The Role of Air Monitoring in SIP Planning

MARAMA SIP Workshop

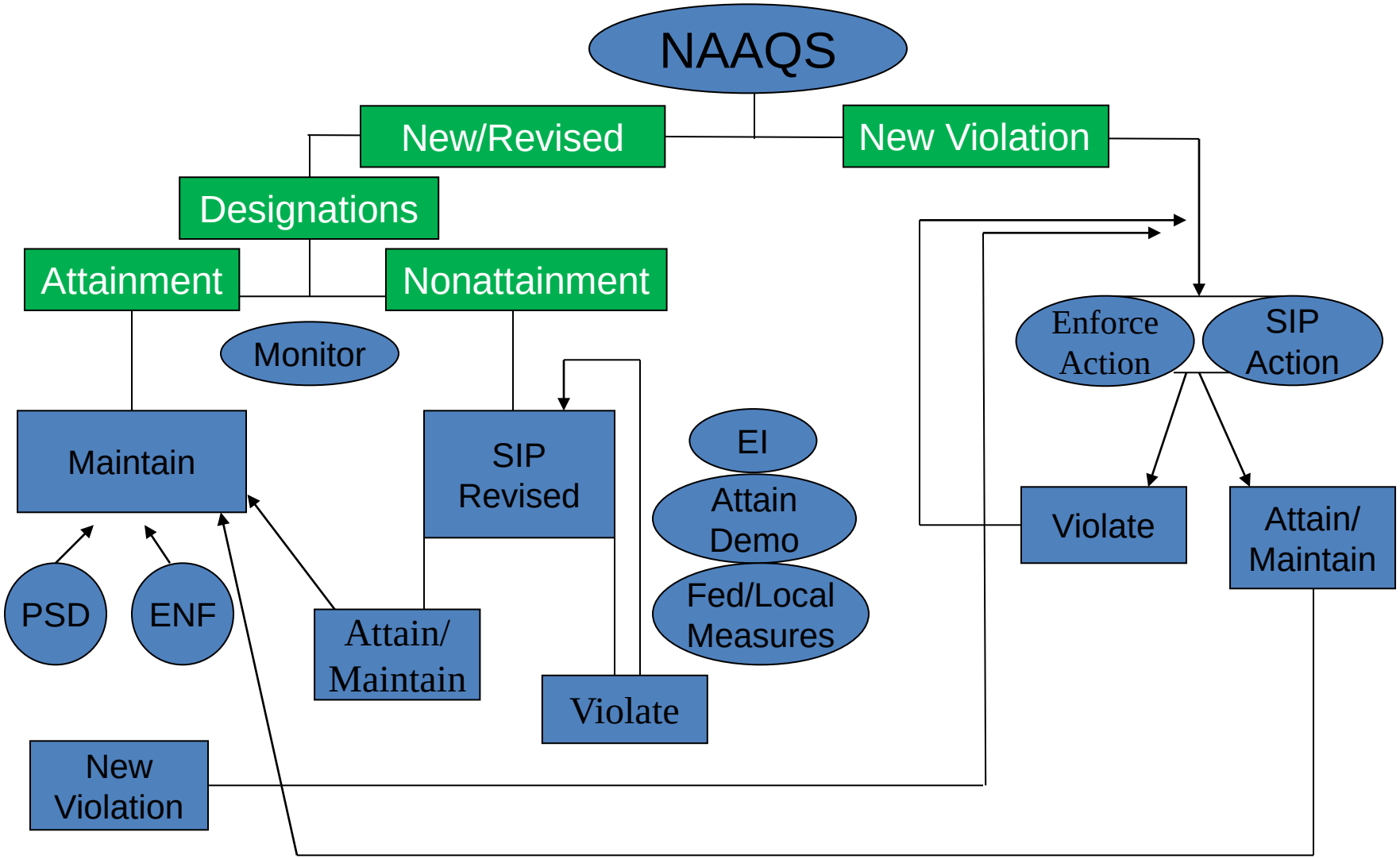
May 17, 2023

Webex

Josh Shapiro, Governor

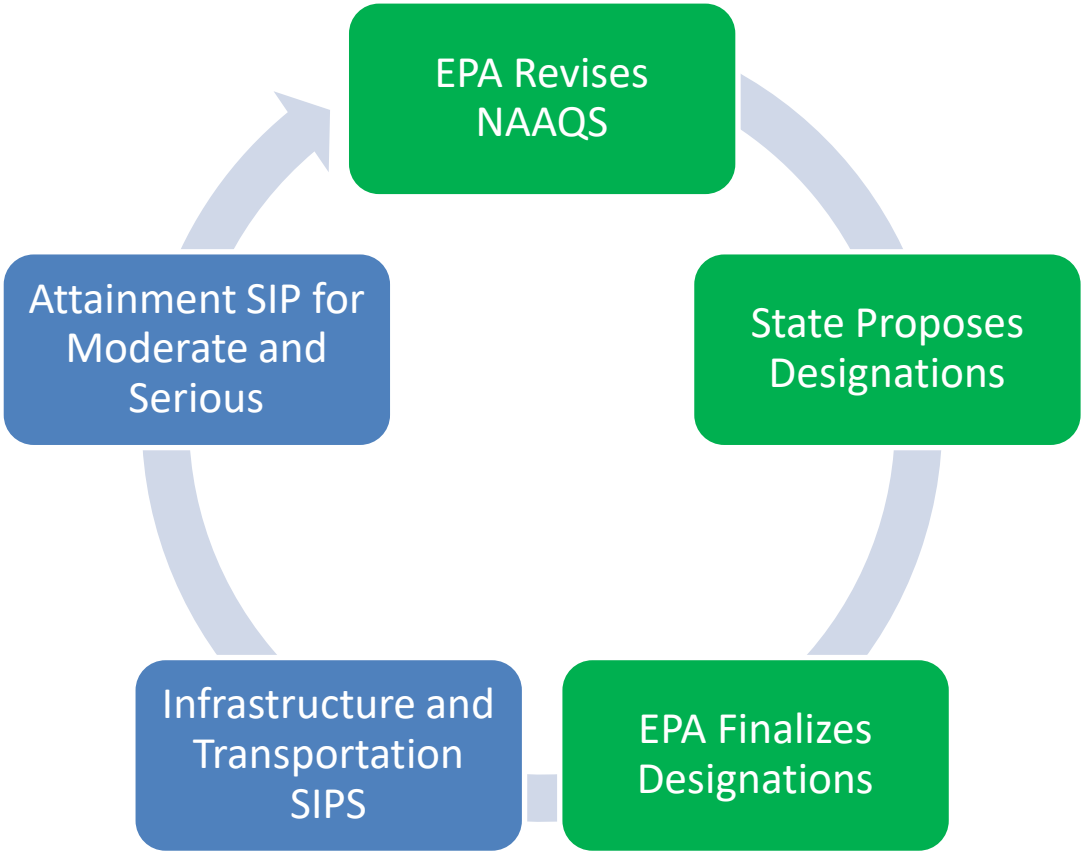
Richard Negrin, Acting Secretary

Air Quality Management Process



Borrowed from US EPA's SIP 101 presentation.
https://cfpub.epa.gov/oarwebadmin/sipman/sipman/Content/chap1/SIP101.ppt

SIP Process Simplified



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Air Monitoring Network

- Ambient Air Monitors
  - Discrete or Continuous
  - NAAQS compliance, special studies, community concerns
- Strict siting, operation, and QA/QC requirements
- Certified data submitted to EPA AQS database

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Types of Air Monitoring Networks

- Types of networks
  - SLAMS- criteria pollutants
  - PAMS- ozone precursors
  - NAMS- subset of SLAMS and PAMS
  - Ncore- advanced multi-pollutant sites
  - SPMS- special purpose/short-term goals
  - Other networks: IMPROVE, CASTNet, Toxics, and more

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Monitoring Networks in Pennsylvania

- DEP's
  - Approx. 70 monitoring sites in 40 counties
- Allegheny County Health Department's
  - 9 monitoring sites
- Philadelphia County Health Department's
  - 10 monitoring sites
- IMPROVE and CASTNet programs

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Monitoring Data's Purpose

- **To demonstrate compliance with the NAAQS**

- Also…
  - Reporting and Forecasting
  - Modeling and Research
  - Validation and Verification
  - Address Community Concerns

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

National Ambient Air Quality Standards

Pollutant [hyperlinks to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		Primary and Secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		Primary and Secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	Primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		Primary and Secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Design Values

- Design Values calculated as prescribed in the NAAQS

  - Example: PM 2.5 (2012 annual standard)
    "annual mean, averaged over 3 years" in $\mu g/m^3$

