

Indiana 2019 Ambient Air Monitoring Network Plan



Indiana Department of Environmental Management
Office of Air Quality
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Acronyms

AADT	Annual Average Daily Traffic
AERMET	American Meteorological Society / Environmental Protection Agency Regulatory Meteorology
AERMOD	American Meteorological Society / Environmental Protection Agency Regulatory Model
ANP	Annual Network Plan (this document)
APCD	Louisville Metropolitan Air Pollution Control District
AQI	Air Quality Index
AQS	Air Quality System
BAM	Beta Attenuation Monitor
BOF	Basic Oxygen Furnace
CAPS	Cavity Attenuated Phase Shift
CASTNET	Clean Air Status and Trends Network
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CSA	Combined Statistical Area
CSN	Chemical Speciation Network
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DNPH	2,4-Dinitrophenylhydrazine
DRR	Data Requirement Rule
DV	Design Value
EMITS	Emission Inventory Tracking System
ESAT	Environmental Services Assistance Team
FEM	Federal Equivalent Method
FID	Flame Ionization Detector
FRM	Federal Reference Method
GC	Gas Chromatograph
GC/MS	Gas Chromatograph / Mass Spectrometry
HPLC	High Pressure Liquid Chromatography
HVAC	Heating Ventilation Air Conditioning
ICP/MS	Inductive Coupled Plasma / Mass Spectrometry
IDEM	Indiana Department of Environmental Management
INDOT	Indiana Department of Transportation
KDEP	Kentucky Department for Environmental Protection
LADCO	Lake Michigan Air Directors Consortium
mm	Millimeter
mmBTU	One million British Thermal Units
LEADS	Leading Environmental Analysis and Display System
mb	millibar
MOA	Memorandum of Agreement
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NATTS	National Air Toxics Trends Station
NCore	National Core multi-pollutant monitoring stations
NEI	National Emissions Inventory
NIPSCO	Northern Indiana Public Services Company
NIST	National Institute of Standards and Technology
nm	Nanometer
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide

NO _x	Oxides of Nitrogen
NO _y	Total Reactive Nitrogen Oxides
NPAP	National Performance Audit Program
NWS	National Weather Service
O ₃	Ozone
OAQPS	Office of Air Quality Planning and Standards
PAMS	Photochemical Assessment Monitoring Station
Pb	Lead
PEP	Performance Evaluation Program
PM	Particulate matter
PM _{2.5}	Particulate matter with a diameter less than or equal to 2.5 micrometers
PM ₁₀	Particulate matter with a diameter less than or equal to 10 micrometers
PM _{10-2.5}	Particulate matter with a diameter less than or equal to 10 micrometers, and greater than or equal to 2.5 micrometers
ppb	parts per billion
ppm	parts per million
PQAO	Primary Quality Assurance Organization
PSD	Prevention of Significant Deterioration
PWEI	Population Weighted Emissions Index
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RTD	Resistance Temperature Detector
SWOAQA	Southwest Ohio Air Quality Agency
SASS	Speciation Air Sampling System
SHARP	Synchronized Hybrid Ambient Real-time Particulate
SIP	State Implementation Plan
SLAMS	State or Local Air Monitoring Stations
SO ₂	Sulfur Dioxide
SPM	Special Purpose Monitor
STN PM _{2.5}	Speciation Trends Network
S/V	Susceptible and Vulnerable Populations
TAD	Technical Assistance Document
TO-11A	Toxic Organic Compound sampling and analysis method
TO-15	Toxic Organic Compound sampling and analysis method
TPY	Tons Per Year
TRI	Toxics Release Inventory
TSA	Technical Systems Audit
TSP	Total Suspended Particulate
TEOM	Tapered Element Oscillating Microbalance
µg/m ³	micrograms per cubic meter
U.S. EPA	United States Environmental Protection Agency
UV	Ultraviolet
VOC	Volatile Organic Compounds
VSCC	Very Sharp Cut Cyclone
XRF	X-Ray Fluorescence

Introduction

In October 2006, United States Environmental Protection Agency (U.S. EPA) issued final regulations concerning state and local agency ambient air monitoring networks. These regulations in 40 CFR Part 58.10 require states to submit an annual monitoring network review to U.S. EPA. This network plan is

required to provide the framework for establishment and maintenance of an air quality surveillance system and to list any changes that are proposed to take place to the current network in 2019.

Public Review and Comment

The annual monitoring network plan must be made available for public inspection for 30 days prior to submission to U.S. EPA. Information on how to comment on the plan and any comments received are listed in Appendix A (page 80).

Indiana's Air Monitoring Network

The Indiana Department of Environmental Management (IDEM) regulates air quality to protect public health and the environment in the State of Indiana. Air monitoring data are required by regulation and are used to determine compliance with U.S. EPA's National Ambient Air Quality Standards (NAAQS). Other important uses of the air monitoring data include, the production of a daily AQI report, daily air quality forecast report, support of short and long-term health risk assessments, identification of a localized health concern, and tracking long-term trends in air quality. Indiana monitors the six criteria pollutants which have NAAQS identified for them; CO, lead, NO₂, O₃, particulate matter (PM₁₀ and PM_{2.5}), and SO₂. Other pollutants which do not have ambient standards established for them are also monitored: toxics (volatile organic compounds, VOCs), metals, carbonyls, PM_{2.5} speciated compounds, ozone precursors, and CO₂. In addition, meteorological data are also collected to support the monitoring and aid in analysis of the data.

Air Quality Data

IDEM presents two different types of air quality data, intermittent and continuous, on IDEM's Internet website <http://www.in.gov/idem/airquality/2346.htm>. Monthly and annual summary reports of pollutants collected by manual methods are available as well as hourly values from continuous monitors. The Leading Environmental Analysis and Display System (LEADS) provides on-line access to Indiana's continuous air quality monitoring network. It has been available to the public since July, 2007. LEADS offers access to near real-time data from 59 active and historic data from 12 discontinued continuous air monitoring sites across Indiana. This allows anyone to track pollutant and meteorological values throughout the day. In addition, past data back to 1998 are available as raw data and canned summary reports or user specified retrievals. Intermittent data from 41 sites are available on LEADS. Site information with site photographs can be found here: http://idem.tx.sutron.com/cgi-bin/site_photo.pl

Overview of Monitored Parameters

Criteria Pollutants

Carbon Monoxide (CO)

Carbon monoxide (CO) is a poisonous gas that, when introduced into the bloodstream, inhibits the delivery of oxygen to body tissue. The health risk is greatest for individuals with cardiovascular disease.

Lead (Pb)

Lead (Pb) is a metal that is highly toxic when ingested or inhaled. It is a suspected carcinogen of the lungs and kidneys and has adverse effects on cardiovascular, nervous, and renal systems.

Nitrogen Dioxide (NO₂)

Nitrogen dioxide (NO₂) is a highly toxic, reddish-brown gas that is created primarily from fuel combustion in industrial sources and vehicles. It creates an odorous haze that causes eye and sinus irritation, blocks natural sunlight, and reduces visibility.

Ozone (O₃)

Ground-level ozone (O₃), or photochemical smog, is not emitted into the atmosphere as ozone, but rather is formed by the reactions of other pollutants. The primary pollutants entering into this reaction, VOCs and oxides of nitrogen, create ozone in the presence of sunlight. Ozone is a strong irritant of the upper respiratory system and also causes damage to crops.

Particulate Matter (PM₁₀)

Particulate matter with a mean diameter of 10 microns or less (PM₁₀) is emitted from transportation and industrial sources. Exposure to particle pollution is linked to a variety of significant health problems ranging from aggravated asthma to premature death in people with heart and lung disease.

Fine Particulate Matter (PM_{2.5})

Fine particulate matter with a diameter of 2.5 microns or less (PM_{2.5}) is created primarily from industrial processes and fuel combustion. These particles are breathed deeply into the lungs. Exposure to particle pollution is linked to a variety of significant health problems ranging from aggravated asthma to premature death in people with heart and lung disease.

Sulfur Dioxide (SO₂)

Sulfur dioxide (SO₂) is a gaseous pollutant that is emitted primarily by industrial furnaces or power plants burning coal or oil containing sulfur. At high concentrations, breathing can be impaired. Damage to vegetation can also result.

Non Criteria Parameters

PM_{2.5} Speciation

U.S. EPA implemented the PM_{2.5} chemical speciation monitoring program. Knowing the chemical composition of the PM_{2.5} mix is important for determining sources of pollution and links between observed health effects. The basic objective of speciation analysis is to develop seasonal and annual chemical characterizations of ambient particulates across the nation. This speciation data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies and regional haze assessments.

The speciation samplers use different inlet tubes and filters to collect the components of the PM_{2.5} mixture. The process consists of using three different types of filters to separate out such specific compounds as: sulfate, nitrate, organic and elemental carbon, ammonium, metals, and certain ions.

NCORE Monitoring

NCORE is a multi-pollutant approach to monitoring. NCORE sites are intended to support multiple objectives with a greater emphasis on assessment, research support, and accountability than the traditional SLAMS networks. NCORE provides an opportunity to address new directions in monitoring and begin to fill measurement and technological gaps that have accumulated in the networks. Indiana is required to establish and operate one urban NCORE site. These sites are required to measure PM_{2.5}, speciated PM_{2.5}, PM_{10-2.5}, O₃, SO₂, CO, Nitrogen Oxides (NO/NO₂), Total Reactive Nitrogen Oxides (NO_y), and

meteorology. In June 2018, IDEM optioned into enhanced PAMS monitoring at the NCore site located in a CBSA with a population of 1,000,000 or more.

Photochemical Assessment Monitoring Station, PAMS (Ozone Precursors)

Of the six criteria pollutants, O₃ is the most encompassing. The most prevalent photochemical oxidant and an important contributor to “smog”, O₃ is unique among the criteria pollutants because it is not emitted directly into the air. Instead, it results from complex chemical reactions in the atmosphere between VOCs and NO_x in the presence of sunlight. There are thousands of sources of VOCs and NO_x located across the country. To track and control O₃, U.S. EPA is trying to create an understanding of not only the pollutant itself, but the chemicals, reactions, and conditions that contribute to its formation as well. Because of this, U.S. EPA called for improved monitoring of O₃ and its precursors, VOC and NO_x, to obtain more comprehensive and representative data on O₃ air pollution. U.S. EPA initiated the PAMS program in February 1993. The PAMS program requires the establishment of an enhanced monitoring network in all O₃ nonattainment areas classified as serious, severe, or extreme. Details of what compounds are sampled are found in the Parameter Networks section.

Toxics / Carbonyls / Metals

Toxic air pollutants, also known as hazardous air pollutants, are those pollutants that are known or suspected to cause cancer, other serious health effects, or adverse environmental conditions. Air toxics include semi-volatile and volatile organic compounds (VOC), metals, and carbonyls.

Air toxic compounds are released from many different sources, including mobile sources (vehicles), stationary industrial sources, small area sources, indoor sources (cleaning materials, etc.), and other environmental sources (wildfires, etc.). The lifetime, transportation, and make-up of these pollutants are affected by weather and landscape. They can be transported far away from the original source, or be caught in rain and deposited to waterways or land.

The air toxics, carbonyls, and metals are divided into separate categories due to different sampling and analytical methodologies used for each. With all three categories combined, more than eighty different pollutants are analyzed.

