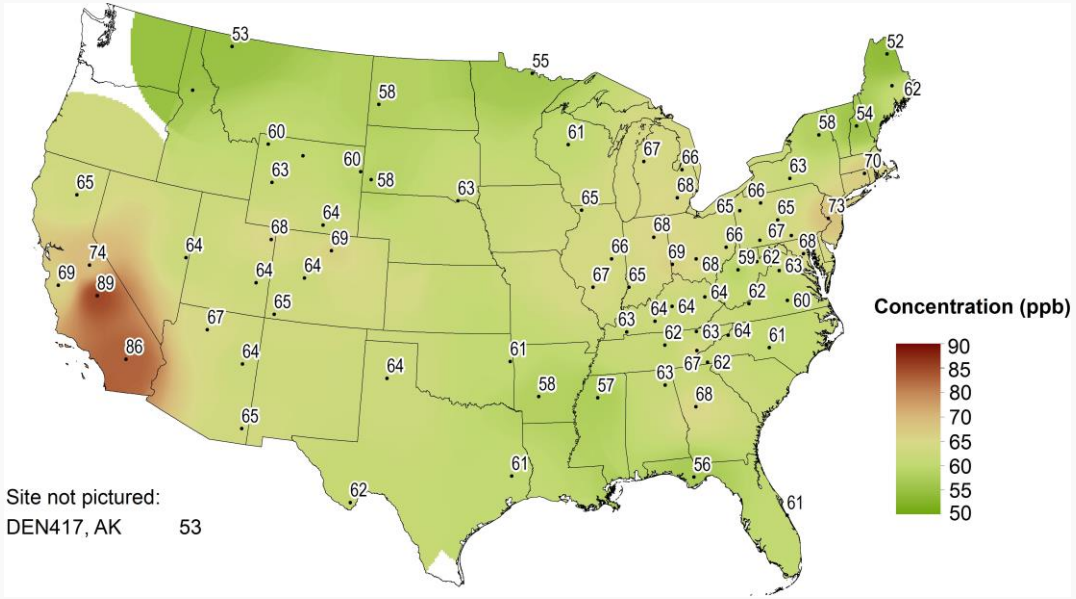
Temperature controlled shelter and 10m tower shown (left) and O_3 analyzer + transfer standard, site laptop and data logger/telemetry shown (below)



CASTNET O_3 Data

- 79 sites measure ground-level O_3 concentrations
- Data are reported as hourly averages (ppb)
- Nightly quality control checks are run with zero air and transfer standard (NIST traceable) to verify instrument is operating within criteria
- Systems are operated following 40 CFR Part 58 regulations to support NAAQS decisions
- Raw data are loaded into CAMD's database nightly and posted to the website ~2 days after
- Validated data are posted ~6 months after

CASTNET O_3 concentrations shown as average (2015-2017) 4th highest daily maximum 8-hour average



The 2015 O_3 NAAQS is set at 70 ppb. Areas with the 3-year average of the 4th highest daily maximum 8-hour average concentrations greater than 70 ppb are exceeding the current standard.

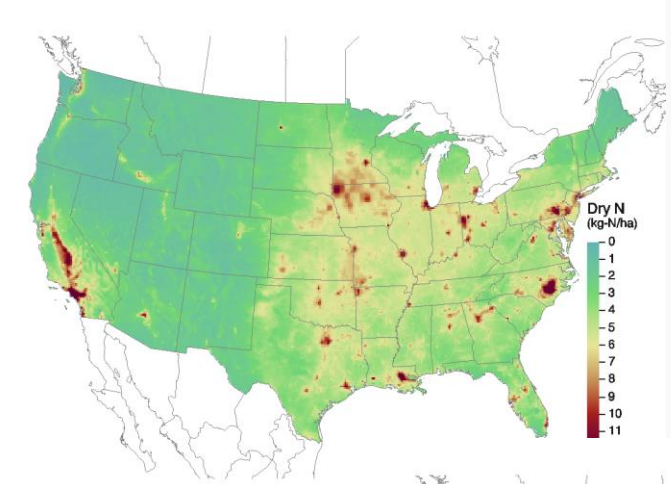
CASTNET Filter Pack Data

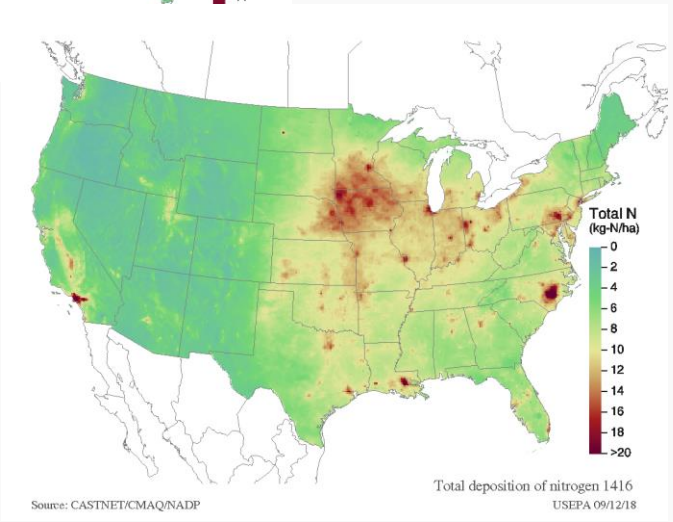
- 91 sites collect sulfur and nitrogen measurements with a filter pack
- Filter packs are changed weekly (Tuesday – Tuesday)
- CASTNET utilizes a 3-stage, open-face filter pack for measuring particles and gases.
  - Filter pack is located at 10m.
- Concentrations are calculated as measured flow rate (calculated from STP to local conditions) * mass of analyte and reported as µg m^{-3}
- Concentration data are reported with flags as final ~6-months after laboratory analysis
  - Invalid flags include: **I** (invalid chemistry data and/or less than 75% valid flow for the week), **M** (Missing or completely invalid flow for the week), **N** (Sample not analyzed)

Filters	Analytes
Teflon	SO_4, NO_3, NH_4, Ca, Mg, Na, K, Cl
Nylon	SO_2, HNO_3
Whatman Cellulose	SO_2

Dry and Total Deposition

- Deposition flux = concentration * deposition velocity
- Total deposition = Wet deposition + dry deposition
- Wet deposition is measured by NADP/NTN
- Dry deposition is expensive and labor intensive to measure
  - Meteorology, vegetation impact deposition velocities on a short time scale
  - Some pollutants (i.e. NH_3) may be deposited or emitted (bi-directional flux)
- CAMD produces annual deposition gridded surface maps
  - calculate dry deposition by combining CASTNET concentrations with modeled output from CMAQ (deposition velocities and concentrations where measurements are not available)
  - Dry deposition surfaces are combined with wet deposition surfaces to provide total deposition surfaces
- Data for CAMD annual dry and total deposition estimates are provided as gridded Arc files and images, and as a data table of estimates at CASTNET site locations