    2020 – 7.8
    2021 – 9.6
    2022 – 8.4

    $$\text{Annual Mean over 3 years} = \frac{(7.8 + 9.6 + 8.4)}{3} = 8.6$$

    Design Value = 8.6 $\mu g/m^3$

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Controlling Design Value

- ‘Controlling’ Design Value is the highest design value within the defined area

  - Example: An attainment / non-attainment area has three PM2.5 monitors at three different sites

    Annual PM2.5 Design Values at Each Site

    Site Alpha = 8.6 µg/m^3
    Site Beta = 8.6 µg/m^3
    Site Gamma = 9.3 µg/m^3

    Controlling Design Value = 9.3 µg/m^3

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Designation Process

- Unclassifiable/Attainment or Non-Attainment
- EPA's Five Factor Analysis
  - Monitoring data
  - Emissions and emission-related data
  - Meteorology
  - Topography/Geography
  - Jurisdictional Boundaries
- Additional Factors for SLTs
  - Metropolitan Statistical Area (MSA)
  - History regarding other NAAQS

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Redesignation

- Five Conditions
  - NAAQS Attained
  - SIP fully approved
  - “Permanent and enforceable reductions in emissions”
  - Section 110 and Part D requirements met
  - Approved maintenance plan

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Maintenance Plan

- Maintenance Plan – A Revised SIP
  - For a total of 20 years
  - 1st maintenance plan lasts 10 years
  - 2nd maintenance plan – A revision occurs in year 8 and the revised plan lasts 10 additional years
  - Contingency plan

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events

In October 2016, U.S. EPA released a revised Exceptional Event Rule (codified in 40 C.F.R. § 50.14). 40 C.F.R. § 50.14(b) discusses the determinations that the U.S. EPA Regional Administrator can make on excluding data, including the following:

- Generally
- Fireworks displays
- Prescribed fires
- Wildfires
- High wind dust events
- Stratospheric intrusions
- Determinations with respect to event aggregation, multiple national ambient air quality standards for the same pollutant, and exclusion for 24-hour values for particulate matter
- Determinations with respect to the not reasonably controllable or preventable criterion.
- Mitigation plans.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events

This exceptional event analysis would be classified as being influenced by wildfires. Furthermore, the wildfire section goes on to state the following:

> *The Administrator shall exclude data from use in determinations of exceedances and violations where a State demonstrates to the Administrator's satisfaction that emissions from wildfires caused a specific air pollution concentration in excess of one or more national ambient air quality standard at a particular air quality monitoring location and otherwise satisfies the requirements of this section. Provided the Administrator determines that there is no compelling evidence to the contrary in the record, the Administrator will determine every wildfire occurring predominantly on wildland to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion.*

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

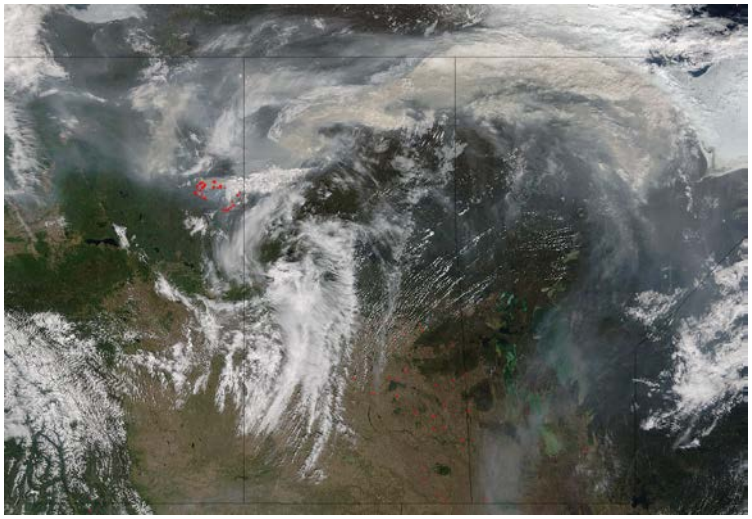
Exceptional Events Example

In May 2016, windfires burned across the southcentral Canada region of Fort McMurray, Alberta, Canada. In total, 1,500,000 acres of land were consumed by the fires.

Satellite imagery indicated a wide swath of smoke traveled for miles across Canada and eventually into the US. On May 24-26, 2016, the smoke from these fires made their way into PA.

After analysis of ozone and PM2.5 data for this period, DEP decided to undergo an exceptional event analysis for this time period, linking the smoke from the Fort McMurray fires to high ozone that was monitored across PA during this period.