Carbon Dioxide (CO₂)

In 2009 the U.S. EPA declared CO₂ a pollutant. Carbon dioxide (CO₂) is the primary greenhouse gas emitted through human activities. Gases that trap heat in the atmosphere are called greenhouse gases. CO₂ is naturally present in the atmosphere as part of the earth's carbon cycle. The carbon cycle is the natural circulation of carbon among the atmosphere, oceans, soil, plants, and animals. CO₂ emissions come from a variety of natural sources. Human activities can influence the carbon cycle by adding more CO₂ to the atmosphere and by influencing the ability of natural sinks, like forests, to remove CO₂ from the atmosphere. The main human activity that emits CO₂ is the combustion of fossil fuels like coal, natural gas, and oil used for energy and transportation.

Meteorological Monitoring

Any study of air pollution should include an analysis of the weather patterns (meteorology) of the local area because the fate of air pollutants is influenced by the movement and characteristics of the air mass into which they are emitted.

If the air is calm and pollutants cannot disperse, then the concentration of these pollutants will build up. Conversely, if a strong and turbulent wind is blowing, the pollutant will rapidly disperse into the atmosphere and will result in lower concentrations near the pollution source.

The measurements of wind speed and direction, temperature, humidity, rainfall, barometric pressure, ultraviolet radiation and solar radiation are important parameters used in the study of air quality monitoring results and to further understand the chemical reactions that occur in the atmosphere. Meteorological monitoring is used to predict air pollution events, high pollutant concentration days, and to simulate and predict air quality using computer models.

National Ambient Air Quality Standards (NAAQS)

NAAQS are identified for the criteria pollutants; CO, Pb, NO₂, O₃, particulate matter (PM₁₀ and PM_{2.5}), and SO₂. Measuring pollutant concentrations in outdoor air and comparing the measured concentrations to corresponding standards determines the ambient air quality status of an area as attaining or not attaining the standards.

The NAAQS are separated into primary and secondary standards. Primary standards are those established to protect public health. Secondary standards are those established to protect the public welfare from adverse pollution effects on soils, water, vegetation, manmade materials, animals, weather, visibility, property, and economy.

The scientific criteria upon which the standards are based are reviewed periodically by U.S. EPA, which may retain or change the standards according to its findings. Note that there are hundreds of compounds that are generally considered pollutants when found in ambient air but whose health and welfare effects are not well enough understood for ambient standards to be defined.

A pollutant measurement that is greater than the ambient air quality standard for its specific averaging time is called an exceedance. An exceedance is not necessarily a synonym for a violation. For each pollutant there are specific rules about how many exceedances are allowed in a given time period before a pattern of exceedances is considered a violation of the NAAQS that may result in regulatory actions to further clean up the area's air. This distinction is made to allow for certain limited exceedances of the standard that may occur during an unusual weather pattern, for example, reserving regulatory action for instances where the exceedances are too frequent.

The design value for a site is the level of pollutant concentration when the rules of the NAAQS calculations are applied to that specific pollutant. For example, the O₃ design value is calculated by taking the three year average of the annual fourth highest daily 8-hour maximums. If this number is above the NAAQS for O₃, then it is a violation or 'nonattainment' of the NAAQS. If the design value is below the NAAQS then the area is in 'attainment' of the standard. Generally, nonattainment is based on the highest design value reported for a specific geographic area (usually a CBSA), and the entire area would be defined by that monitor, and classified accordingly. This number basically tells you how polluted an area would be in relation to a NAAQS. A listing of the NAAQS can be found at:

<https://www.epa.gov/criteria-air-pollutants/naqs-table>

5-Year Network Assessment

U.S. EPA requires a Network Assessment be performed every five (5) years, as per 40 CFR Part 58.10(d). The second Regional Network Assessment, published in 2015 by the Lake Michigan Air Directors Consortium (LADCO) for the states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin is available at:

http://www.ladco.org/reports/general/Regional_Network_Assessment/RNA15.html

The first Regional Network Assessment, published July 1, 2010 is available at:

http://www.ladco.org/reports/general/Regional_Network_Assessment/index.php

Indiana uses the recommendations from the Regional Assessment as input into the Annual Network Review.

New U.S. EPA Monitoring Requirements

Several of the NAAQS and monitoring requirements for the various pollutants have either been revised recently, are in the final review stages prior to promulgation, or are planning to have proposals within the next year. Even though IDEM is aware of these proposals and how they could possibly affect Indiana's monitoring network, only those requirements which have been approved and are in effect at this time are considered when modifying Indiana's current network.

Network Overview

Indiana has reviewed its current ambient air quality network and has developed a proposed network to be implemented during 2019. Current NAAQS, data trends, site redundancy, siting problems, site access concerns and other identified monitoring issues all contribute to any proposed network revisions.

Indiana's air monitoring network for 2019 consists of the sites and monitors listed in Table 1. All site changes which have occurred or plan to take place in 2018 are included along with the planned network modifications for 2019. Figure 1 is an overview of Indiana's current monitoring network with population density showing the locations where monitoring takes place in 2019.

The number of monitoring locations operated by the State will remain at 78 sites. The number of monitored pollutant parameters will decrease by three to 154.

Table 1 – State Air Monitoring Network

AQS#	COUNTY	CITY	SITE NAME	SITE ADDRESS	O ₃	SO ₂	CO / CO ₂	NO _x / NO ₂	PM ₁₀	PM _{10-2.5}	PM _{2.5} (FRM)	PM _{2.5} (Cont)	PM _{2.5} (Spec)	PM _{2.5} (Spec Cont)	LEAD	TOXICS (VOCs)	O ₃ PREC	CARBONYLS	METALS	MET	
170230001	Clark, IL	West Union, IL	West Union	416 S. Hwy 1	X																X
180030002	Allen	Leo	Leo	Leo HS, 14600 Amstutz Rd.	X																
180030004	Allen	Fort Wayne	Fort Wayne - Beacon St.	2022 N. Beacon St	X						Discontinue	X									X
180050007	Bartholomew		Hope	Hauser Jr-Sr HS, 9404 N775 E.	X		X														
180050008	Bartholomew	Columbus	Columbus - Rocky Ford Rd.	3475 Trestle Dr.							Discontinue	X									
180110001	Boone		Whitestown	Perry-Worth Elem Sch., 3900 E. 300 S. Lebanon	X																
180130001	Brown		Helmsburg	Jackson Twp Fire Dept., 4831 Helmsburg Road, Nashville	X																
180150002	Carroll		Flora	Flora Airport, 481 S. 150 W. Flora	X																X
180190006	Clark	Jeffersonville	Jeffersonville - Walnut St	PFAU, 719 Walnut St.					Relocate		Relocate		Relocate								
18019___	Clark	Jeffersonville							Relocation		Relocation	Add	Relocation	Add B. Carbon							
180190008	Clark		Charlestown St. Park	Charlestown State Park, 12500 Highway 62, Charlestown	X						Discontinue										X
180190009	Clark	Clarksville	Clarksville	Falls of the Ohio State Park, 201 W. Riverside Dr.												X					
180350006	Delaware	Muncie	Muncie - Central HS	801 N. Walnut St.								X									
180350009	Delaware	Muncie	Muncie - Mt. Pleasant Blvd.	2601 W. Mt. Pleasant Blvd.											X						
180350010	Delaware	Albany	Albany	Albany Elem. Sch., 700 W. State St.	X																
180372001	Dubois	Jasper	Jasper - Post Office	Post Office, 206 E. 6th St.					X		X		X								
180390007	Elkhart	Bristol	Bristol	Bristol Elem. Sch. 705 Indiana Ave.	X																
180390008	Elkhart	Elkhart	Elkhart - Prairie St.	2745 Prairie St.							Discontinue	X		B. Carbon							
180431004	Floyd	New Albany	New Albany	Green Valley Elem. Sch., 2230 Green Valley Rd.	X	X						X	X								
180550001	Greene		Plummer	2500 S. 275 W	X							X									X
180570006	Hamilton	Noblesville	Noblesville - 191st St.	Our Lady of Grace Catholic Church, 9900 E. 191st St.	X																
180570007	Hamilton	Fishers	Fishers	11775 Brooks School Road							Discontinue	X									
180630004	Hendricks	Avon	Avon	7203 E. US Highway 36	X																
180650003	Henry		Mechanicsburg	Shenandoah HS, 7354 W. Hwy. 36, Middletown							X		X								X
180670004	Howard	Kokomo	Kokomo - E. Vaile Ave.	1802 E. Vaile Ave.	X						Discontinue	X									
180690002	Huntington	Roanoke	Roanoke	Roanoke Elem. Sch., 423 W. Vine St.	X																
180710001	Jackson		Brownstown	225 W & 300 N. Brownstown	X																X
180890006	Lake	East Chicago	East Chicago - Franklin Sch.	Washington (formerly Franklin) Elem. Sch, 2400 Cardinal Dr.					X		X										
180890015	Lake	East Chicago	East Chicago - Post Office.	East Chicago Post Office, 901 E. Chicago Ave.			X														
180890022	Lake	Gary	Gary - IITRI	IITRI Bunker, 201 Mississippi St.	X	X		X	X		X	X	X	B. Carbon		X					X
180890026	Lake	Gary	Gary - Burr St.	25th Ave. and Burr St.								X									
180890031	Lake	Gary	Gary - Madison St.	Indiana American Water Co. 650 Madison St.					X		X										
180890032	Lake	Gary	Gary - 4th Ave.	Gary SouthShore RailCats, One Stadium Plaza											X					X	
180890034	Lake	East Chicago	East Chicago - Marina	East Chicago Marina, 3301 Aldis St.		Add			X		Add	Add			X	X			X	Add	
180890035	Lake	Whiting	Whiting - Center St.	1500 Center St. (H.S. Admin. Bldg.)												X					
180890036	Lake	Hammond	Hammond - 167th St.	NIPSCO district office and maintenance facility 1313 167th St.							X	X									
18089___	Lake	Hammond	Hammond - E. Lakeview St.	2141 E. Lakeview St.											Add					Add	
180892008	Lake	Hammond	Hammond - 141st St.	1300 E. 141st St.	X	X										X					X
180910005	LaPorte	Michigan City	Michigan City - W. Michigan Blvd.	NIPSCO Gas Station, 490 W. Michigan Blvd.	X																
180910010	LaPorte	LaPorte	LaPorte - E. Lincolnway	2011 E. Lincolnway	X																
180910011	LaPorte	Michigan City	Michigan City - Marsh Elem. Sch.	400 E. Homer St.								X									
180950010	Madison		Emporia	East Elem. Sch., 893 E. US 36, Pendleton	X																