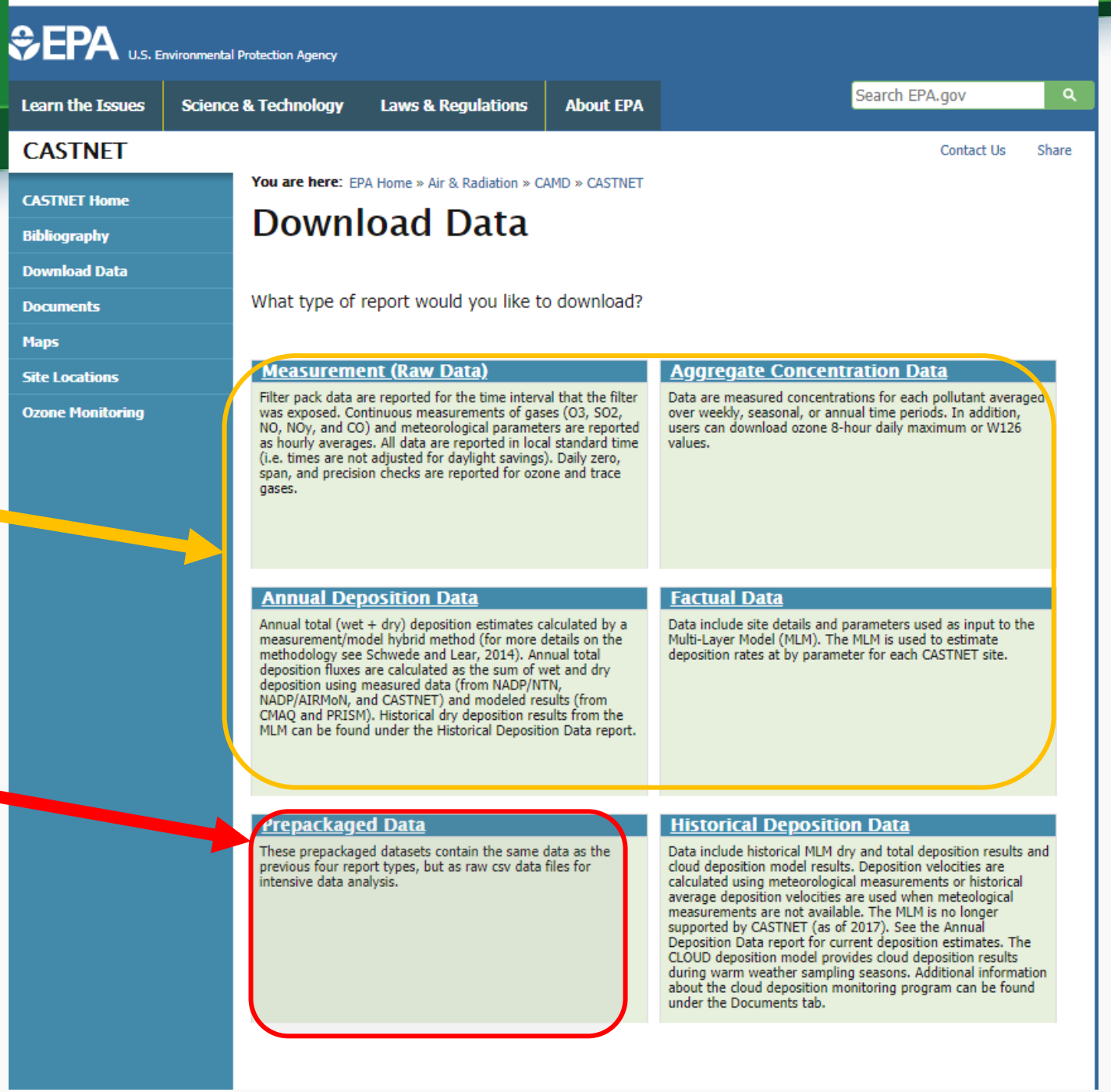


Dry (left) and total (below) nitrogen deposition from 2014-2016

CASTNET Website

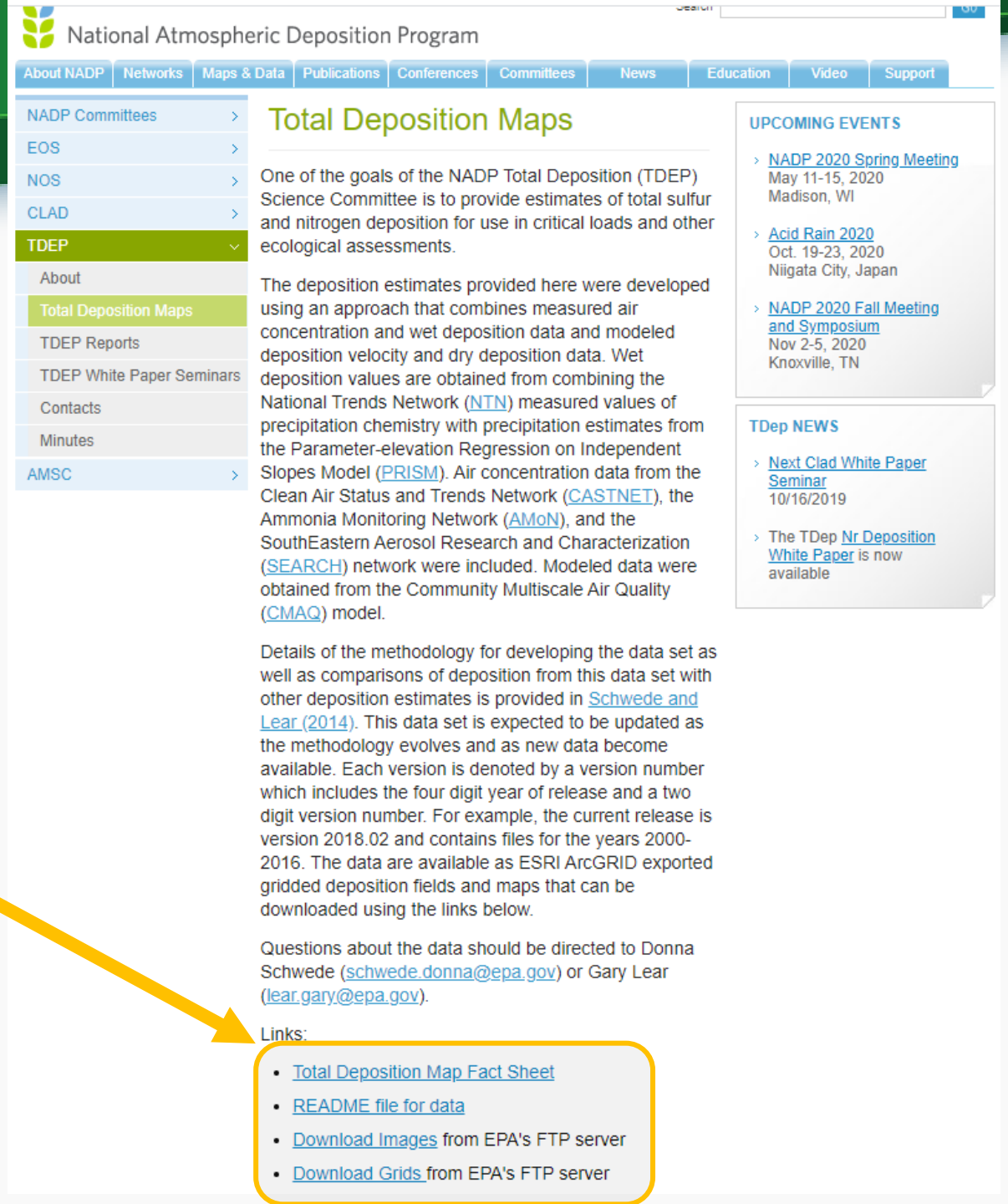
- Data may be downloaded for individual sites or time periods using the query tool