Source: Instagram - @tamarackaspenbirch



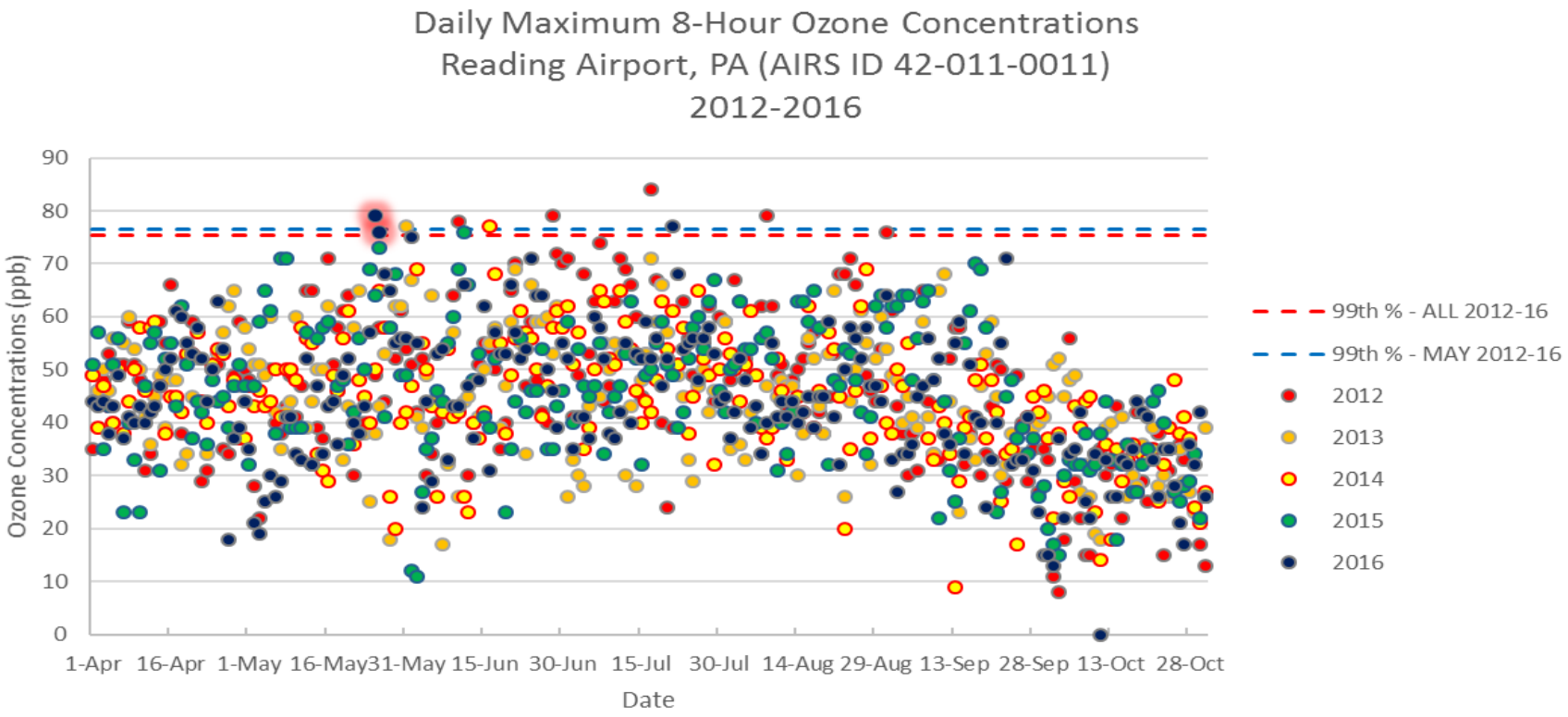
Source: https://www.nasa.gov/feature/goddard/2016/nasa-satellites-image-fort-mcmurray-fires-day-and-night

Exceptional Events Example - Ozone

- An in-depth analysis was completed of the emissions associated with the fires, the distribution of smoke across the region and the meteorological conditions that were occurring to provide enough support of a clear, causal relationship between the Fort McMurray fires and monitored ozone concentrations across PA.
- After analysis was completed and data was appropriately flagged within AQS and concurred from EPA Region 3, three ozone monitors (Lebanon, Reading and Norristown) in PA had ozone design values lowered due to the flagging of data with respect to this exceptional event.

