

Elizabeth Landis¹, Joann Rice¹, Michael Schlatt², Peter Ahn¹
¹ U.S. Environmental Protection Agency; Office of Air Quality Planning and Standards; Research Triangle Park, North Carolina 27711
² Battelle; Columbus, Ohio 43201
³ Special Technology Solutions, LLC; Westerville, Ohio 43082

In 2014, an assessment was conducted of the Chemical Speciation Network (CSN). Historically, the CSN has consisted of the Speciation Trends Network (STN), a core set of 52 speciation trends analysis sites, as well as a variable number of Supplemental sites. The STN sites and the majority of the Supplemental sites utilize a national EPA contract for shipping, handling and laboratory analysis. The recommendations from the CSN assessment were implemented in September 2014 through January 2015.

In mid-2015, an assessment was conducted of the Interagency Monitoring of Protected Visual Environments (IMPROVE) Protocol sites. These sites are considered CSN Supplemental sites when the monitoring agencies chose to operate them as IMPROVE Protocol sites when the CSN was established. They are operated under the National Park Service (NPS) contract and use IMPROVE samplers and IMPROVE's laboratory analysis contract. They were excluded from the 2014 CSN Assessment because it only considered sites using the CSN national contract for shipping, handling, and laboratory analysis. The CSN and IMPROVE Protocol Assessments used the same objectives-based approach and nearly identical evaluation criteria.

APPROACH

An objectives based approach was taken in an effort to optimize the network to meet the primary objectives, which include support of PM_{2.5} implementation, aiding in interpretation of health effects and exposure research studies, and the detection of trends.

A two-step decision-making process was utilized to make recommendations regarding the continued funding of 174 CSN sites using EPA's national contract and the 38 IMPROVE Protocol sites using IMPROVE's national contract. Fifteen CSN sites that do not use the national contract were not considered in the assessment process.

DECISION CRITERIA

Step 1: Primary Objectives Scoring

Sites were evaluated and provided points according to the table below for meeting the primary objectives of the network.

Parameter	Points
National Core (NCore) site	+5
Site annual Design Value (DV) > 12 µg/m ³	+5
24-hr DV > 35 µg/m ³	+5
STN site	+4
County annual DV > 12 µg/m ³ and site annual DV ≤ 12 µg/m ³	+3
County 24-hr DV > 35 µg/m ³ and site 24-hr DV ≤ 35 µg/m ³	+3
Collocated with a PM _{2.5} Daily Federal Reference Method (FRM) monitor	+3
Health effects/exposure city of interest	+3
Continuous monitor(s) (i.e., OC/EC, sulfate)	+2
Collocated* with IMPROVE, National Air Toxics Trends Stations (NATTS) or Photochemical Assessment Monitoring Stations (PAMS)	+1/network

*Although collocation did not meet a "primary objective", it did meet an assessment goal of leveraging with existing networks.

Step 2: Decision Matrix for 102 Sites

A matrix was created using the scoring outlined in the table below to further determine funding recommendations for the 102 sites scoring ≤ 3 points in Step 1. Positive points were applied for parameters that added value. Negative points were applied for parameters that did not add value.