- Data may be downloaded for entire period or by year using prepackaged data
  - Prepackaged zip files include data, column and table metadata (3 csv files)



Total Deposition Grids

- Documentation information, the grids (.e00 files), and images of the grids can be downloaded from the NADP Total Deposition page



LONG-TERM MONITORING (LTM) DATA

Provides ambient air quality data from 97 monitoring sites across the U.S. to assess regional air quality and deposition

Water Quality Data

- EPA has been monitoring changes in water quality parameters (chemical and physical) related to deposition since the early 1990's

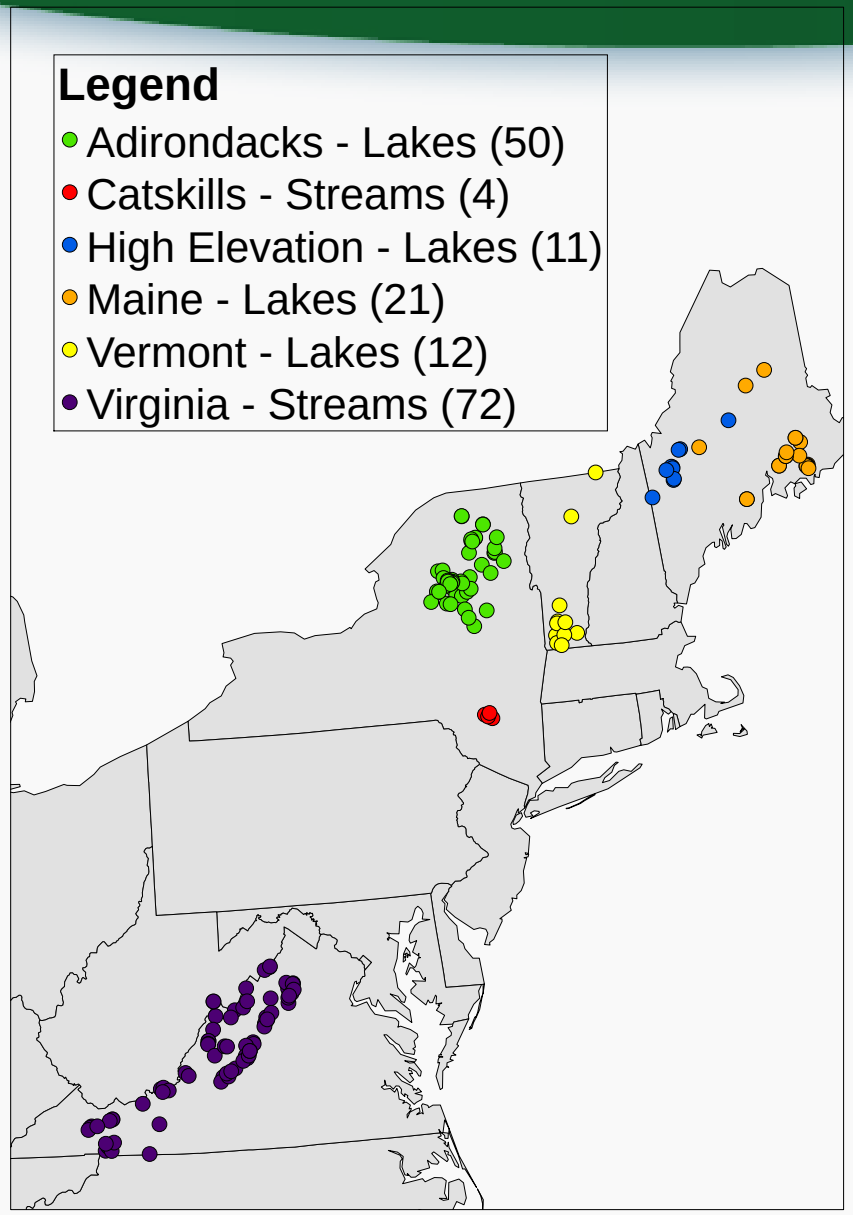
Chemical Parameters

- Nitrate (NO_3)
- Ammonium (NH_4^+)
- Sulfate (SO_4^{2-})
- Base Cations:
  - Calcium (Ca)
  - Magnesium (Mg)
  - Sodium (Na)
  - Potassium (K)
- Chloride (Cl^-)
- Acid Neutralizing Capacity (ANC)
- pH
- Dissolved Organic Carbon (DOC)

Physical Parameters

- Water Temperature
- Water Color
- Water Clarity
- Flow

Current LTM Network



- 170 locations, ~1200 samples annually
- 220 peer-reviewed publications (and counting)
- Accomplished cooperatively through our network partners:

Vermont Lakes – 12 lakes , VT Department of Environmental Protection

Maine + High Elevation Lakes – 32 lakes, US Geological Survey (USGS) and the University of New Hampshire and University of Maine

Adirondack Lakes – 50 lakes, USGS, Adirondacks Lakes Survey Corporation (ALSC), the New York State Department of Environmental Conservation (NYSDEC), & New York State Energy and Research Development Authority (NYSERDA)

Catskills Streams – 4 streams, USGS

Ridge and Blue Ridge (VA) Streams –72 streams, Shenandoah National Park and the University of Virginia

Data Available Online

SITE_ID	PROGRAM_ID	DATE_SMP	PARAMETER	SAMPLE_LOCATION	WATERBODY_TYPE	SAMPLE_DEPTH	VALUE	UNITS	METHOD	METHOD_DESCRIPTION
20059	LTM_ME	7/30/1991	AL_ORG	EPI	Lake		28	ug/L	Unknown	Unknown
20059	LTM_ME	7/30/1991	AL_TD	EPI	Lake		79	ug/L	Hillman et	Perkin-Elr D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/30/1991	ANC	EPI	Lake		32.9	ueq/L	EPA 1983	Gran plot EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	CA	EPI	Lake		70.9	ueq/L	EPA 1983	AAS with EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	CL	EPI	Lake		30	ueq/L	Hillman et	Dionex 21 D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/30/1991	COLOR_TRU	EPI	Lake		45	PtCo	EPA 1983	Bausch & EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	DIC	EPI	Lake		0.5	mg/L	Unknown	Unknown
20059	LTM_ME	7/30/1991	DOC	EPI	Lake		7.9	mg/L	OI Standa	OI Corpor College S TX 77841.
20059	LTM_ME	7/30/1991	K	EPI	Lake		14.1	ueq/L	EPA 1983	AAS with EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	MG	EPI	Lake		37	ueq/L	EPA 1983	AAS with EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	N_TD	EPI	Lake		365	ueq/L	Unknown	Unknown
20059	LTM_ME	7/30/1991	NA	EPI	Lake		43.1	ueq/L	EPA 1983	AAS with EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/30/1991	NO3	EPI	Lake		0.1	ueq/L	Hillman et	Dionex 21 D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/30/1991	P_TL	EPI	Lake		14.3	ug/L	Unknown	Unknown
20059	LTM_ME	7/30/1991	PH_EQ	EPI	Lake		6.41	Units	Hillman et	Aeration v D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/30/1991	PH_STVL	EPI	Lake		6.13	Units	Unknown	Unknown
20059	LTM_ME	7/30/1991	SIO2	EPI	Lake		0.09	mg/L	Hillman et	EPA 1983 Technicro D.C. J. Potter and S. Sin 1986. Ana Eastern La
20059	LTM_ME	7/30/1991	SO4	EPI	Lake		76	ueq/L	Hillman et	Dionex 21 D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/30/1991	COND	EPI	Lake		22.3	uS/cm	EPA 1983	YSI model EPA 600/4 1979 Revised 1983.
20059	LTM_ME	7/26/1995	AL_TD	EPI	Lake		46	ug/L	Hillman et	Perkin-Elr D.C. J. Potter and S. Sin 1986. Ana Eastern La EPA Las Ve
20059	LTM_ME	7/26/1995	ANC	EPI	Lake		25.7	ueq/L	EPA 1983	Gran plot EPA 600/4 1979 Revised 1983