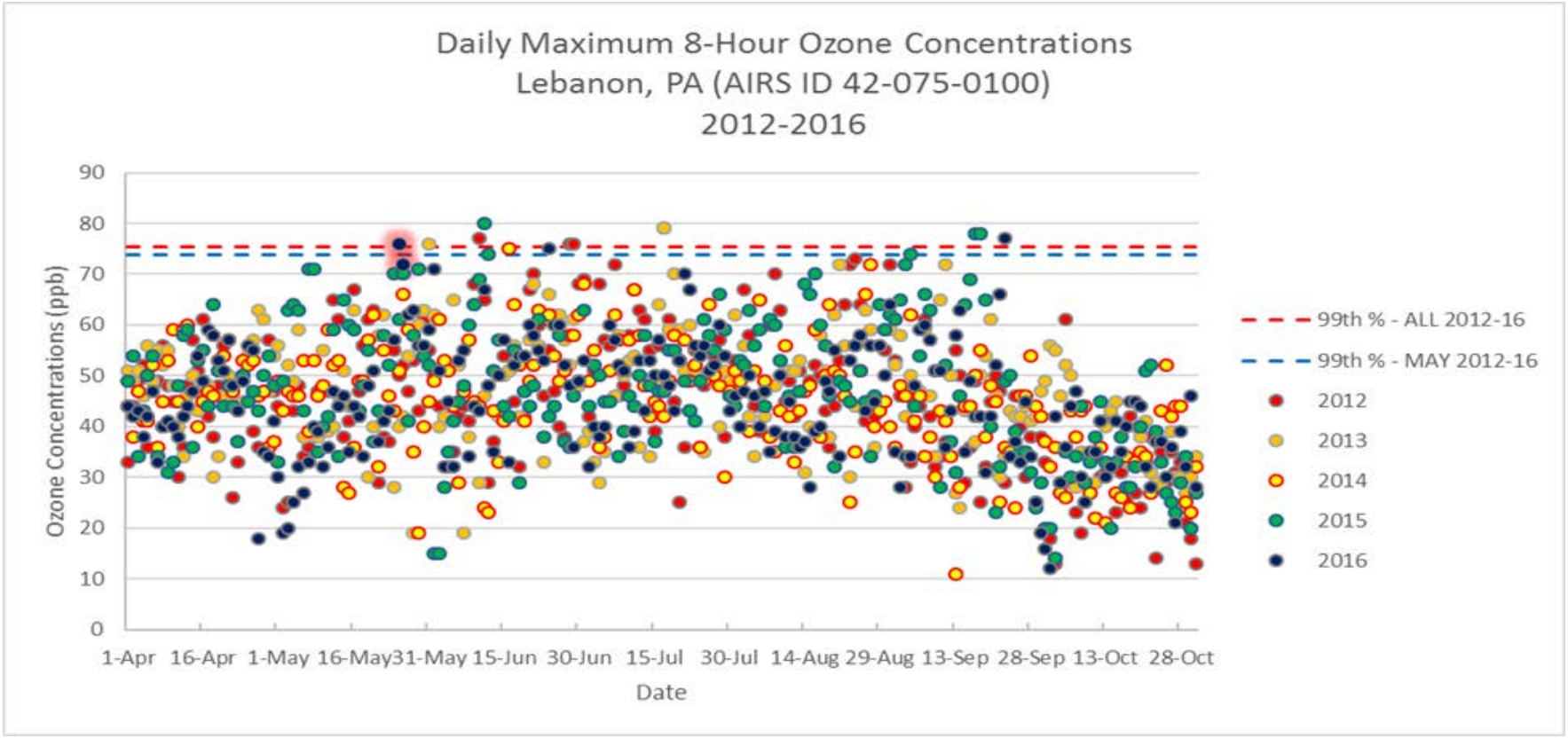
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events Example - Ozone