Parameter	Range	CSN Pts	IMPROVE Protocol Pts
Annual DV (if applicable)	10-10.9 µg/m ³	+1	
	11-11.4 µg/m ³	+2	
	≥ 11.5 µg/m ³	+3	
24-hr DV (if applicable)	30-31 µg/m ³	+1	
	32-33 µg/m ³	+2	
	≥ 34 µg/m ³	+3	
Population	≥ 1 Million	+1	
County Emission Rank	Top 1.1-5%	+1/pollutant ^A	
	Top 1%	+2/pollutant ^A	
Nearest Speciation Site (CSN or IMPROVE)	> 200 km	+1	
Statistically significant increase in trend concentration	n/a	+1/pollutant ^B	
Increased model bias or error if site removed ^C	n/a	+1/pollutant ^D	n/a
Correlation with major species at the nearest 5 speciation (CSN or IMPROVE) sites ^E .	R > 0.75 for ALL major species	-5 (regardless of # of sites)	
	R > 0.75 for PM _{2.5}	-1/site	
	R > 0.75 for SO ₄	-0.2/site	-0.25/site
	R > 0.75 for NO ₃	-0.2/site	-0.25/site
	R > 0.75 for OC	-0.2/site	-0.25/site
	R > 0.75 for EC	-0.2/site	-0.25/site
	R > 0.75 for NH ₄	-0.2/site	n/a ^E
Nearest 5 speciation (CSN or IMPROVE) sites	< 150 km	-1	
Nearest CSN Site	< 50 km	-1	

^A Pollutants considered using 2011 National Emissions Inventory (NEI): PM_{2.5}, SO₄, NO₃, OC, EC, VOCs & SO₂.

^B Pollutants considered (> 75% records above MDL and overall average precision < 10% for 2010-2012): PM_{2.5}, SO₄, NO₃, OC, EC, NH₄, Fe, S, K, Ca, Na, Si, Cu, Br and Zn.

^C Only evaluated in the 2014 CSN assessment.

^D Pollutants considered: PM_{2.5}, SO₄, NO₃, total carbon and NH₄.

^E Major species considered: PM_{2.5}, SO₄, NO₃, OC, EC and NH₄ (when applicable).

RECOMMENDATIONS

Recommendation #1 - Eliminate the CSN PM_{2.5} mass measurement

- Extensive analysis has been conducted demonstrating that the CSN and FRM PM_{2.5} mass measurements compare well. Any differences in the measurement can primarily be explained by the differences in the measurement techniques (e.g., sample volume, sampler design, etc.).
- A quality assurance check can still be conducted by performing a mass balance and comparing it to a collocated FRM or nearby FRM or Federal Equivalent Method (FEM) PM_{2.5} mass monitors.
- The CSN PM_{2.5} mass measurement was eliminated in Oct. 2014 (last sample 9/29/14)

Recommendation #2 - Reduce sample frequency at 3 CSN Sites

- Sample frequency was reduced to 1-in-6 at CSN Supplemental sites that are not NCore or STN in January 2015 (Arnold West, MO, Wylam, AL and Albany, NY).