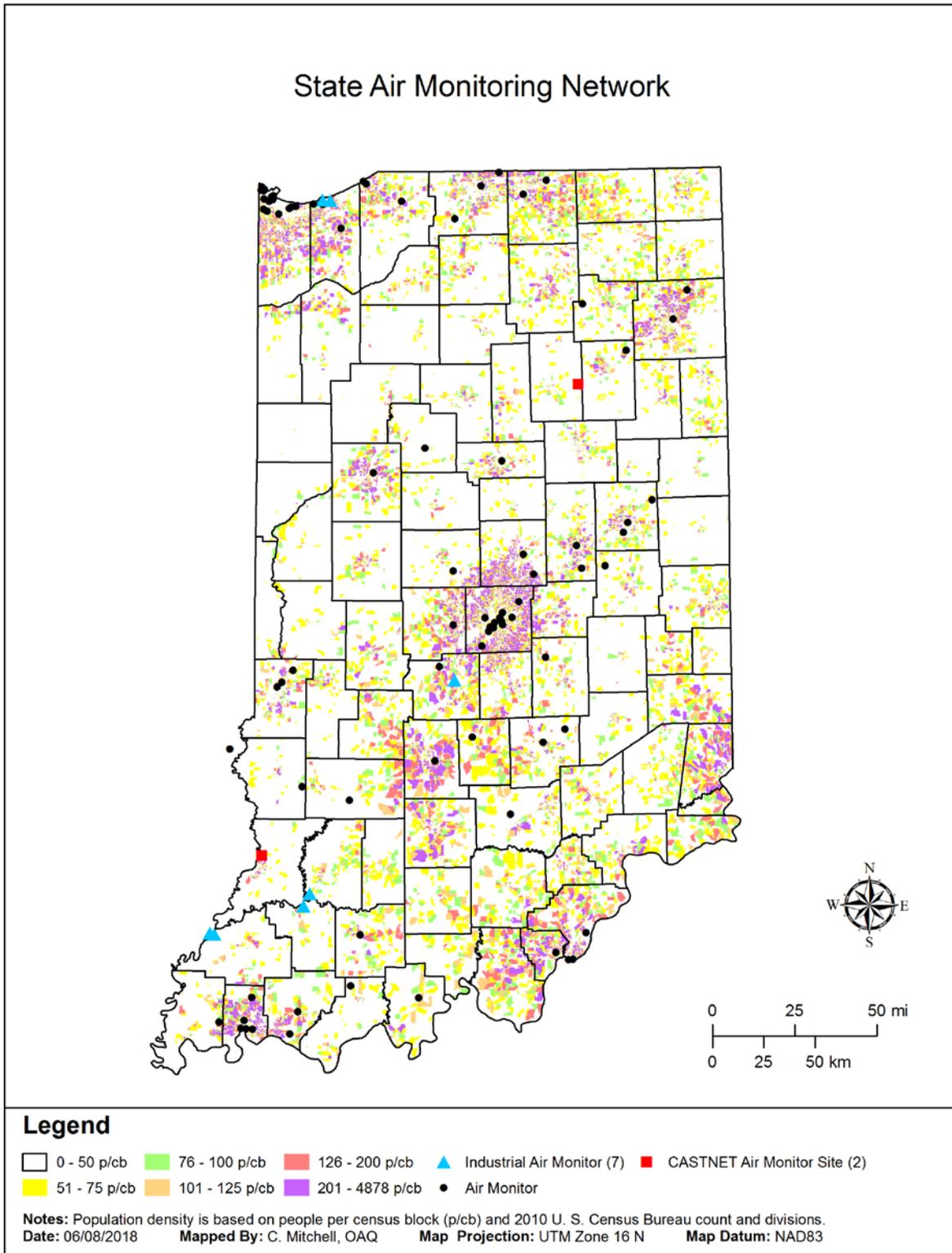
AQS#	COUNTY	CITY	SITE NAME	SITE ADDRESS	O ₃	SO ₂	CO / CO ₂	NO _x / NO ₂	PM ₁₀	PM _{10-2.5}	PM _{2.5} (FRM)	PM _{2.5} (Cont)	PM _{2.5} (Spec)	PM _{2.5} (Spec Cont)	LEAD	TOXICS (VOCs)	O ₃ PREC	CARBONYLS	METALS	MET
180950011	Madison	Anderson	Anderson - Eastside Elem.	Eastside Elem. Sch., 844 N. Scatterfield Rd.							Discontinue	X								
180970043	Marion	Indianapolis	Indpls - West St.	1735 S. West St.					X		X									
180970050	Marion	Indianapolis	Indpls - Ft. Harrison	Ft. Harrison St. Park, 5753 Glenn Rd.	X															
180970057	Marion	Indianapolis	Indpls - Harding St.	1321 S. Harding St.	X	X	Add													
180970072	Marion	Indianapolis	Indpls - N. Illinois St	50 N. Illinois St.			X													
180970073	Marion	Indianapolis	Indpls - E. 16th St	6125 E. 16th St.																X
180970078	Marion	Indianapolis	Indpls - Washington Park	Washington Park, 3120 E. 30th St.	X	X	X	X	X	X	X	X	X	B. Carbon	X	X	X	X	X	X
180970081	Marion	Indianapolis	Indpls - W. 18th St	School 90, 3351 W. 18th St.							X	X								
180970083	Marion	Indianapolis	Indpls - E. Michigan St	School 15, 2302 E. Michigan St.							X									
180970084	Marion	Indianapolis	Indpls - School 21	School 21, 2815 English Ave.							X									
180970086	Marion	Indianapolis	Indpls - Southport	Southport Advanced Wastewater Treatment Plant, 3800 W. Southport Rd																X
180970087	Marion	Indianapolis	Indpls - I-70 E	1650 Ludlow Ave.	X		X	X			X	X		B. Carbon	X					X
181050003	Monroe	Bloomington	Bloomington - Binford	Binford Elem. Sch., 2300 E. 2nd St.							X	X								
181090005	Morgan	Monrovia	Monrovia	Monrovia HS, 135 S Chestnut St	X															
181230009	Perry		Leopold	Perry Central HS, 18797 Old St. Rd 37, Leopold	X															
181270023	Porter	Portage	Portage - Hwy 12	Bethlehem Steel Waste Lagoon, Hwy. 12					X											
181270024	Porter	Ogden Dunes	Ogden Dunes	Water Treatment Plant, 84 Diana Rd.	X						Discontinue	X			X					
181270026	Porter	Valparaiso	Valparaiso	Valparaiso Water Dept., 1000 Wesly St.	X															
181270027	Porter		Burns Harbor - Port of Indiana	E. Boundary Rd											X				X	
181290003	Posey		St. Philips	2027 St. Phillips Rd., Evansville	X															X
181410010	St. Joseph		Potato Creek St. Park	Potato Creek St. Park, 25601 St. Rd. 4, N. Liberty	X															
181410015	St. Joseph	South Bend	S. Bend - Shields Dr.	2335 Shields Dr.	X			X			X	X								X
181410016	St. Joseph	Granger	Granger - Beckley St.	12441 Beckley St., Granger	X															
181450001	Shelby		Fairland	Triton Central MS, 4740 W. 600N, Fairland	X															
181470009	Spencer	Dale	Dale	David Turnham School, 105 Dunn St.							X									
181530007	Sullivan		Dugger	Greene Sullivan State Forest, 2551 IN-159							X									
181570008	Tippecanoe	Lafayette	Lafayette - Greenbush St.	Cinergy Substation, 3401 Greenbush St.							Discontinue	X								
181630013	Vanderburgh		Inglefield	Scott Elem. School, 14940 Old State Rd.	X															
181630016	Vanderburgh	Evansville	Evansville - U. of E.	University of Evansville - Carson Center							X				X					
181630021	Vanderburgh	Evansville	Evansville - Buena Vista	1110 W. Buena Vista Rd.	X	X		X	X	X	X	X	X	B. Carbon						
181630022	Vanderburgh	Evansville	Evansville - Lloyd	10 S. 11th Ave.			X													
181630023	Vanderburgh	Evansville	Evansville - E. Walnut	Rescue Mission, 500 E. Walnut St.							Discontinue									
181670018	Vigo	Terre Haute	Terre Haute - Lafayette Ave.	961 N. Lafayette Ave.	X	X			X	X	X	X								
181670025	Vigo	Terre Haute	Terre Haute - Fort Harrison Rd.	INDOT Maintenance, 2400 Fort Harrison Rd.											X					
181670024	Vigo		Sandcut	7597 Stevenson Rd., Terre Haute	X															
181730008	Warrick	Boonville	Boonville	Boonville HS, 300 N. 1st St.	X															
181730011	Warrick		Dayville	3488 Eble Rd., Newburgh	X															X
181830003	Whitley		Larwill	Whitko Middle School, 710 N. State Rd. 5							X	X								X

	Number of Monitoring Sites	Number of Monitored Pollutant Parameters	O ₃	SO ₂	CO / CO ₂	NO _x / NO ₂	PM ₁₀	PM _{10-2.5}	PM _{2.5} (FRM)	PM _{2.5} (Cont)	PM _{2.5} (Spec)	PM _{2.5} (Spec Cont)	LEAD	TOXICS (VOCs)	O ₃ PREC	CARBONYLS	METALS	MET
Current Monitoring Network (2018)	78	157	41	7	6	5	11	1	36	19	6	6	4	10	1	1	3	17
Proposed Monitoring Network (2019)	78	154	41	8	7	5	11	1	27	21	6	6	5	10	1	1	4	18

Indicates a site where a change is to occur or occurred in 2018

Indicates a site where a change is planned for 2019

Figure 1 – State Air Monitoring Network 2019



Review Summary

The changes proposed for the 2019 Monitoring Network are:

- Add CO₂ at Indpls - Harding St.
- Add SO₂, continuous PM_{2.5} and PM₁₀, 3-day intermittent PM_{2.5} and, hourly Benzene to East Chicago – Marina.
- Add Pb and Mn 3-day intermittent monitoring at a new site in Hammond to be a source oriented site on Whiting Metals.
- Discontinue PM_{2.5} 3-day intermittent monitoring at Charlestown – State Park.
- Discontinue PM_{2.5} 3-day intermittent monitoring at Evansville – E. Walnut St.
- A Pb waiver for Leigh Cement in Cass County is being requested.

Updates on the changes proposed for the 2018 Monitoring Network:

- Relocate Jeffersonville 3-day intermittent PM_{2.5}, and 6-day intermittent PM₁₀, and speciation. Add continuous PM_{2.5}, and Black Carbon. Ongoing from 2017 Network Plan. Land lease negotiations are continuing.
- The continuous PM_{2.5} Met One BAM 1020 at South Bend – Shields Dr. was to be replaced with a Thermo Fisher SHARP 5030 in an effort to obtain better correlation with the intermittent PM_{2.5} FRM. The SHARP 5030 slated for the site was used elsewhere when a spare unit failed. Another continuous monitor needs to be purchased.

Unplanned changes to the 2018 Monitoring Network:

- Relocation of New Albany SO₂ and O₃ monitors on January 31, 2018 from air monitoring shelter to inside school while a new air monitoring shelter location is being prepared due to new school construction. The continuous and 3-day intermittent PM_{2.5} have been discontinued temporarily until new site construction is completed. Collocated PM_{2.5} monitor was relocated to Charlestown on April 4, 2018 until renovation is completed.
- Discontinued East Chicago – E. 135 St. Pb and Mn monitoring on July 1, 2017 because the school closed where the monitoring site was located and the building was to be demolished. Due to the much improved lead concentrations in the area, the decrease in the lead emissions from the surrounding sources, and the improved modeling results a new site did not need to be found.
- Discontinue PM_{2.5} 3-day intermittent monitoring at Ft. Wayne – Beacon St., Columbus – Rocky Ford Rd., Elkhart – Prairie St., Fishers, Kokomo – E. Vaile Ave., Anderson – Eastside Elem. School, Ogden Dunes and Lafayette - Greenbush St. (Reporting and Collocated) on July 31, 2018. These FRM's are being discontinued due to good data correlation with the FEM's.

Network Description

As per 40 CFR Part 58.10, an annual monitoring network plan which provides for the establishment and maintenance of an air quality surveillance system consisting of the air quality monitors in the state, is required to be submitted by all states to U.S. EPA.

Specifically §58.10 (a) requires for each existing and proposed monitoring site:

1. A statement of whether operation of each monitor meets the requirements of appendices A, B, C, D, and E of 40 CFR Part 58, where applicable.
2. Proposals for any State and Local Air Monitoring Station (SLAMS) network modifications.
3. A detailed description of the PAMS network being operated in accordance with the requirements of appendix D to 40 CFR Part 58.