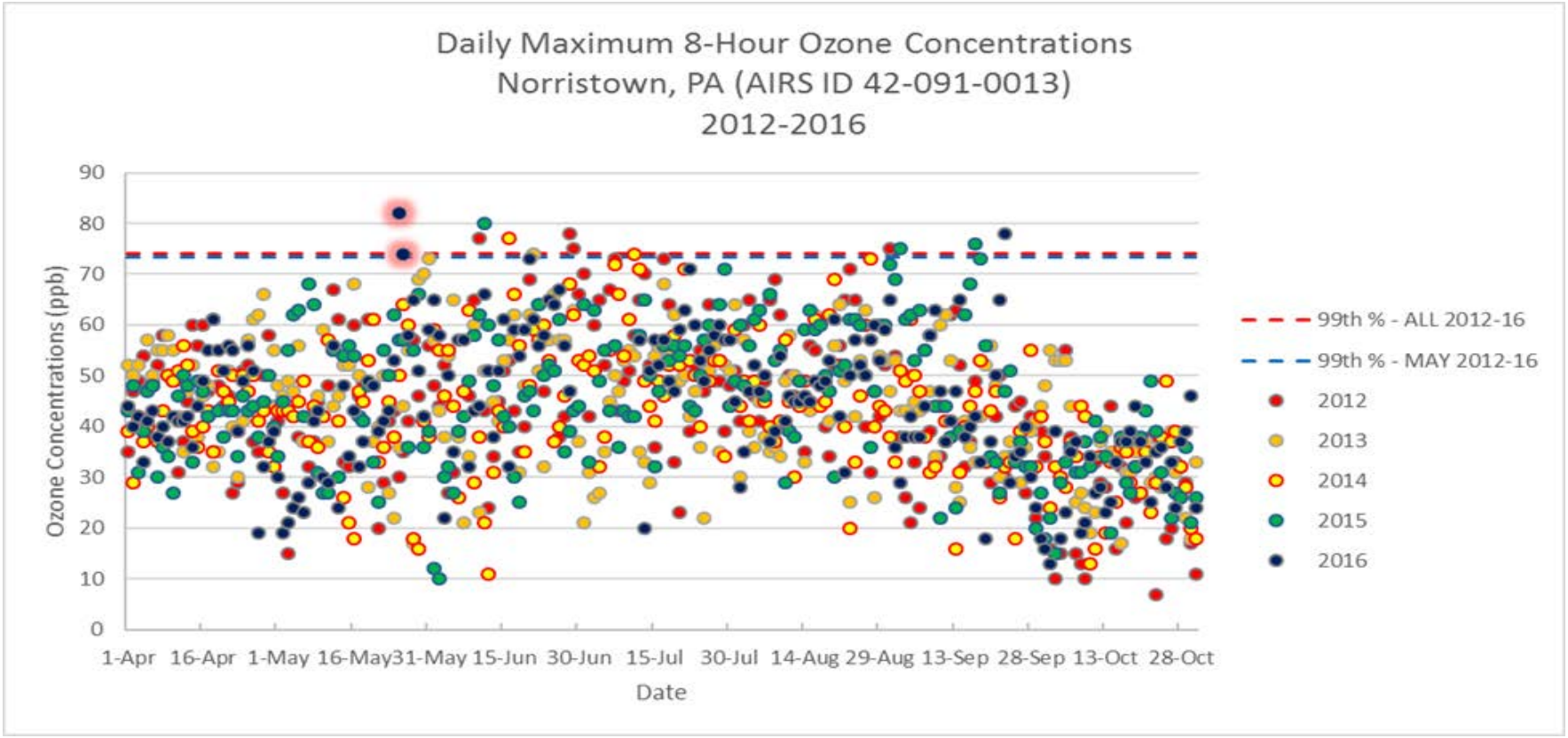
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events Example - Ozone



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events Example - Ozone



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Exceptional Events Example - Ozone

AQS Code	Site Name	4th Maximum 8-Hour Ozone Concentration (ppb)			2014-2016 Ozone Design Value (ppb)**	Maximum 8-Hr Ozone Concentration & Rank (ppb) for Exceptional Event Days						Ozone Design Value Excluding Exceptional Event Data	
						5/24/2016		5/25/2016		5/26/2016		2016 4th Max (ppb)	2014-2016 Ozone Design Value (ppb)
		2014	2015	2016		Max	Rank*	Max	Rank*	Max	Rank*		
42-011-0011	Reading Airport	68	71	75	**71**	57	29	79	1	76	3	71	**70**
42-075-0100	Lebanon	67	74	72	**71**	57	29	76	2	72	4	70	**70**
42-091-0013	Norristown	72	73	73	**72**	53	55	82	1	74	3	67	**70**

* - Rank 1 through 4 is highlighted in red.
** - Ozone Design Values in exceedance of the 2015 ozone NAAQS are highlighted in red.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Reminders from your M.O.M.

M.O.M. = Manager of Monitoring

1) Help us help you
2) Input is critical, timing is everything
3) Name that NAAQS
4) Keep it general
5) Come visit
6) Say “Thank You”

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Chris Robbins
Environmental Chemist 2
PA DEP Air Quality Monitoring Division

717-787-9481
crobbins@pa.gov