Metadata | Data | Site_Information

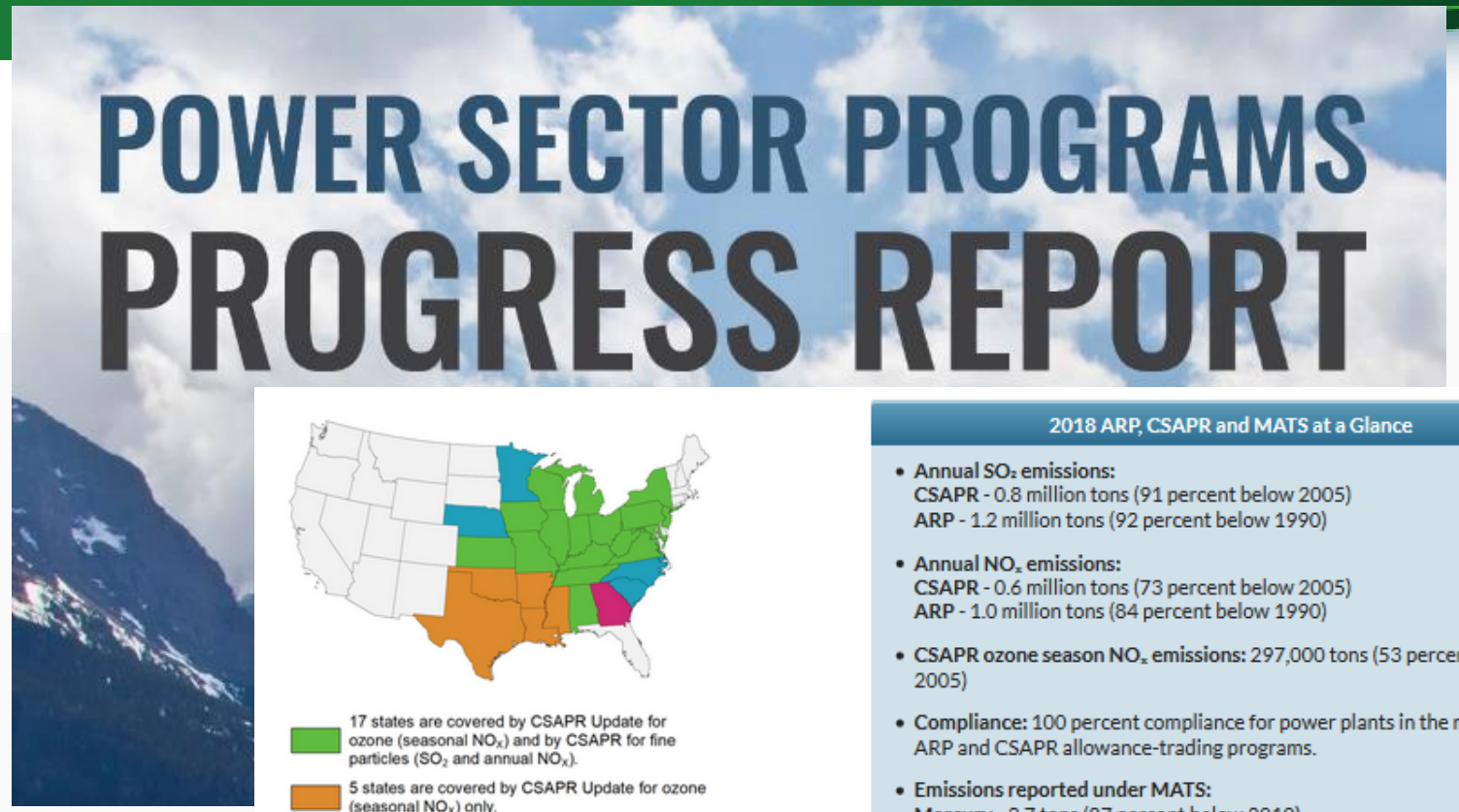
POWER SECTOR PROGRESS REPORT

Summarizes results from the many amazing tools/databases that you just learned about

Web-Based Tool and Document

Provides overview of:

1. Program Basics
2. Covered Units
3. Emission Reductions
4. Emissions Controls and Monitoring
5. Program Compliance
6. Market Activity
7. Air Quality
8. Acid Deposition
9. Ecosystem Response



17 states are covered by CSAPR Update for ozone (seasonal NO_x) and by CSAPR for fine particles (SO_2 and annual NO_x).

5 states are covered by CSAPR Update for ozone (seasonal NO_x) only.

4 states are covered by CSAPR for fine particles (SO_2 and annual NO_x) only.

Georgia is covered by CSAPR for both fine particles (SO_2 and annual NO_x) and ozone (seasonal NO_x).