§58.10 (b) requires the plan must contain the following information for each existing and proposed site:

1. The Air Quality System (AQS) site identification number.
2. The location, including street address and geographical coordinates.

3. The sampling and analysis method(s) for each measured parameter.
4. The operating schedules for each monitor.
5. Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.
6. The monitoring objective and spatial scale of representativeness for each monitor.
7. The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM_{2.5} NAAQS as described in §58.30.
8. The Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.
9. The designation of any Pb monitors as either source-oriented or non-source-oriented according to Appendix D to 40 CFR part 58.
10. Any source-oriented monitors for which a waiver has been requested or granted by the U.S. EPA Regional Administrator as allowed for under paragraph 4.5(a)(ii) of Appendix D to 40 CFR part 58.
11. Any source-oriented or non-source-oriented site for which a waiver has been requested or granted by the U.S. EPA Regional Administrator for the use of Pb-PM₁₀ monitoring in lieu of Pb-TSP monitoring as allowed for under paragraph 2.10 of Appendix C to 40 CFR part 58.
12. The identification of required NO₂ monitors as near-road, area-wide, or vulnerable and susceptible population monitors in accordance with Appendix D, section 4.3 of this part.
13. The identification of any PM_{2.5} FEMs and/or ARMs used in the monitoring agency's network where the data are not of sufficient quality such that data are not to be compared to the NAAQS. For required SLAMS where the agency identifies that the PM_{2.5} Class III FEM or ARM does not produce data of sufficient quality for comparison to the NAAQS, the monitoring agency must ensure that an operating FRM or filter-based FEM meeting the sample frequency requirements described in §58.12 or other Class III PM_{2.5} FEM or ARM with data of sufficient quality is operating and reporting data to meet the network design criteria described in appendix D to this part.

Network Review Description

The following definitions represent the categories found in the Network Review. Over the years, the list of Monitor Type designations has changed. This is the current list.

Monitor Type – Indicates the “Administrative classification of a monitor.” Each monitor can only have one monitor type at a time. The complete list allowed is listed below with those used in Indiana’s network **underlined and in bold**:

- **SLAMS** – State or Local air monitoring station for parameters (pollutants and/or meteorological data) addressed by 40 CFR Part 58. The SLAMS make up the ambient air quality sites that are primarily needed for NAAQS comparison, but may serve other data purposes. U.S. EPA must approve all SLAMS sites.
- TRIBAL – Air monitoring stations operating under the authority of a Federally recognized tribal agency for parameters addressed by 40 CFR Part 58.
- **SPECIAL PURPOSE (SPM)** – A monitor that an agency has designated as “Special Purpose” in its annual monitoring network plan for parameters addressed by 40 CFR Part 58. SPMs are not counted by the agency when showing compliance with the minimum network requirements for the number and siting of monitors. SPMs generally indicated a shorter term monitoring project. Or monitors are designated SPM for the first 24-months of monitoring to allow for ease of site movement due to unforeseen circumstances.
- INDUSTRIAL – A monitor that is operated by a private industry entity rather than under control of a State, Local, or Tribal government.
- EPA – A monitor that is operated by EPA or an EPA contractor for parameters addressed by 40 CFR Part 58.
- NON-EPA FEDERAL – A monitor operated by another Federal agency for parameters addressed by 40 CFR Part 58.

- **OTHER** – A monitor for a parameter not addressed by 40 CFR Part 58. It is not allowed for criteria pollutants or other parameters associated with a monitoring network such as NCORE, PAMS, NATTS, etc.

Network – The Monitor Network or Program affiliation of the monitor. A monitor may have more than one at a time or no value. Those networks in Indiana’s plan are listed:

- **NCORE** – *National Core (NCORE) Multi-pollutant Monitoring Station*: Sites that measure multiple pollutants at trace levels in order to provide support to integrated air quality management data needs. There is currently one NCORE site for Indiana located in Indianapolis.
- **Near-Road** – Monitors at sites meeting the near road design as per 40 CFR Part 58. Typically measure near road peak hourly NO₂ or CO concentrations in larger urban areas. There is currently one Near-Road site for Indiana located in Indianapolis.
- **CSN Supplemental** – *Supplemental Speciation Station*: Any PM_{2.5} speciation station that is used to gain supplemental data and is not dedicated as part of the speciation trends network.
- **CSN STN** – *Trends Speciation Station*: A PM_{2.5} speciation station designated to be part of the speciation trends network. This network provides chemical species data of fine particulates.
- **PAMS** – *Photochemical Assessment Monitoring Station*: Sites established in serious and severe O₃ nonattainment areas in the 1990s to obtain more comprehensive data of areas with ozone pollution by also monitoring NO_x and VOCs.
- **CASTNET** – Clean Air Status and Trends Network is a national monitoring network established to assess trends in pollutant concentrations, atmospheric deposition, and ecological effects due to changes in air pollutant emissions.

NO₂ Design Criteria – operation of a minimum number of required NO₂ monitoring sites.

- **Near-Road** - Within the NO₂ network, there must be one microscale near-road NO₂ monitoring station in each CBSA with a population of 500,000 or more persons to monitor a location of expected maximum hourly concentrations sited near a major road with high AADT counts.
- **Area-Wide** - Within the NO₂ network, there must be one monitoring station in each CBSA with a population of 1,000,000 or more persons to monitor a location of expected highest NO₂ concentrations representing the neighborhood or larger spatial scales.
- **Regional Administrator Required Monitoring** – *Susceptible and vulnerable populations (S/V)*. The U.S. EPA Regional Administrators, in collaboration with States, must require additional NO₂ monitoring stations nationwide in any area, inside or outside of CBSAs, above the minimum monitoring requirements, with a primary focus on siting these monitors in locations to protect susceptible and vulnerable populations.

Operating Schedule - specifies how often a sample is taken.

- **Continuous** - operates 24 hours per day, 7 days per week; applies mainly to gaseous analyzers, although some particulate samplers (TEOM, SHARP, and BAMs) operate continuously.
- **Daily** – a sample is taken every day; applies to manual method particulate samplers.
- **3 - Day** - Manual method particulate samplers that run every third day.
- **6 - Day** - Manual method particulate samplers that run every sixth day.

Sampling Method – Each ambient air monitor is classified by a specific method number. This method combines both the collection procedure along with the analysis performed on the sample. These numbers can be found in the U.S. EPA “List of Designated Reference and Equivalent Methods” (see U.S. EPA Ambient Monitoring Technology Information Center web page at:

<https://www3.epa.gov/ttn/amtic/criteria.html>

Scale – The specific “spatial scales of representation” describes the physical dimensions of the air parcel around the monitoring station throughout which actual pollutant concentrations are reasonably similar.

- **Microscale** - Areas ranging from several meters to about 100 meters,
- **Middle scale** - Areas ranging from 100 meters to 0.5 kilometers,
- **Neighborhood** - 0.5 to 4.0 kilometers, and uniform land use,

- Urban scale - 4 to 50 kilometers,
- Regional - 50 to hundreds of kilometers.

Monitoring Objective – Describes the purpose/objective for monitoring at a site.

- General/Background concentration – sites located to determine general background concentration levels.
- Highest concentration – sites located to determine the highest concentrations expected to occur in the area covered by the network.
- Maximum Precursor Emissions Impact – sites where the magnitude and type of precursor emissions in the area are expected to impact. These sites are suited for the monitoring of urban air toxic pollutants.
- Population exposure – sites located to measure typical concentrations in areas of high population density.
- Quality assurance – sites where two monitors of the same type are located; one used to report air quality for the site, and the other dedicated as an audit monitor.
- Regional transport – sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.
- Source-oriented – sites located to determine the impact of significant sources or source categories on air quality.
- Upwind background – sites established to characterize upwind background and transported ozone and its precursor concentrations into an area.

Waiver Required – 40 CFR Part 58 Appendix E Section 10 allows for waiver provisions. Most sampling probes or monitors can be located so they meet the requirements of Appendix E. There may be existing sites that may not meet these requirements. The U.S. EPA will consider a written request from the State agency to waive one or more siting criteria for some monitoring sites providing that the State can adequately demonstrate the need (purpose) for monitoring or establishing a monitoring site at that location.

NAAQS Comparable – 40 CFR Part 58 Subpart B requires the identification of any sites that are suitable or not suitable for comparison against the PM_{2.5} NAAQS as described in § 58.11 and §58.30. If a 'No' is present in this category the data should not be used in comparison to the NAAQS.

Primary Monitor - The monitor identified by the monitoring organization that provides concentration data used for comparison to the NAAQS. For any specific site, only one monitor for each pollutant can be designated in AQS as primary monitor for a given period of time. The primary monitor identifies the default data source for creating a combined site record for purposes of NAAQS comparisons.

CBSA - Core-Based Statistical Area is defined by the U.S. Office of Management and Budget as a statistical geographic entity consisting of the county or counties associated with at least one urbanized area/urban cluster of at least 10,000 population, plus adjacent counties having a high degree of social and economic integration. CBSA replaces the term Metropolitan Statistical Area, MSA. The term MSA continues to be used in the CFR. Figure 2 is a map of the CBSAs in Indiana. Several border areas are included with other counties in bordering states.

CSA - Combined Statistical Area (CSA) is defined by the U.S. Office of Management and Budget as a geographical area consisting of two or more adjacent Core Based Statistical Areas (CBSA) with employment interchange of at least 15 percent.

Site Change Proposed – Designates whether this particular site is being considered for some type of modification during 2018: relocation, discontinuation, or addition.

Monitoring Requirements

Appendix A of 40 CFR Part 58 outlines the Quality Assurance Requirements for SLAMS, and other monitor types whose data are intended to be used to determine compliance with the NAAQS. It details the calibration and auditing procedures used to collect valid air quality data, the minimum number of collocated monitoring sites, the calculation used for data quality assessments and the reporting requirements. All sites in Indiana operate following the requirements set forth in this appendix.

Appendix B of 40 CFR Part 58 specifies the Quality Assurance Requirements for the control and assessment of the quality of the ambient air monitoring data submitted to a PSD reviewing authority or the EPA by an organization operating an air monitoring station, or network of stations, operated in order to comply with Part 51 New Source Review—Prevention of Significant Deterioration (PSD).

Appendix C of 40 CFR Part 58 specifies the criteria pollutant monitoring methods which must be used in SLAMS and NCore stations. All criteria pollutant monitoring in Indiana follows the methods specified in this appendix.

Appendix D of 40 CFR Part 58 deals with the network design criteria for ambient air quality monitoring. The overall design criteria, the minimum number of sites for each parameter, the type of sites, the spatial scale of the sites, and the monitoring objectives of the sites are detailed in this appendix. In designing the air monitoring network for Indiana, the requirements of this appendix were followed. The specifics for each pollutant network are in the individual parameter chapters.

O₃, PM₁₀, and PM_{2.5} have minimum monitoring requirements based upon the population of an MSA. Estimated 2017 population data from the U.S. Census Bureau are used in this report unless otherwise specified.