Recommendation #3 - Reduce carbon blank collection frequency in the CSN

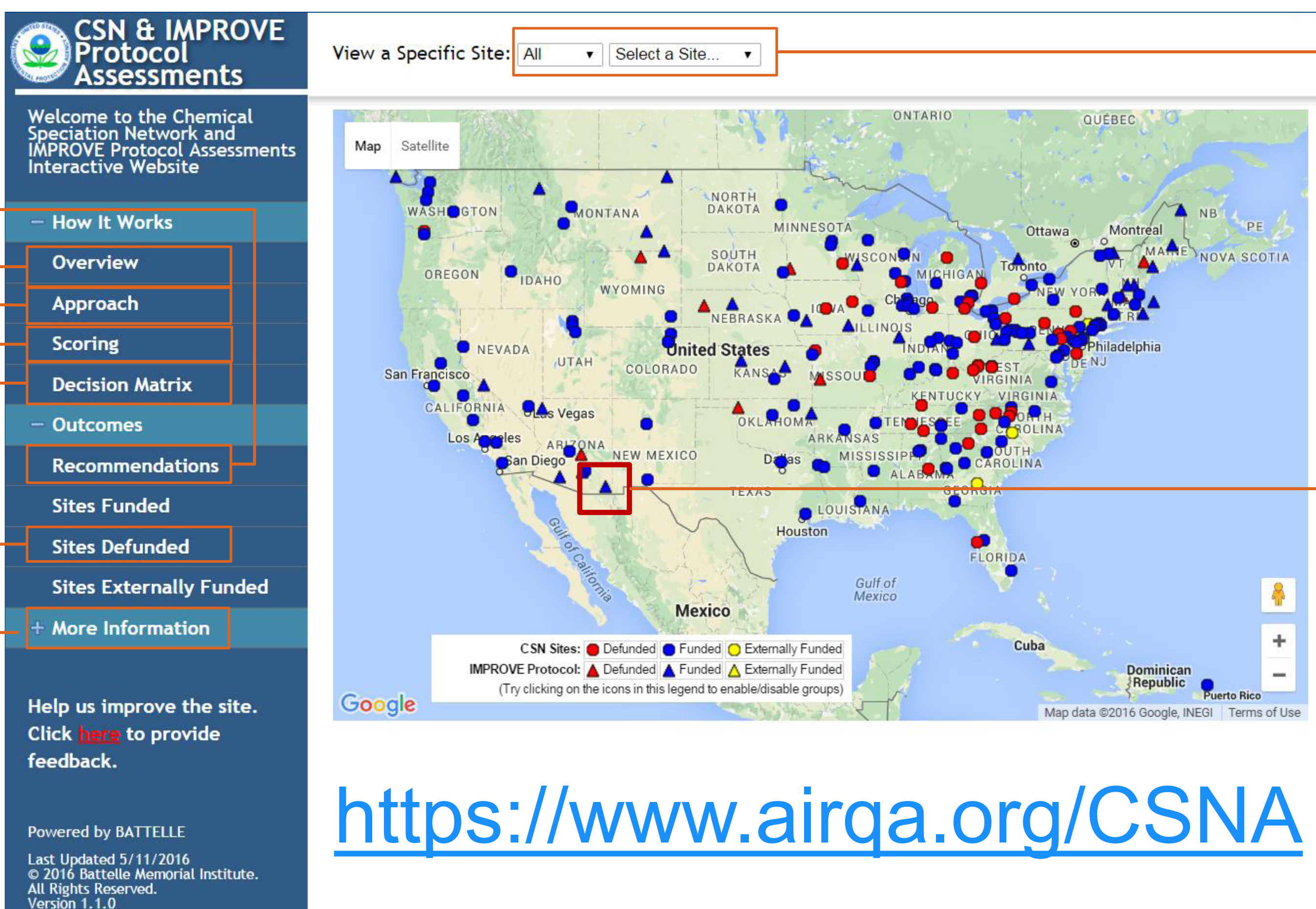
- Carbon backup filter blanks were eliminated in January 2015.
- The number of field blank filters were reduced to the lowest level needed to adequately support organic carbon (OC) artifact correction for the CSN.
- As of February 2015, carbon field blanks are collected at 26 representative 1-in-3 day CSN sites and 23 representative 1-in-6 day CSN sites at a frequency of 1 per month.
- The full report on the recommendations for field blank collection for the CSN can be found on the assessment website.

Recommendation #4 - Reduce ice packs in shipping in the CSN

- The number of icepacks included in sample shipments was reduced in October 2014 from 8 to 6 during the cooler months of the year (October 1 - March 31).

Recommendation #5 - Defund CSN and IMPROVE Protocol sites

- After incorporating decision criteria scoring, intangibles, and feedback from stakeholders, 38 CSN sites were defunded by January 2015 and 8 IMPROVE Protocol sites were defunded by January 2016.