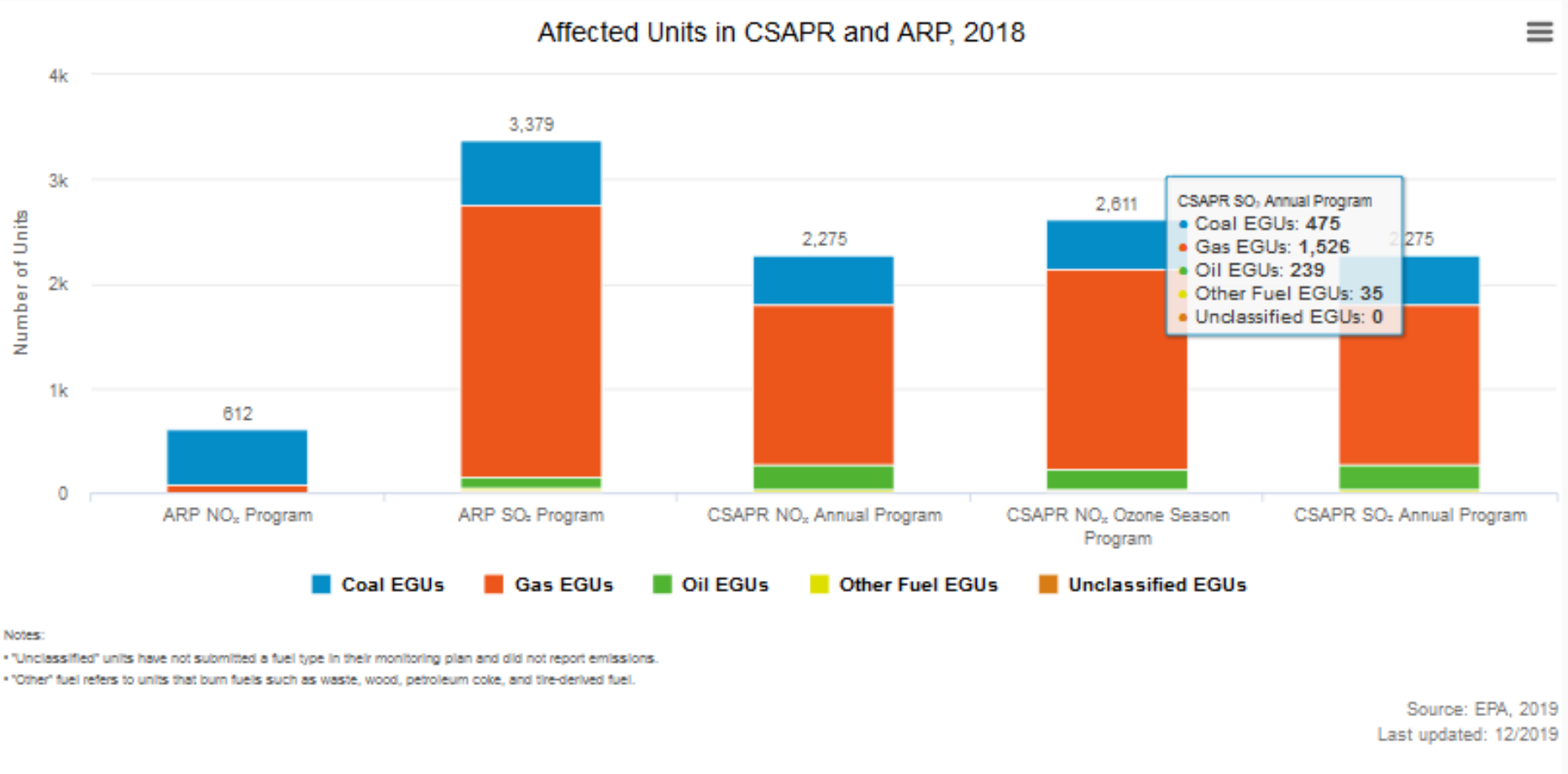
The ARP covers sources in the lower 48 states.

The MATS covers sources in all 50 states and US territories.

2018 ARP, CSAPR and MATS at a Glance

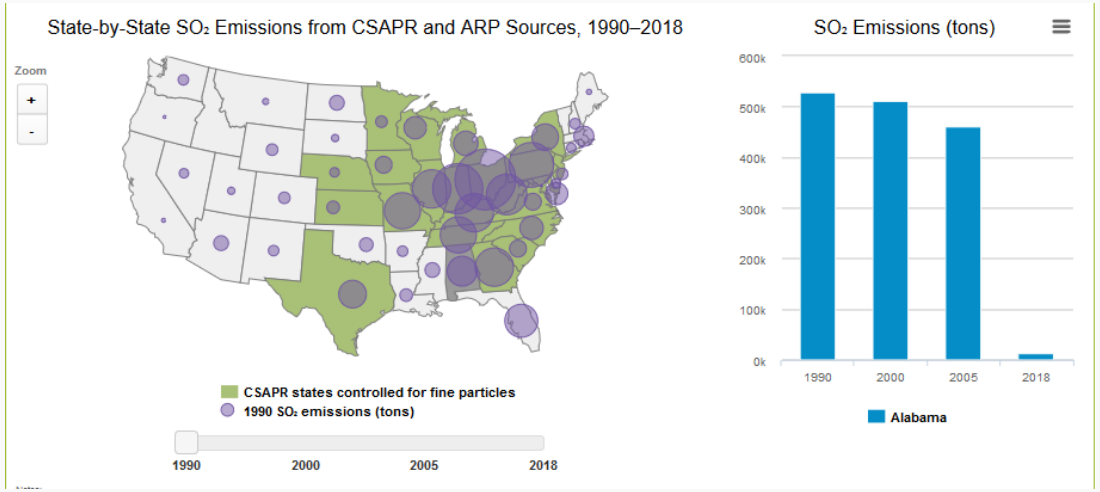
- **Annual SO_2 emissions:**
  CSAPR - 0.8 million tons (91 percent below 2005)
  ARP - 1.2 million tons (92 percent below 1990)
- **Annual NO_x emissions:**
  CSAPR - 0.6 million tons (73 percent below 2005)
  ARP - 1.0 million tons (84 percent below 1990)
- **CSAPR ozone season NO_x emissions:** 297,000 tons (53 percent below 2005)
- **Compliance:** 100 percent compliance for power plants in the market-based ARP and CSAPR allowance-trading programs.
- **Emissions reported under MATS:**
  Mercury - 3.7 tons (87 percent below 2010)
- **Ozone NAAQS attainment:** Based on 2016–2018 data, 88 of the 92 areas in the East originally designated as nonattainment for the 1997 ozone NAAQS are now meeting the standard, while the remaining 4 areas had incomplete data.
- **$PM_{2.5}$ NAAQS attainment:** Based on 2016–2018 data, 35 of the 39 areas in the East originally designated as nonattainment for the 1997 $PM_{2.5}$ NAAQS are now meeting the standard (one area has incomplete data).
- **Wet sulfate deposition:** All areas of the eastern United States have shown significant improvement with an overall 66 percent reduction in wet sulfate deposition from 2000–2002 to 2016–2018.
- **Levels of acid neutralizing capacity (ANC):** This indicator of recovery improved (i.e., increased) significantly from 1990 levels at lake and stream monitoring sites in the Adirondack region, New England and the Catskill mountains.

- Data gathered from Air Markets Program Data (AMPD)
- Summarizes number of units in each CSAPR and ARP program
- Data available in Excel sheets for easy download



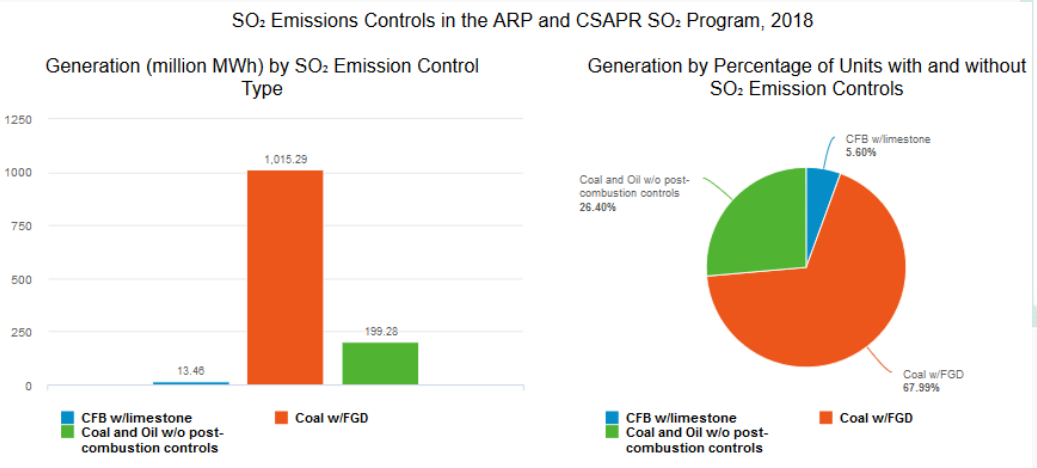
Emissions Reductions

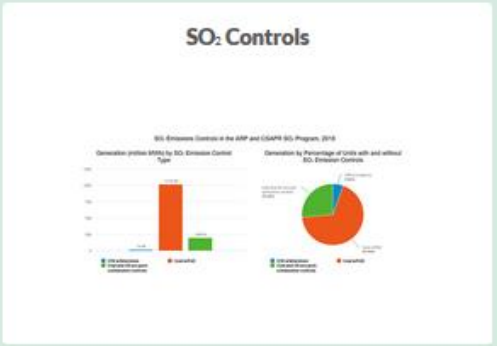
- Data gathered from Air Markets Program Data (AMPD)
- Data available in Excel sheets for easy download
- Provides emission trends, state-by-state trends, and emissions/generation data for the following pollutants:
  - sulfur dioxide,
  - annual nitrogen oxides,
  - ozone season nitrogen oxides, and
  - mercury