According to §2(e) of Appendix D, “The EPA recognizes that State and local agencies must consider MSA/CSA boundaries and their own political boundaries and geographical characteristics in designing their air monitoring networks. The EPA recognizes that there may be situations where the EPA Regional Administrator and the affected State or local agencies may need to augment or to divide the overall MSA/CSA monitoring responsibilities and requirements among these various agencies to achieve an effective network design. Full monitoring requirements apply separately to each affected State or local agency in the absence of an agreement between the affected agencies and the EPA Regional Administrator.” The individual tables list the data, the requirements, and the current sites for the full multi-agency MSAs or CBSAs. In instances where it is more logical or desirable to divide the monitoring requirements, Indiana has entered into an MOA, Memorandum of Agreement with some of the neighboring agencies to ensure that the minimum requirements for the MSA continue to be met and the resulting network provides adequate coverage. MOAs have been signed with the Southwest Ohio Air Quality Agency (SWOQA), the Louisville Metropolitan Air Pollution Control District (APCD), and the Illinois EPA. IDEM has verified with these agencies that nothing has changed and the MOA is current.

Appendix E of 40 CFR Part 58, which deals with the placement of the monitoring probe, its spacing from obstructions and what materials the probe can be made of. All monitors operated in Indiana meet Appendix E criteria.

Most monitoring sites are visited weekly by site operators who confirm and document operations and note any potential siting problems that could cause noncompliance with Part 58.

Quality Assurance

Quality assurance of environmental data operations (data and equipment) is provided by the Quality Assurance Section, an independent unit within the Air Monitoring Branch of the IDEM Office of Air

Quality. The foundation for the quality assurance program is set forth in 40 CFR Part 58 Appendix A and realized through the guidance found within its Quality Assurance Project Plan (QAPP), the IDEM Quality Assurance Manual. This document provides monitoring equipment operating procedures, quality assurance procedures, and data management tools to fulfill the requirements of Appendix A. The document's regulatory framework is based on those requirements outlined in 40 CFR Part 58 Appendices A, B, C, D, and E, as well as information in a variety of vendor and U.S. EPA guidance documents, primarily the *QA Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program* and *QA Handbook for Air Pollution Measurement Systems: Volume IV: Meteorological Measurements*. To further elaborate and define the information in the IDEM Quality Assurance Manual, standard operating procedures (SOPs) have been developed as guidance in achieving consistent and accurate quality assurance of environmental data operations.

An integral part of the monitoring network design are the siting requirements for ambient air-monitoring sites. The siting requirements are outlined in 40 CFR Part 58 Appendix E with additional guidance in the U.S. EPA QA Handbooks and the IDEM Quality Assurance Manual. The Appendix E site requirement include the following:

- Vertical distance of probe inlet above ground
- Horizontal distance of probe inlet from supporting structures, walls, parapets
- Location of probe inlet relative to prevailing wind conditions
- Probe inlet distance from minor sources
- Probe inlet distance from buildings and other potential obstruction
- Probe inlet distance from the drip-line of trees
- Probe inlet distance from roadways
- Probe material type
- Determination of pollutant sample residence time.

Over time, monitoring sites that initially met siting requirements may no longer conform to those requirements due to changes in the surrounding physical environment, the shelter conditions, and/or property land-use. During quarterly audits any potential siting or safety problems are noted and recommendations for corrections are made. On a triennial schedule, the Quality Assurance Section evaluates the site condition through physical measurements, site photographs and other observations to verify that each monitoring site continues to meet the criteria outlined in 40 CFR 58 Appendix E, Appendix A (vertical and horizontal distances between collocated particulate monitors), and the IDEM Quality Assurance Manual.

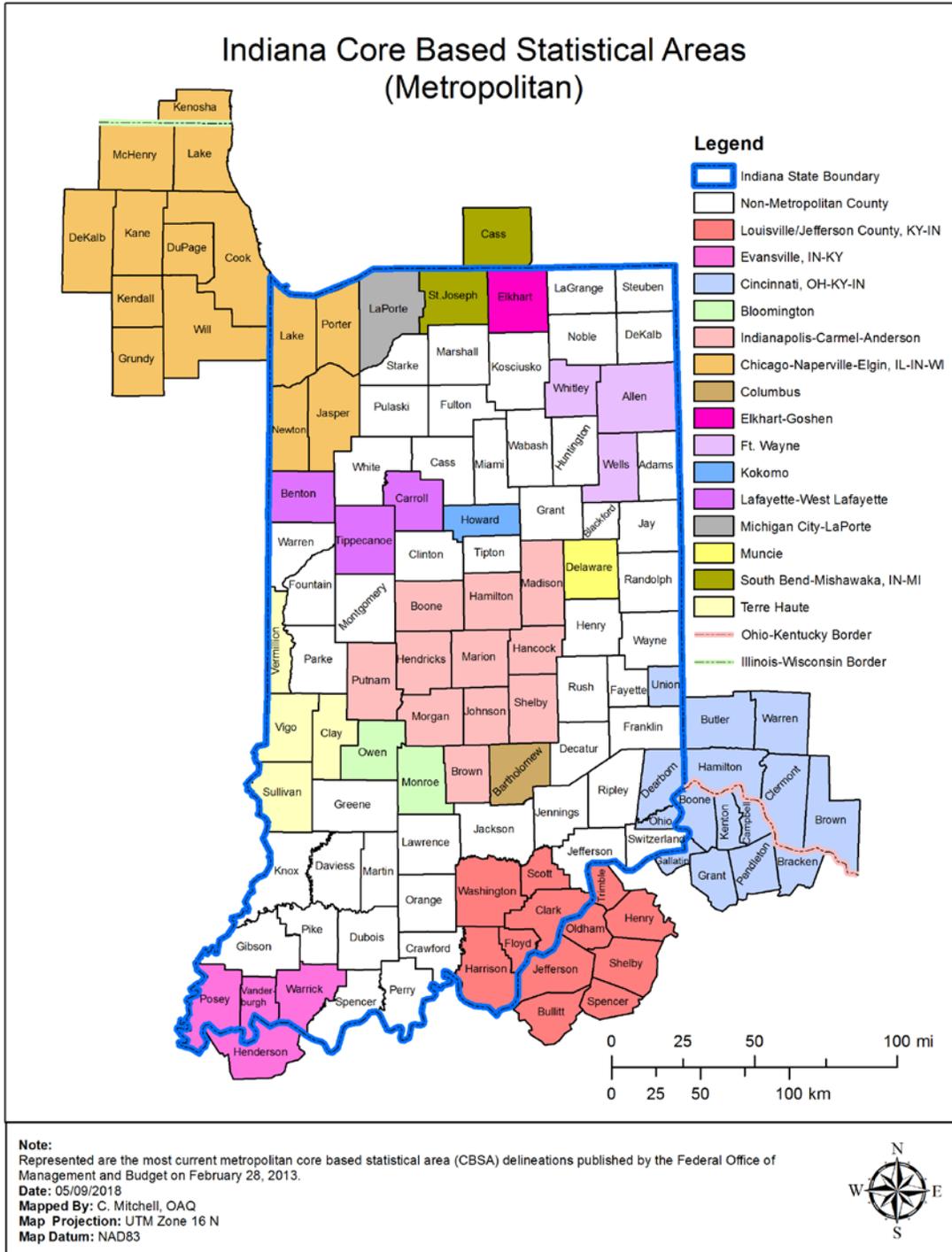
To confirm that the quality and usefulness of the collected air-monitoring data, Appendix A specifies acceptable limits on measurement uncertainty. To ensure that the data collection instruments meet those limits, the Air Monitoring Branch utilizes an automated calibration system for gas analyzers and manual verifications of filter-based and automated particulate matter (PM) instruments for quality control (QC) purposes. Daily span/zero control checks and weekly span/one-point QC checks/zero checks are scheduled to evaluate the operation of the gas analyzers. These results are reviewed by the LEADS system administrator and the Ambient Monitoring Section parameter specialist to identify issues that may affect data validity. In the event a weekly scheduled QC check cannot be performed due to issues with the on-site calibrator, a manual span/1-point QC check may be performed on the gas analyzer by the Ambient Section parameter specialist (or a QA staff member) to ensure that the monitoring system has at least one check per bi-weekly period. For particulate matter instruments, staff from the Ambient Monitoring Sections perform a monthly flow rate verification, along with other checks (ambient temperature, filter temperature, barometric pressure, system leak checks), on each filter-based and continuous PM monitor in the network and the units of the Chemical Speciation Network (CSN) PM_{2.5} monitoring program. Corrective action is undertaken when the one-point QC checks and the PM flow rate verifications exceed the limits prescribed in Appendix D of the U.S. EPA *Quality Assurance Handbook for Air Pollution Measurement System; Volume II* and the IDEM Quality Assurance Manual.

Appendix A of 40 CFR Part 58 requires an independent assessment of the ambient data collection activities. The Quality Assurance Section fulfills this role by performing quarterly audits of gas analyzers, filter-based and continuous PM instruments, CSN samplers, and annual audits of the meteorological sensors. Audit equipment used by the Quality Assurance Section staff is independent of that equipment used in calibrations, QC checks, and verifications. Quarterly performance evaluation audits of gas analyzers utilize the audit concentration levels outlined in Appendix A. For filter-based and automated PM samplers and the CSN PM_{2.5} monitoring network, the QA Section performs quarterly audits of the flow rate, temperature, barometric pressure, and leak checks of those units. Recently, the Quality Assurance Section has initiated a program to verify the capability of zero air generators and field zero air checks of the Summa canister collection systems used in the Air Toxics program. In addition, the Quality Assurance Section maintains and operates the Air Monitoring Branch Certification Facility. This facility certifies that the operation of calibration and test equipment and the concentration of test gas cylinders are comparable to equipment or test gas cylinders certified to National Institute of Standards and Technology (NIST) standards.

Data review is an examination of the collected data to ensure that it has been recorded and processed correctly. The collected environmental monitoring data and all audit results (weekly 1-point QC checks, monthly flow rate verifications and quarterly flow rate audits, and performance evaluation audits) are verified by Ambient Monitoring Section staff and validated by the Quality Assurance Section. The environmental data and the audit results are submitted to the U.S. EPA's Air Quality System (AQS) within 90 days after the end of the quarter.

In addition to the monitoring review activities performed by the Quality Assurance Section, U.S. EPA Region V staff and its Environmental Services Assistance Team (ESAT) contractor, TechLaw, Inc., provide an additional review of the IDEM monitoring operations and procedures. Each year the ESAT contractor conducts Performance Evaluation Program (PEP) audits on eight PM_{2.5} samplers and National Performance Audit Program (NPAP) audits on approximately 20% of the gas parameter monitoring sites. Every three years U.S. EPA Region V staff conducts a Technical Systems Audit (TSA) to review and evaluate the monitoring program, QA procedures, laboratory operations and project documentation. The latest TSA was performed May, 2018. These reviews ensure that the collected data meets its intended purpose of being representative of the air over Indiana and that the data can be compared to the National Ambient Air Quality Standards (NAAQS).

Figure 2 – Indiana CBSAs



Parameter Networks

Carbon Oxides (CO, CO₂)

Monitoring Requirements

40 CFR Part 58 Appendix D §4.2 details the requirements for CO monitoring. One CO monitor is required to operate collocated with one required near-road NO₂ monitor in CBSAs having a population of 1,000,000 or more persons. Other CO monitors may be required if deemed necessary by the Regional Administrator. As per 58.13(e)(2), Indiana's CO site must be operational by January 1, 2017.

In addition 40 CFR Part 58 Appendix D §3(b) states that CO measurements will be included at the NCore multi-pollutant monitoring sites. CO is monitored at the Indpls - Washington Park (180970078) NCore site.

Microscale and middle scale measurements are useful classifications for SLAMS CO sites since most people have the potential for exposure on these scales. Maximum CO concentrations primarily occur in areas near major roadways and intersections with high traffic density and often poor atmospheric ventilation.