View a Specific Site: All | Select a Site

https://www.airqa.org/CSNA

DEFUNDED SITES

CSN Sites					
AQS Site ID	Site Name	State	AQS Site ID	Site Name	State
01-089-0014	Huntsville Old Airport	AL	37-057-0002	Lexington	NC
01-101-1002	MOMS	AL	37-159-0021	Rockwell	NC
10-001-0003	Dover	DE	39-049-0081	Columbus - Maple Canyon	OH
12-103-0026	Skyview (Pinellas County)	FL	39-087-0012	ODOT Garage	OH
13-059-0001	Athens	GA	39-095-0026	Toledo Airport	OH
18-039-0008	Elkhart Prarie Street	IN	39-099-0014	Head Start	OH
19-113-0040	Linn County Health	IA	42-011-0011	Reading Airport	PA
19-153-0030	Public Health Building	IA	42-027-0100	State College	PA
21-019-0017	Ashland Health Dept	KY	42-043-0401	Harrisburg	PA
21-043-0500	Grayson Lake	KY	42-049-0003	Erie	PA
21-067-0012	Lexington Health Dept	KY	42-069-2006	Scranton	PA
26-113-0001	Houghton Lake	MI	42-133-0008	York	PA
26-115-0006	Sterling Park	MI	45-045-0015	Greenville ESC	SC
26-147-0005	Port Huron	MI	47-037-0023	Lockeland School	TN
27-109-5008	Rochester	MN	47-065-4002	UTC	TN
29-047-0005	Liberty	MO	47-099-0002	Lawrence County	TN
29-186-0005	Bonne Terre	MO	53-011-0023	VANNEVAN	WA
37-021-0034	Buncombe Co. Board of Edu.	NC	54-039-1005	South Charleston Library	WV
37-035-0004	Hickory	NC	55-133-0027	Waukesha - Cleveland Ave.	WI

IMPROVE Protocol Sites					
AQS Site ID	Site Name	State	AQS Site ID	Site Name	State
04-021-8001	Queen Valley (QUVA1)	AZ	29-039-0001	EI Dorado Springs (ELDO1)	MO
23-005-0002	Bridgton (BRMA1)	ME	31-069-9000	Crescent Lake (CREST1)	NE
25-015-4002	Quabbin Reservoir (QURE1)	MA	40-045-0890	Ellis (ELL11)	OK
27-133-9000	Blue Mounds (BLMO1)	MN	56-019-9000	Cloud Peak (CLPE1)	WY

Website and poster design completed by Battelle under EPA contract EP-D-13-005

EXAMPLE OF SITE DETAILS

04-003-1005: Douglas (DOUG1)

Primary Objectives Scoring:

Network	IMPROVE Protocol
Speciation Trends Network	No
Region	9
Population	131346
Latitude	31.3492065
Longitude	-109.5397315
Frequency	1-in-3