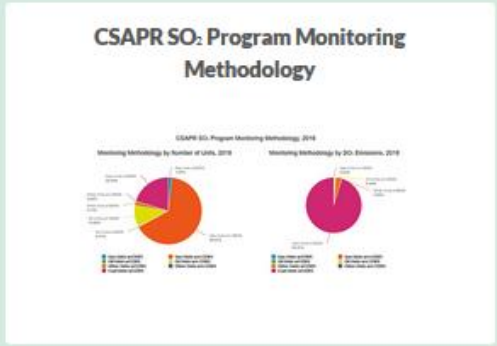


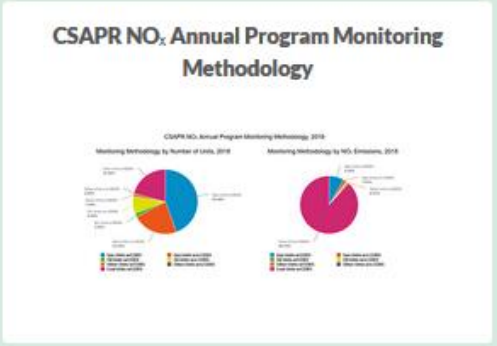
Emissions Controls and Monitoring

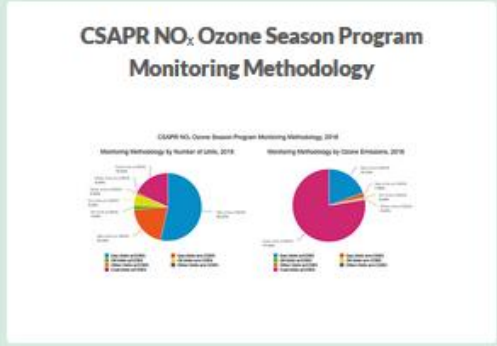
- Data gathered from AMPD
- Summarizes types of controls used and how many units are monitoring with Continuous Emissions Monitoring Systems (CEMS)

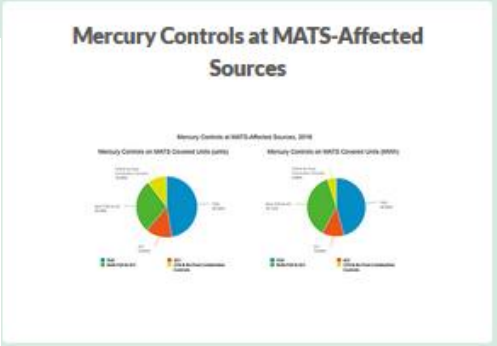












Program Compliance

- Data gathered by AMPD
- Summarizes program allowance reconciliation data for each program under ARP and CSAPR

Acid Rain Program SO_2 Program Allowance Reconciliation Summary, 2018

Total Allowances Held (1995 - 2018 Vintage)	**53,451,159**	Held by Affected Facility Accounts	**34,991,787**
		Held by Other Accounts (General and Non-Affected Facility Accounts)	**18,459,372**
Allowances Deducted for Acid Rain Compliance*	1,275,351		
Penalty Allowance Deductions	0		
Banked Allowances	**52,175,808**	Held by Affected Facility Accounts	**33,716,436**
		Held by Other Accounts (General and Non-Affected Facility Accounts)	**18,459,372**

* Allowances deducted for ARP Compliance Includes 29,696 allowances deducted from opt-ins for reduced utilization.

ARP SO_2 Program Compliance Results

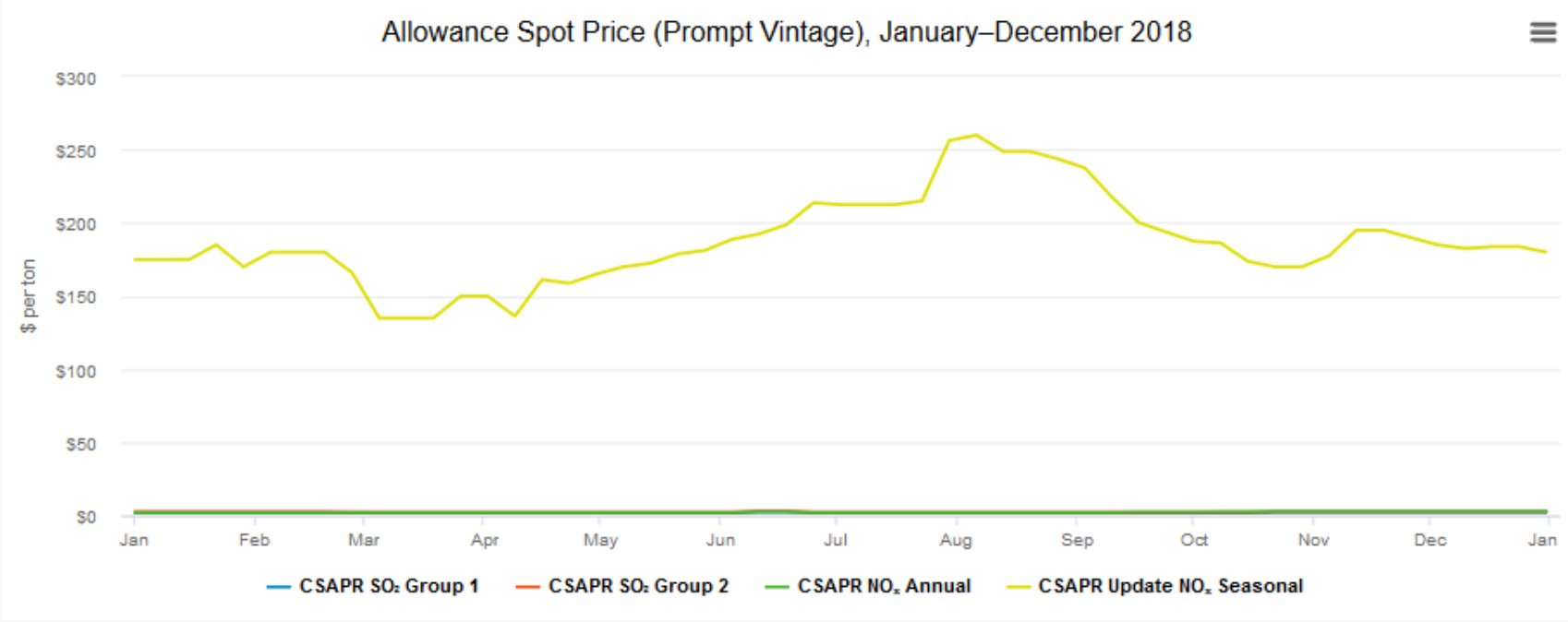
Reported Emissions (tons)	**1,245,696**
Compliance issues, rounding, and report resubmission adjustments (tons)	**-41**
Emissions not covered by allowances (tons)	**0**
Total allowances deducted for emissions	**1,245,655**