Middle scale CO monitoring is intended to represent areas with dimensions from 100 meters to 0.5 kilometers. In some cases middle scale measurements may apply to areas that have a total length of several kilometers such as "Line Emission Sources." This type of emission source area would include air quality along a commercially developed street, a shopping plaza, a freeway corridor, parking lots and feeder streets.

Microscale CO monitoring applies when air quality measurements are to be used to represent distributions within street canyons, over sidewalks and near major roadways. Microscale measurements in one location can often be considered as representative of similar locations throughout a city.

There are no requirements to monitor the greenhouse gas CO₂. A regional scale site, Hope (180050007) measures background CO₂ concentrations in Indiana.

Monitoring Methodology

Indiana's carbon oxides monitoring network collects data with Teledyne Advanced Pollution Instrumentation (API) T300 and T360 (CO₂) analyzers along with Thermo Scientific Model 48i using nondispersive infrared monitoring methodology. The API Model 300EU and T300EU Trace level/Ultra-sensitive analyzers are used to collect trace level CO data at the NCore Indpls – Washington Park site.

Monitoring Network

Indiana operates five CO and two CO₂ monitors located throughout the state, as displayed in Figure 3. The details of the current network are listed in Table 2.

Network Modifications

A CO₂ monitor will be installed at Indpls – Harding St (180970057) for Neighborhood scale CO₂ monitoring in an urban setting.

Figure 3 – Carbon Oxides Monitoring Network

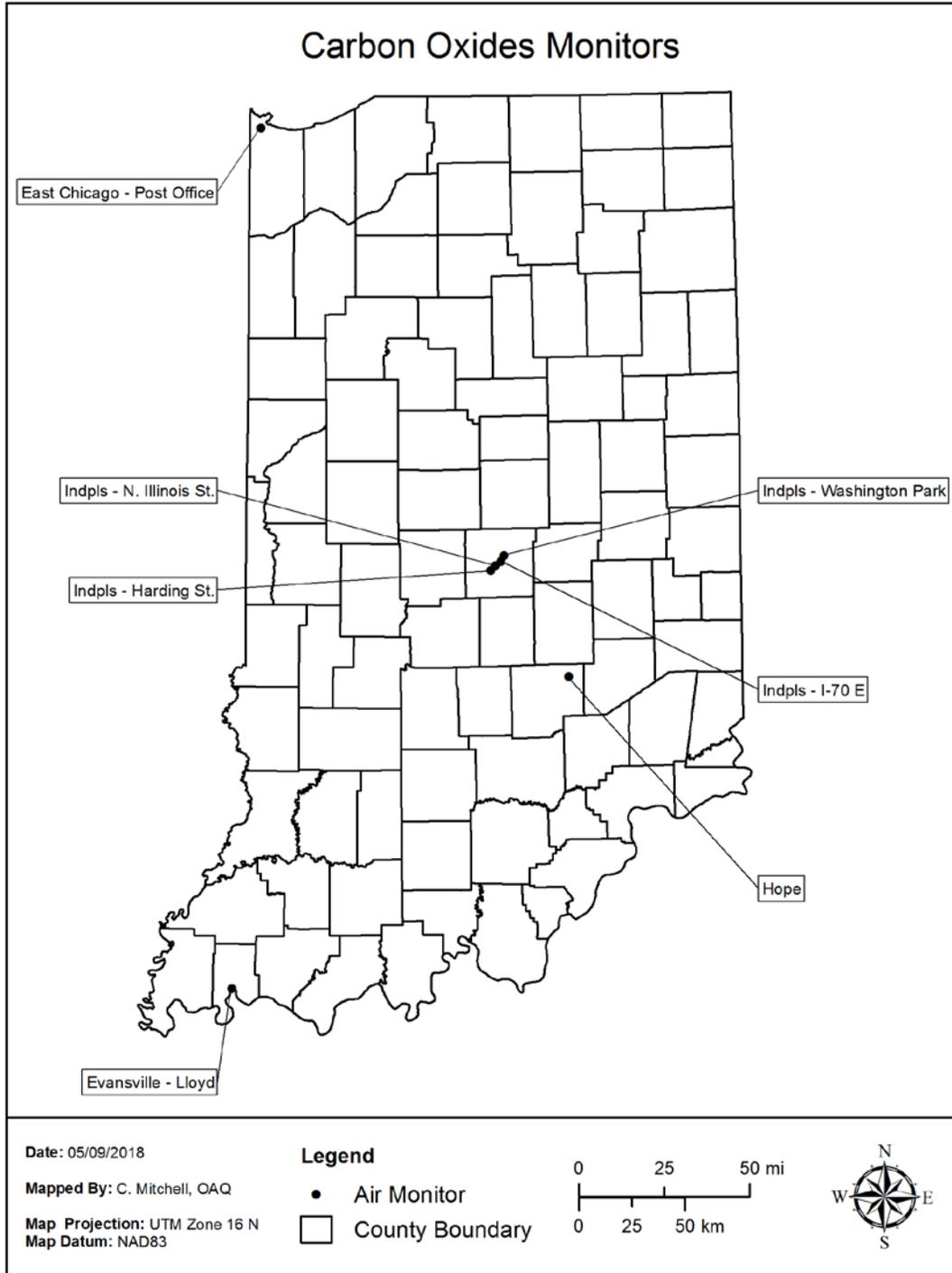


Table 2 – Carbon Oxides Monitoring Network

Parameter Code: 42101, 42102 CO, CO ₂ - Carbon Oxides														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180050007	Hope	Bartholomew		Hauser Jr-Sr HS, 9404 N775 E.	SPM	09/28/16	Continuous	012	Regional	Background	39.294322	-85.766846	Columbus	No
180890015	East Chicago - Post Office	Lake	East Chicago	Post Office, 901 East Chicago Ave.	SLAMS	03/01/84	Continuous	093	Micro	Highest Conc	41.629073	-87.461554	Chicago-Naperville-Elgin, IL-IN-WI	No
180970057	Indpls - Harding St.	Marion	Indianapolis	1321 S. Harding St.	SPM	01/01/19	Continuous	012	Neigh	Pop Exp	39.749027	-86.186269	Indianapolis-Carmel-Andersor	Add
180970072	Indpls - Illinois St.	Marion	Indianapolis	50 N. Illinois St.	SLAMS	02/01/90	Continuous	093	Micro	Highest Conc	39.768056	-86.160000	Indianapolis-Carmel-Andersor	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE)	01/01/10	Continuous	593	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Andersor	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	05/02/14	Continuous	093	Micro	Highest Conc	39.787933	-86.130880	Indianapolis-Carmel-Andersor	No
181630022	Evansville - Lloyd	Vanderburgh	Evansville	10 S. 11th Ave	SLAMS	09/10/09	Continuous	093	Micro	Highest Conc	37.977680	-87.596836	Evansville, IN-KY	No
<p><i>CO MONITORING METHOD: 054 - THERMO ELECTRON 48C, 48i</i> <i>093 - TELEDYNE API T300</i> <i>593 - TELEDYNE API 300EU, T300EU TRACE-LEVEL</i> <i>012 - TELEDYNE API T360 - CO2</i></p>														

Lead (Pb)

Monitoring Requirements

The lead NAAQS final rule of November 12, 2008, states that the primary and secondary standards for lead are not to exceed 0.15 $\mu\text{g}/\text{m}^3$ averaged over a rolling 3-month time period. 40 CFR Part 58 Appendix D §4.5 specifies that Pb monitoring must be conducted taking into account Pb sources which are expected to or have been shown to contribute to a maximum Pb concentration in ambient air in excess of the NAAQS, taking into account the logistics and potential for population exposure. At a minimum there must be one source-oriented SLAMS site located to measure the maximum Pb concentration in ambient air resulting from each Pb source which emits 0.5 or more tons per year (TPY). Annually IDEM works with U.S. EPA in reviewing the latest emissions inventories to determine if additional sources warrant monitoring. These emissions inventories include the most recent versions of the National Emissions Inventory (NEI), Toxics Release Inventory (TRI), and Indiana's Emission Inventory Tracking System (EMITS). IDEM reviewed the current emissions inventories and determined no new sources exceed the 0.5 TPY threshold, so no new Pb monitoring is required.

Waivers may be granted if the state can demonstrate the Pb source will not contribute to a maximum Pb concentration in ambient air in excess of 50% of the NAAQS. The waivers must be renewed once every 5 years as part of this ANP (see Appendix B, page 82).

Collocated samplers are required at 15% of the sites operated by a Primary Quality Assurance Organization (PQAO) or a minimum of one per network. Indiana is required to operate one collocated site.

Monitoring Scale

The appropriate scales for the source-oriented sites are either microscale (up to 100 meters) or middle scale (100 to 500 meters). The neighborhood scale (0.5 – 4.0 kilometers) is the appropriate scale for population-oriented monitoring.

Monitoring Methodology

Indiana utilizes TSP filter sampling with atomic absorption analysis to generate ambient Pb concentrations from the monitoring sites.

Monitoring Network

Waivers were granted in 2017 for ALCOA Power Plant, Warrick County and Ardagh Glass, Randolph County. Waivers were also granted in 2018 for the Belmont Wastewater Treatment facility in Indianapolis, Marion County, and Crane Army Ammunition Activity Area in Martin County. A waiver request is being made for Lehigh Cement in Cass County. See Appendix B.

The Pb monitoring network in Indiana in 2019 will consist of five sites. These sites are displayed in Figure 4 and detailed in Table 3.

Unplanned Changes to the 2018 Network Plan

Discontinued East Chicago – E. 135 St. Pb and Mn monitoring on July 1, 2017 because the school closed where the monitoring site was located and the building was to be demolished. Due to the much improved lead concentrations in the area, the decrease in the lead emissions from the surrounding sources, and the improved modeling results a new site did not need to be found.

Network Modifications

A Pb and Mn 3-day intermittent monitoring site will be installed at a Hammond wastewater pumping station. It will be a source-oriented site on Whiting Metals.