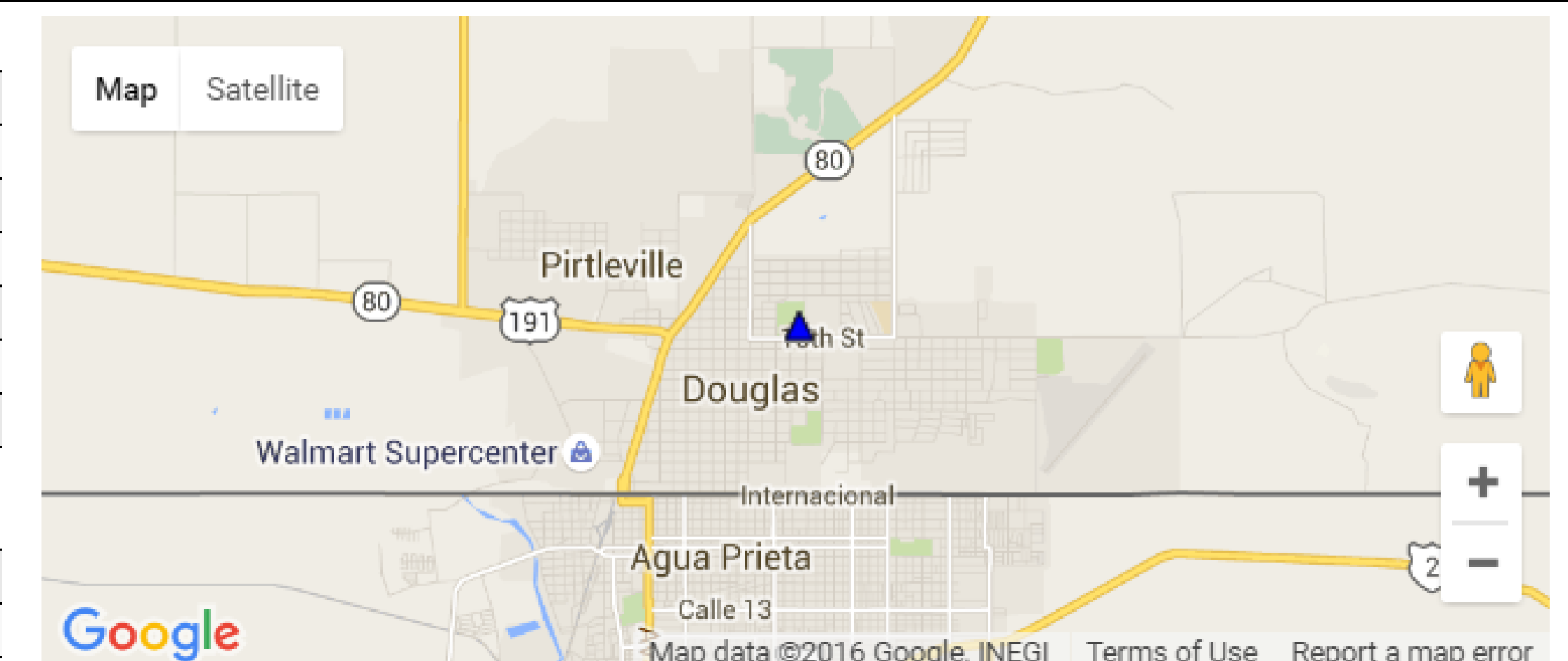
Collocation with Other Networks

NCore	No	IMPROVE	No
PAMS	No	NATTS	No

Daily FRM	No
2010-2012 Annual DV (µg/m ³)	6.7
2010-2012 24hr DV (µg/m ³)	12
County Annual DV (µg/m ³)	n/a
County 24hr Annual DV (µg/m ³)	n/a
Continuous Sunset or Sulfate	No
Health Effects City of Interest	No

Primary Objectives Score: 0

This site required further analysis



Additional Decision Matrix Scoring Parameters:

County Rank for 2011 NEI Emissions (of 3238 counties in 2011 NEI)	
PM _{2.5}	11
SO ₄	27
NO ₃	8
OC	9
EC	11
NH ₄	42
VOC	14
SO ₂	238

Number of Sites (of the nearest 5) with Correlation R>0.75 for:

PM _{2.5}	0	SO ₄	3
NO ₃	0	OC	0
EC	0	NH ₄ (if appl.)	n/a

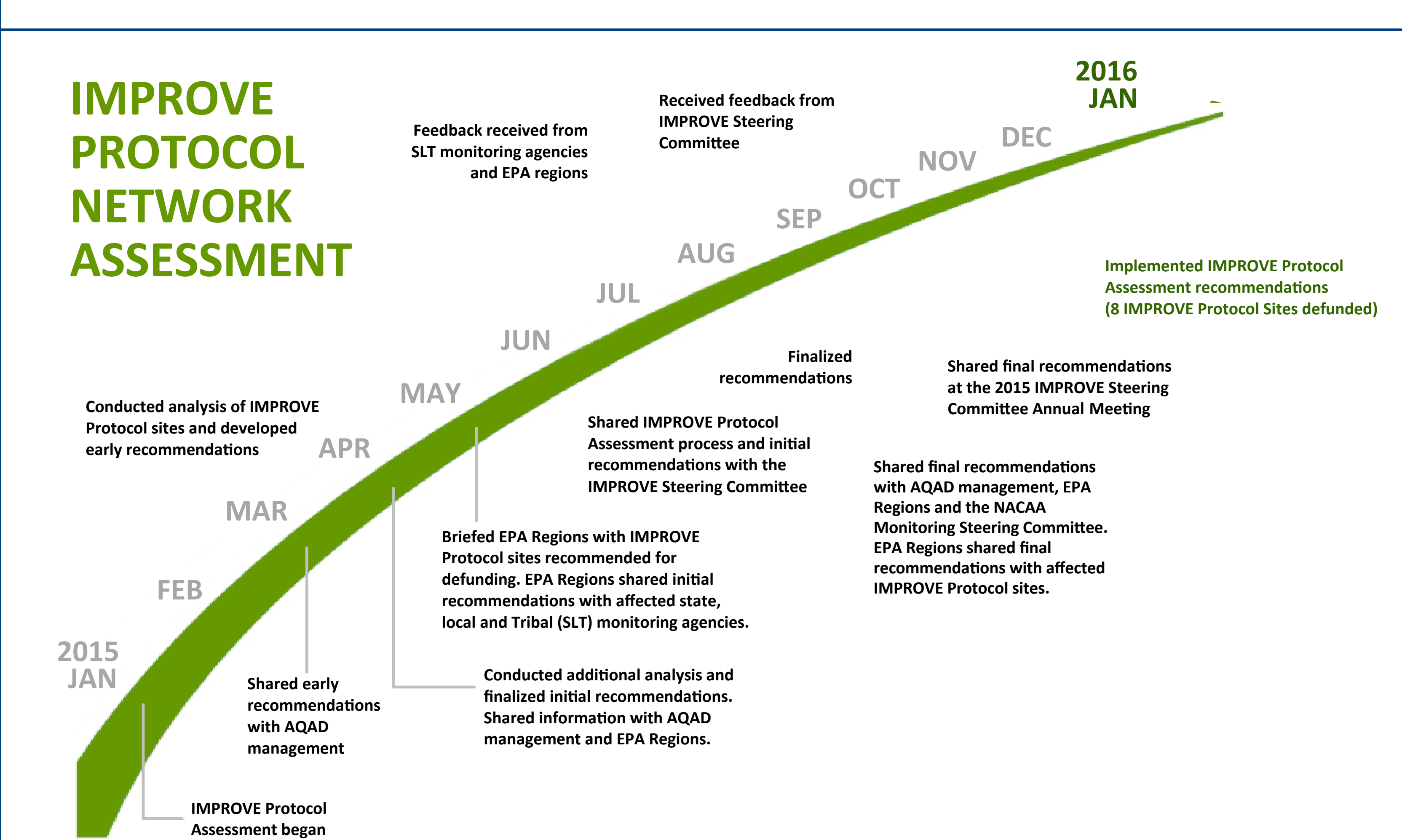
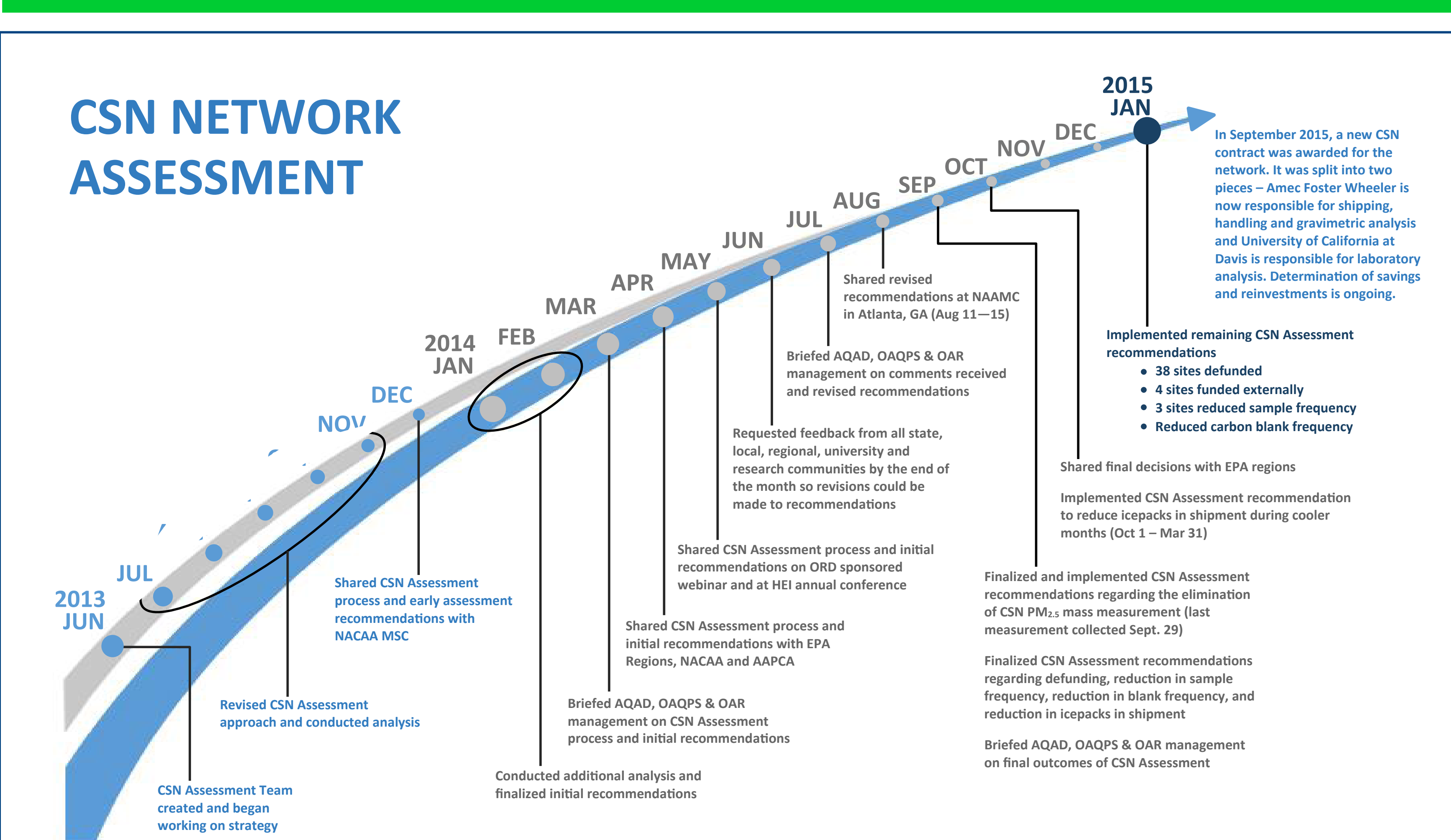
Distance to Closest Site (km): 75
 Distance to 5th Closest Site (km): 296

Increased Model Bias Error (if Site Defunded): No

Statistically Significant Increase in Concentration Trends: n/a

*The following compounds were considered: PM_{2.5}, SO₄, NO₃, OC, EC, NH₄, Fe, S, K, Ca, Na, Si, Cu, Br & Zn

ASSESSMENT TIMELINES



Acknowledgements:

- The following people were involved with the analysis & helped determine recommendations in the CSN Assessment:
- Beth Landis, Joann Rice, Lewis Weinstock, Tim Hanley, Adam Reff, Neil Frank, Liz Naess, Jim Kelly, Beth Palma, & Tesh Rao - EPA Office of Air Quality Planning and Standards (OAQPS)
 - Beth Hassett-Sipple - EPA Office of Research and Development (ORD)
 - Alan VanArsdale - EPA Region 1
 - Daniel Garver - EPA Region 4
 - Rich Poirot - National Association of Clean Air Agencies (NACAA)