Market Activity

- Data gathered from AMPD and a non-EPA source
- Summarizes allowance transfers under each program as well as allowance spot price data

2018 Allowance Transfers under CSAPR and ARP

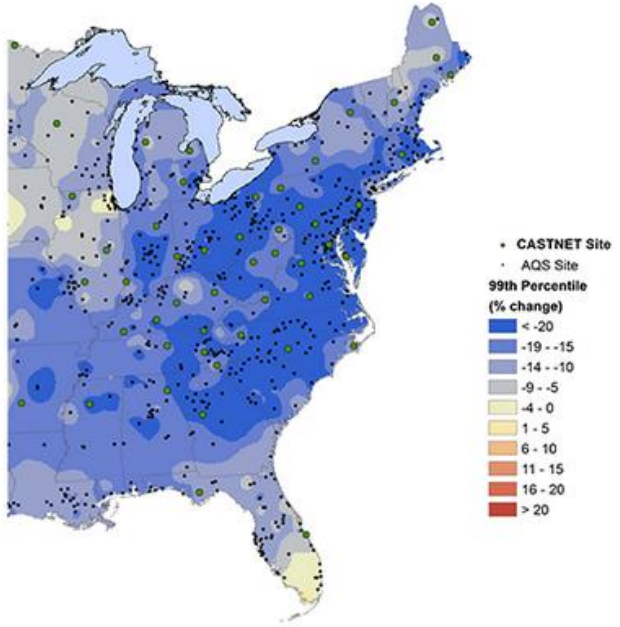
	Transactions Conducted	Allowances Transferred	Share of Program's Allowances Transferred	
			Related (%)	Distinct (%)
ARP SO_2	754	9,433,556	89%	11%
CSAPR SO_2 Group 1	254	350,962	80%	20%
CSAPR SO_2 Group 2	65	48,995	48%	52%
CSAPR NO_x Annual	572	105,855	71%	29%
CSAPR NO_x Ozone Season Group 1	20	1,463	98%	2%
CSAPR NO_x Ozone Season Group 2	708	94,622	60%	40%



Air Quality

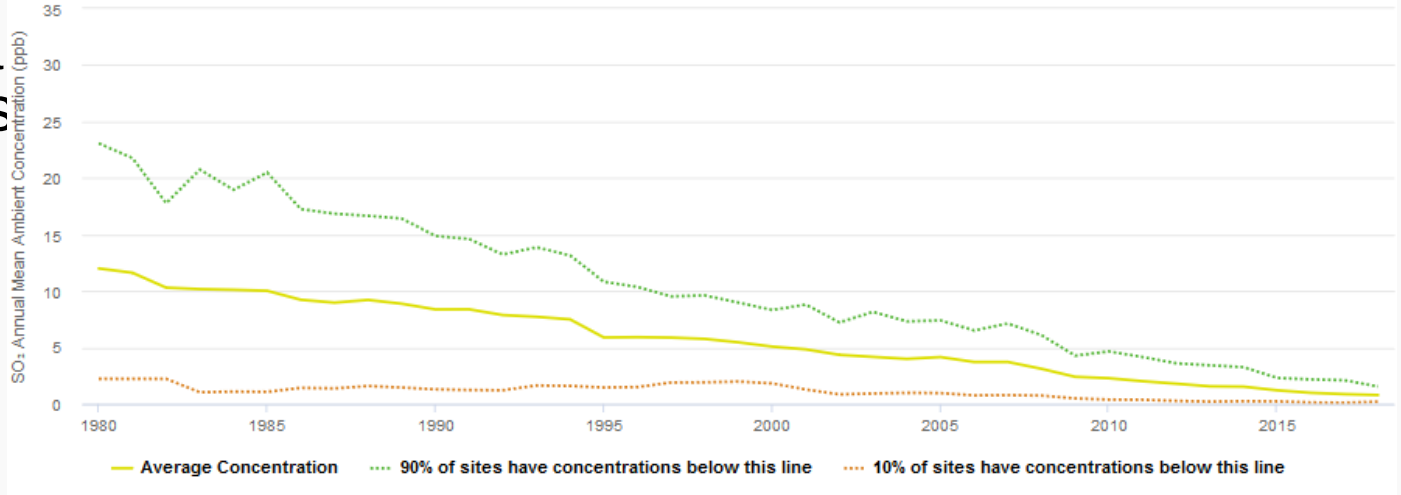
- Data gathered from the Clean Air Status and Trends Network (CASTNET) and another EPA office
- Summarizes trends in regiona air quality, trends in ozone, and trends in PM2.5

Percent Change in the Highest Values (99th percentile) of 1-hour Ozone Concentrations during the Ozone Season, 2000–2002 versus 2016–2018



Changes in the 1997 Annual $PM_{2.5}$ NAAQS Nonattainment Areas in CSAPR States, 2001–2003 (Original Designatio versus 2016–2018

National SO_2 Air Quality Trend, 1980–2018

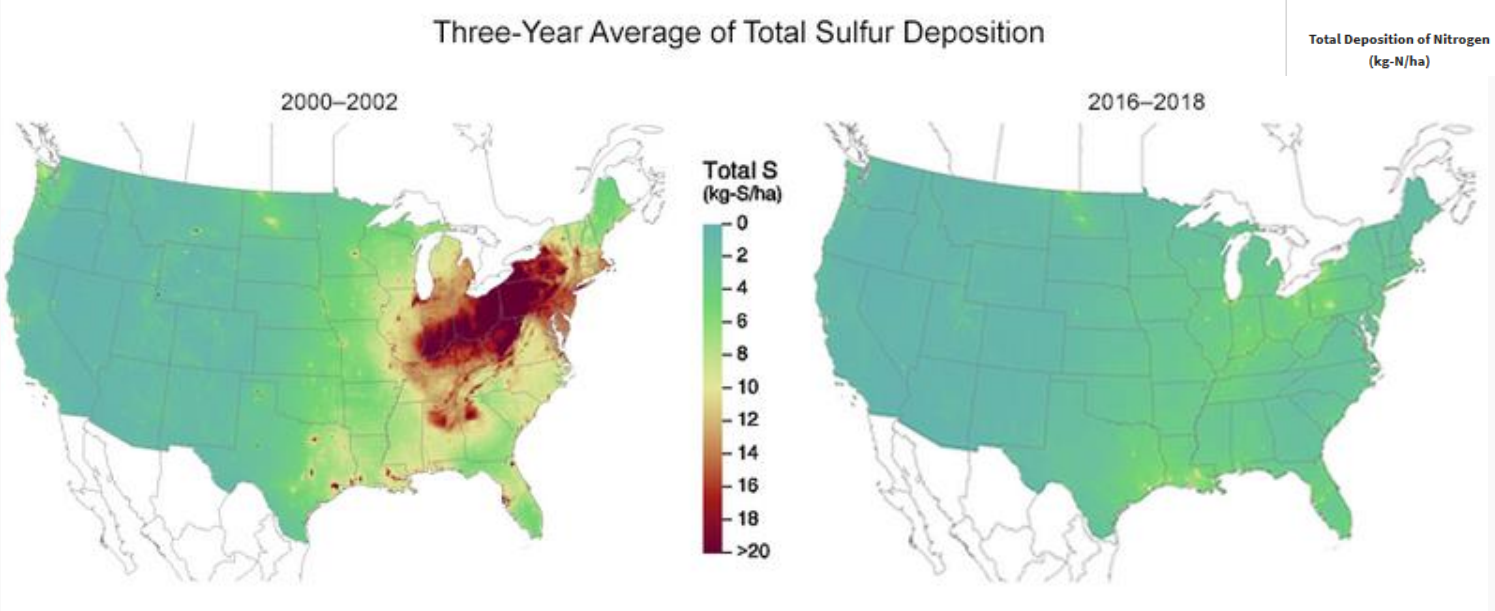


Acid Deposition

- Data gathered from CASTNET and a partner monitoring program
- Summarizes wet, dry, and total deposition for sulfur and nitrogen species