Figure 4 – Lead Monitoring Network

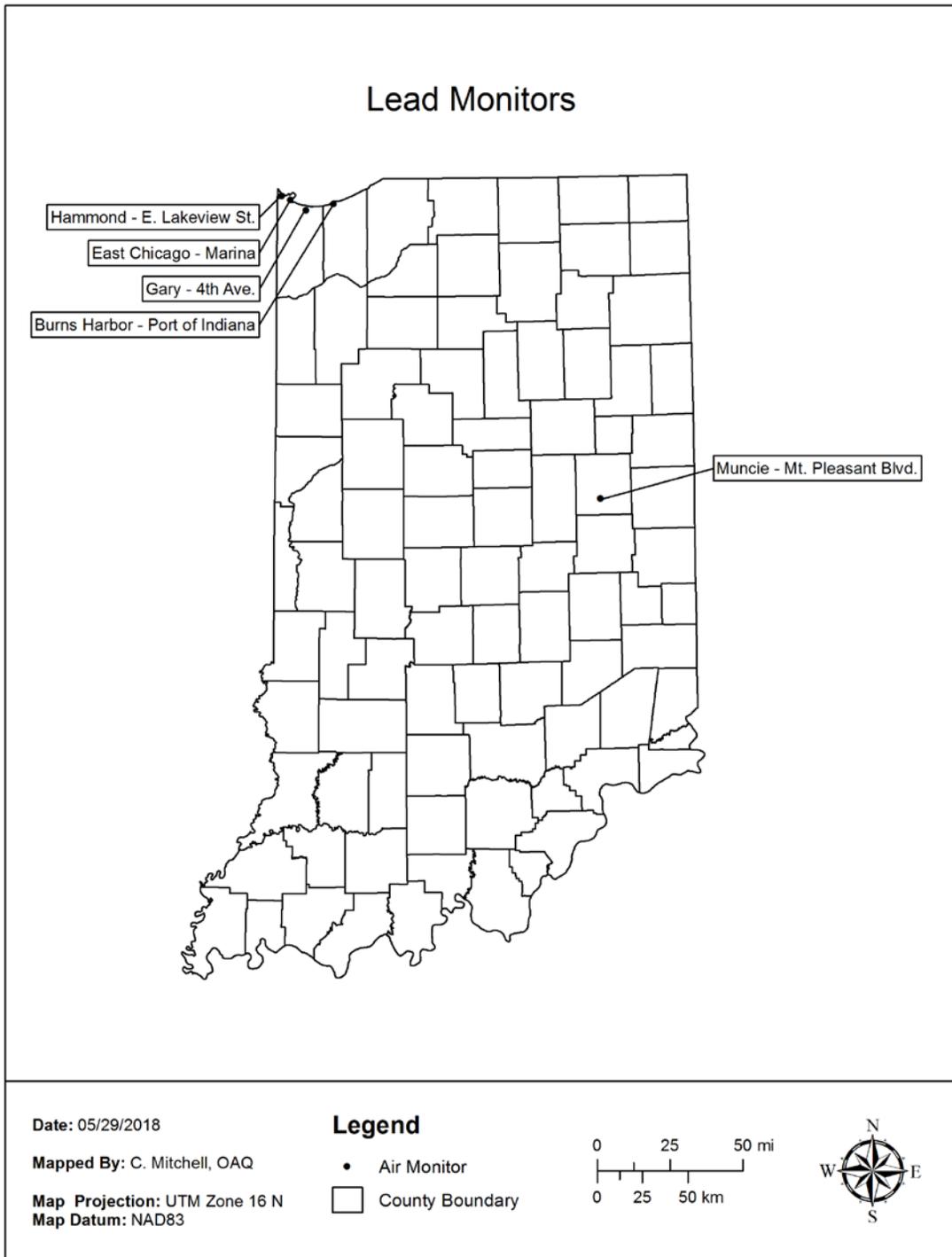


Table 3 – Lead Monitoring Network

Parameter Code: 14129 Pb - Lead																
Site ID	Site Name	County	City	Address	Monitoring Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Source Oriented?	Site Change Proposed?	
180350009	Muncie - Mt. Pleasant Blvd.	Delaware	Muncie	2601 W. Mt. Pleasant Blvd.	SLAMS	01/02/10	6-Day	107	Middle	Source Oriented	40.158417	-85.415021	Muncie	Yes Exide	No	
180350009	Muncie - Mt. Pleasant Blvd.	Delaware	Muncie	2601 W. Mt. Pleasant Blvd.	SLAMS	01/01/18	6-Day	107	Middle	Quality Assurance	40.158417	-85.415021	Muncie	Yes Exide	No	
180890032	Gary - 4th. Ave	Lake	Gary	Gary SouthShore RailCats, One Stadium Plaza	SLAMS	01/02/10	6-Day	107	Middle	Source Oriented	41.603582	-87.332658	Chicago-Naperville-Elgin, IL-IN-WI	Yes US Steel	No	
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SLAMS	10/30/12	6-Day	107	Middle	Source Oriented	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	Yes Mittal East	No	
18089	Hammond - E. Lakeview St	Lake	Hammond	2141 E. Lakeview St	SPM		3-Day	107	Middle	Source Oriented	41.674189	-87.495024	Chicago-Naperville-Elgin, IL-IN-WI	Yes Whiting Metals	Add	
181270027	Burns Harbor-Port of Indiana	Porter		E. Boundary Rd	SLAMS	08/18/11	6-Day	107	Middle	Source Oriented	41.635161	-87.150376	Chicago-Naperville-Elgin, IL-IN-WI	Yes Arcelor Mittal	No	
MONITORING METHOD: 107 - HI-VOL SAMPLER/FLAMELESS ATOMIC ABSORPTION (GFAA)																

Oxides of Nitrogen (NO, NO₂, NO_x, NO_y)

Monitoring Requirements

On February 9, 2010, the Federal Register amended 40 CFR Parts 50 and 58 establishing a new NO₂ NAAQS for 1-hour concentrations and new monitoring requirements to be implemented by January 1, 2014.

One microscale near-road NO₂ monitoring station must be located within each CBSA with a population of 500,000 people, or more to be installed by January 1, 2014. An additional near-road NO₂ monitoring station is required for any CBSA with a population of 2,500,000 persons or more. For Indiana, one near-road site is required for the Indianapolis-Carmel-Anderson CBSA. Additionally, sites are required for the Cincinnati, OH-KY-IN CBSA, the Louisville/Jefferson County, KY-IN CBSA, and the Chicago-Naperville-Elgin, IN-IL-WI CBSA. These cross-state requirements are addressed in agreements signed with the appropriate neighboring agencies.

One area-wide NO₂ monitoring station must also be located in each CBSA with a population greater than 1,000,000 people and was required to be installed by January 1, 2013. Each area listed above also requires an area-wide monitor.

Gary – IITRI (180890022) has been designated a Regional Administrator Required Monitor by the U.S. EPA. 40 CFR Part 58 Appendix D §4.3.4(a) states: "The Regional Administrators, in collaboration with States, must require a minimum of forty additional NO₂ monitoring stations nationwide in any area, inside or outside of CBSAs, above the minimum monitoring requirements, with a primary focus on siting these monitors in locations to protect susceptible and vulnerable populations." Susceptible and vulnerable populations include asthmatics and disproportionately exposed groups at particular risk of NO₂-related health effects, both because of increased exposure and because these groups have a higher prevalence of asthma and higher hospitalization rates for asthma. These monitors were to be designated by January 1, 2013.

40 CFR Part 58 Appendix D §3(b) and 40 CFR Part 58 Appendix D §4.3 state that NO/NO_y measurements should be included at the NCore multi-pollutant monitoring sites and in the PAMS program. NO/NO_y monitors are used at these sites because it is important to collect data on total reactive nitrogen species in order to better understand O₃ photochemistry.

Monitoring Methodology

The NO, NO₂ and NO_x network uses Thermo Scientific Model 42i chemiluminescence monitors to collect data. The API Model T200U NO_y Trace level/Ultra-sensitive analyzer is used to collect NO and NO_y data at the Indpls – Washington Park NCore site (180970078). The Teledyne Model T500U Cavity Attenuated Phase Shift (CAPS) NO₂ Analyzer measures NO₂ directly unlike the traditional chemiluminescence monitors that measure NO₂ by subtracting NO from NO_x.

Monitoring Network

Indiana operates five NO₂ monitors and one trace level NO_y monitor as displayed in Figure 5. The current network, along with any changes planned in 2019, is listed in Table 4.

Network Modifications

There are no network modifications planned for 2019.

Figure 5 – Oxides of Nitrogen Monitoring Network

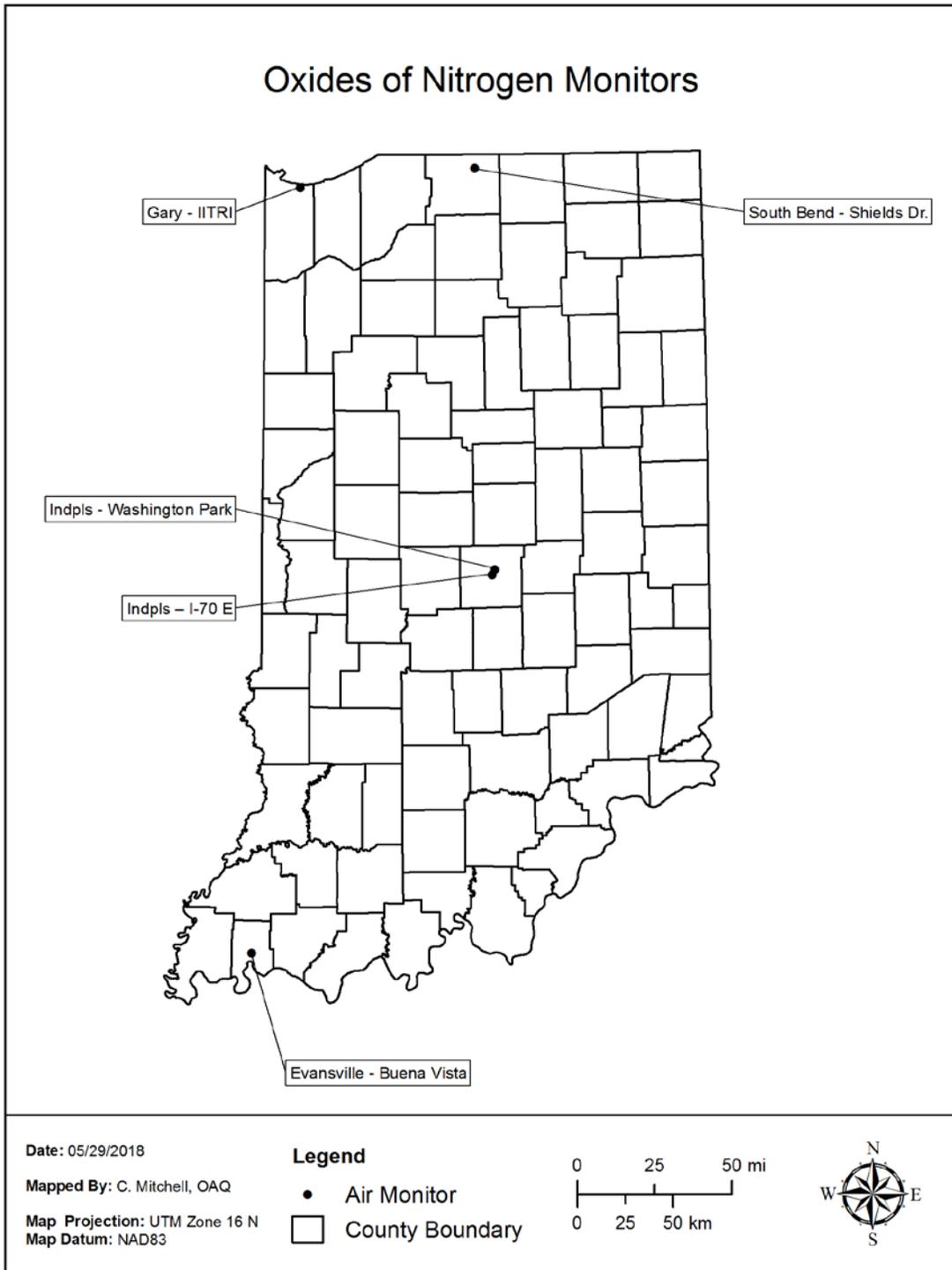


Table 4 – Oxides of Nitrogen (NO, NO₂, NO_x, NO_y) Monitoring Network

Parameter Code: 42601, 42602, 42603, 42600															
NO, NO ₂ , NO _x , NO _y - Oxides of Nitrogen															
Site ID	Site Name	County	City	Address	Monitor Type (Network)	NO _x Design Criteria	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	S/V	06/27/95	Continuous	074	Neigh	Highest Conc	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE/PAMS)	Area-Wide	01/01/13	Continuous	212	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE/PAMS)		01/01/11	Continuous	699	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	Near-Road	02/07/14	Continuous	212	Micro	Pop Exp	39.787933	-86.130880	Indianapolis-Carmel-Anderso	No
181410015	South Bend - Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	SLAMS		06/06/06	Continuous	074	Neigh	Pop Exp	41.696667	-86.214722	South Bend-Mishawaka, IN-MI	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS		07/08/09	Continuous	074	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No

NO_x MONITORING METHOD: 074-THERMO ELECTRON 42i
 NO_y MONITORING METHOD: 699-TELEDYNE API 200EU NO_y TRACE-LEVEL
 NO₂ MONITORING METHOD: 212-TELEDYNE API T500U CAPS

Ozone (O₃)

Monitoring Requirements

Table D-2 in 40 CFR Part 58 Appendix D details the number of O₃ sites required in each CBSA. The number of sites is based on the population of a CBSA and if the design value exceeds 85% of the standard, or 0.060 ppm, for that area. Table 5 lists the requirements stated in Part 58. Table 6 lists the requirements as they relate to Indiana. There are five CBSAs which cross state lines. Except for the Cincinnati, OH-KY-IN CBSA, Indiana meets the requirement for all CBSAs, including multi-agency CBSAs. A multi-agency agreement between the Southwest Ohio Air Quality Agency (Cincinnati, OH) and IDEM specifies that the Southwest Ohio Air Quality Agency will fulfill all the O₃ monitoring requirements in this CBSA. In the absence of an agreement, Indiana would be required to operate two sites in the Cincinnati, OH-KY-IN CBSA.