Regional Trends in Deposition

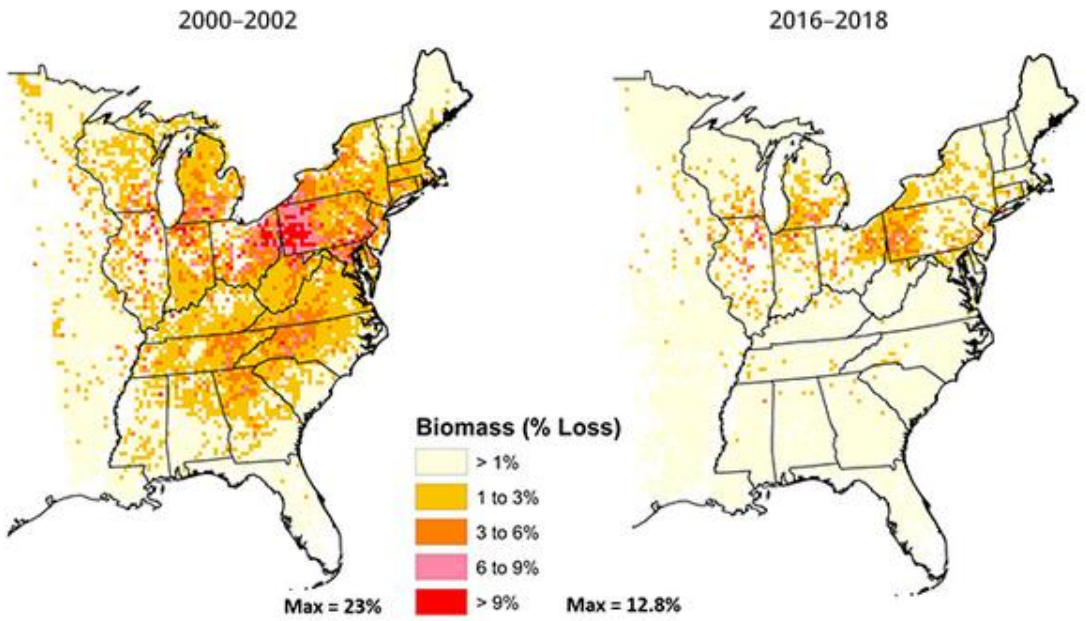
Measurement	Region	Annual Average, 2000–2002	Annual Average, 2016–2018	Percent Change
Dry Nitrogen Deposition (kg-N/ha)	Mid-Atlantic	9.9	6.1	-38
	Midwest	7.0	5.0	-29
	North Central	4.7	4.7	0
	Northeast	6.1	3.4	-44
	Pacific	2.7	2.2	-19
	Rocky Mountain	2.3	2.0	-13
	South Central	5.8	4.9	-16
	Southeast	6.7	4.5	-33
Wet Nitrogen Deposition (kg-N/ha)	Mid-Atlantic	4.8	4.0	-17
	Midwest	5.9	5.4	-8.0
	North Central	4.5	5.1	13
	Northeast	4.8	3.3	-31
	Pacific	1.0	1.1	10
	Rocky Mountain	1.5	1.6	7.0
	South Central	4.0	4.0	0
	Southeast	4.0	3.5	-13
Total Deposition of Nitrogen (kg-N/ha)	Mid-Atlantic	14.7	10	-32
	Midwest	12.9	10.4	-19
	North Central	9.2	9.8	7.0
	Northeast	10.9	6.7	-39
	Pacific	3.7	3.3	-11

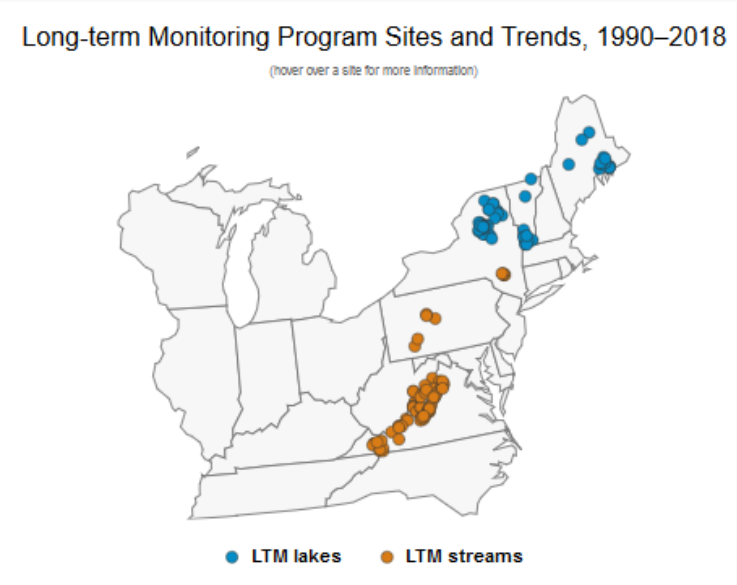


Ecosystem Response

- Data gathered from our divisions' Long-Term Monitoring program, which monitors surface water chemistry
- Summarizes trends in regional water bodies as well as trends in critical loads

Estimated Black Cherry, Yellow Poplar, Sugar Maple, Eastern White Pine, Virginia Pine, Red Maple, and Quaking Aspen Biomass Loss Due to Ozone Exposure, 2000-2002 versus 2016-2018





Regional Trends in Sulfate, Nitrate, ANC, and Base Cations at Long-term Monitoring Sites, 1990–2018

Region	Water Bodies Covered	% of Sites with Improving Sulfate Trend	% of Sites with Improving Nitrate Trend	% of Sites with Improving ANC Trend	% of Sites with Improving Base Cations Trend
Adirondack Mountains	38 lakes in NY*	100%	81%	86%	92%
New England	26 lakes in ME and VT	100%	32%	82%	67%
Catskills/ N. Appalachian Plateau	9 streams in NY and PA**	80%	78%	70%	90%
Central Appalachians	66 streams in VA	52%	59%	6%	41%

Wrap-Up

A full video and audio recording of this session along with this PowerPoint will be made available on https://ecmps.camdsupport.com/webinars.shtml. Materials from previous Ask CAMD sessions are also located there.

Thank you for joining us! If you have any questions, please review the full agenda and direct your questions to the appropriate contact person.