Monitoring Season

Table D-3 of Appendix D of Part 58 defines the O₃ monitoring season for all of the states. Indiana's monitoring season is from March 1 to October 31 which is the same as all surrounding states. All Indiana sites began operating year-round starting on January 1, 2018.

Indpls – Washington Park (180970078) is Indiana's NCore site and Indpls – I-70 E (180970087) is Indiana's near-road site. They are both required to collect data all year. Indiana has elected to conduct year-round O₃ monitoring at all sites starting on January 1, 2018 due to the extension of the O₃ season by two months in 2017. The previous benefits of being able to turn equipment off for six months to save wear and expendables has been lessened with the longer season.

Data

The design value for an area, usually a county or a CBSA, is determined by the 3-year average of the 4th highest daily 8-hour maximum from the highest site in the area. If this value is greater than 0.070 ppm, the area is considered to be in violation of the NAAQS and could potentially be designated as a nonattainment area. If the air quality improves and the design value is 0.070 ppm or less, the area may be reclassified as a maintenance area.

The design values for all sites for the most recent sampling period (2015 – 2017) along with the 2015 8-hour nonattainment areas are illustrated in Figure 6. All sites had design values for the most recent sampling period (2015 – 2017) meet the current 2015 NAAQS of 0.070 ppm. Michigan City – W. Michigan Blvd. (180910005) monitor does not have a design value for the sample period (2015 – 2017) because there was less than 75% data recovery in 2016 due to the replacement of the shelter, land lease delays, and equipment problems.

Monitoring Methodology

Monitoring sites in Indiana use Federal Equivalent Method O₃ analyzers from Thermo Scientific; Models 49c, or 49i (Method Code 047), or API Model T400 (Method Code 087). These monitors use ultraviolet absorption photometry. Air is drawn through a sample cell through which ultraviolet light (254 nm wavelength) passes. Any light that is not absorbed by the O₃ is then converted into an electrical signal proportional to the O₃ concentration.

Monitoring Network

In 2019 there will be 41 monitoring sites in Indiana's O₃ monitoring network as displayed in Figure 7. In addition CASTNET operates two O₃ analyzers in Indiana at Vincennes (180839991) and Salamonie Reservoir (181699991). CASTNET's Annual Network Plan can be found at: <https://java.epa.gov/castnet/documents.do>

In 2013 Greene County was removed from the Bloomington MSA. This necessitated finding another O₃ site in the Bloomington MSA to replace Plummer as it was no longer included in the Bloomington MSA. A new O₃ site was located in Helmsburg, northeast (downwind) of

Bloomington. Even though Helmsburg is in Brown County, part of the Indianapolis MSA, consultations with U.S. EPA Region 5 deemed it acceptable as the downwind site to collect data for the Bloomington MSA. (Indiana 2015 Ambient Air Monitoring Network Plan, pages 81-82)

Indiana's O₃ monitoring network with proposed changes for 2019 is in Table 7.

Network Modifications

There are no network modifications planned for 2019.

Table 5 – SLAMS Minimum O₃ Monitoring Requirement

# of Sites Required per Population and Design Value		
<u>MSA Population</u>	<u>3yr Design Value ≥ 85% of NAAQS (0.060 ppm)</u>	<u>3 yr Design Value < 85% of NAAQS (0.060 ppm)</u>
>10 million	4	2
4-10 million	3	1
350,000 - 4 million	2	1
50,000 - 350,000	1	0

Table 6 – SLAMS O₃ Sites Required for Indiana

Indiana MSAs	MSA Population (Est 2017) ¹	Design Value (ppm) (2015-2017)	# of Sites Required per CFR	2018 No. of Sites	2019 No. of Sites
Bloomington	167,825	0.062	1	1 ⁴	1 ⁴
Chicago-Naperville-Elgin, IL-IN-WI (total MSA)	9,533,040	0.078 ²	3	21 ²	-
Chicago-Naperville-Elgin, IL-IN-WI (IN only)	9,533,040	0.069 ³	3	4 ³	4
Cincinnati, OH-KY-IN (total MSA)	2,179,082	0.073 ²	2	10 ²	
Cincinnati, OH-KY-IN (IN only)	2,179,082	No Data ³	2	0 ³	0
Columbus	82,040	0.067	1	1	1
Elkhart-Goshen	205,032	0.064	1	1	1
Evansville, IN-KY (total MSA)	315,669	0.069 ²	1	6 ²	-
Evansville, IN-KY (IN only)	315,669	0.069 ³	1	5 ³	5
Fort Wayne	434,617	0.064	2	2	2
Indianapolis-Carmel-Anderson	2,028,614	0.07	2	11 ⁴	11 ⁴
Kokomo	82,363	No Data	0	1	1
Lafayette-West Lafayette	219,239	0.063	1	1	1
Louisville/Jefferson County, KY-IN (total MSA)	1,293,953	0.074 ²	2	7 ²	-
Louisville/Jefferson County, KY-IN (IN only)	1,293,953	0.071 ³	2	2 ³	2
Michigan City-LaPorte	110,029	0.072 ⁵	1	2	2
Muncie	115,184	0.062	1	1	1
South Bend-Mishawaka, IN-MI (total MSA)	321,815	0.070 ²	1	4 ²	-
South Bend-Mishawaka, IN-MI (IN only)	321,815	0.070 ³	1	3 ³	3
Terre Haute	169,965	0.067	1	2	2
Non MSA					
West Union - Clark Co., IL		0.065		1	1
Plummer - Greene Co. ³		0.067		1	1
Brownstown - Jackson Co.		0.065		1	1
Huntington - Huntington Co.		0.060		1	1
Leopold - Perry Co.		0.067		1	1
		DV exceeds NAAQS			
		DV ≥ 85% of NAAQS			
# of sites needed if Indiana meets all multi-state MSA requirements			20		
			Sites in Indiana Network	41	41
¹ Population from estimated 2017 US Census Bureau					
² Information for full MSA.					
³ Information for Indiana's portion of MSA.					
⁴ Bloomington MSA impact site is located in Brown County, part of Indianapolis-Carmel-Anderson MSA.					
⁵ Data from 2015 and 2017 only.					

Figure 6 – O₃ Design Values (2015 – 2017)

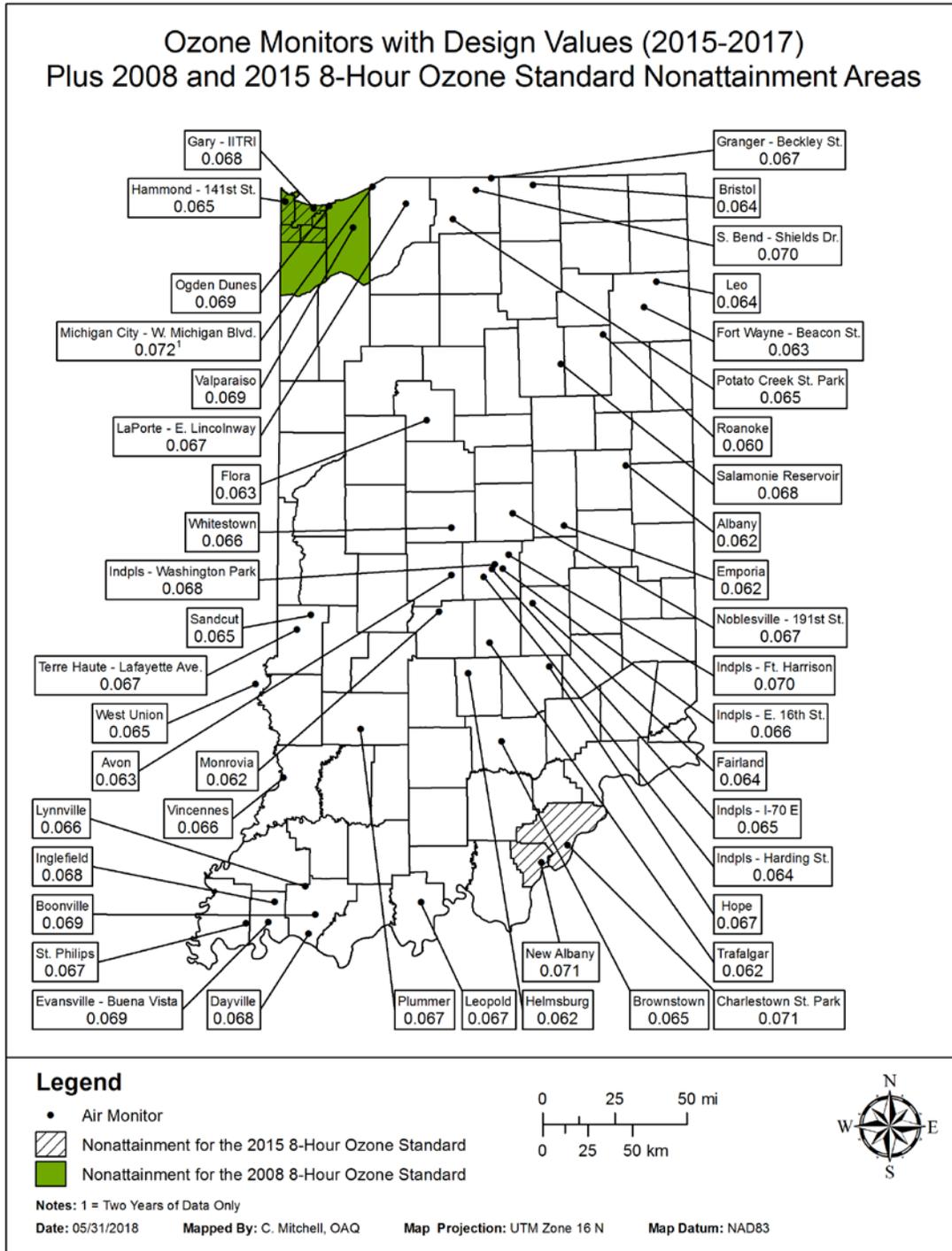


Figure 7 – O₃ Monitoring Network

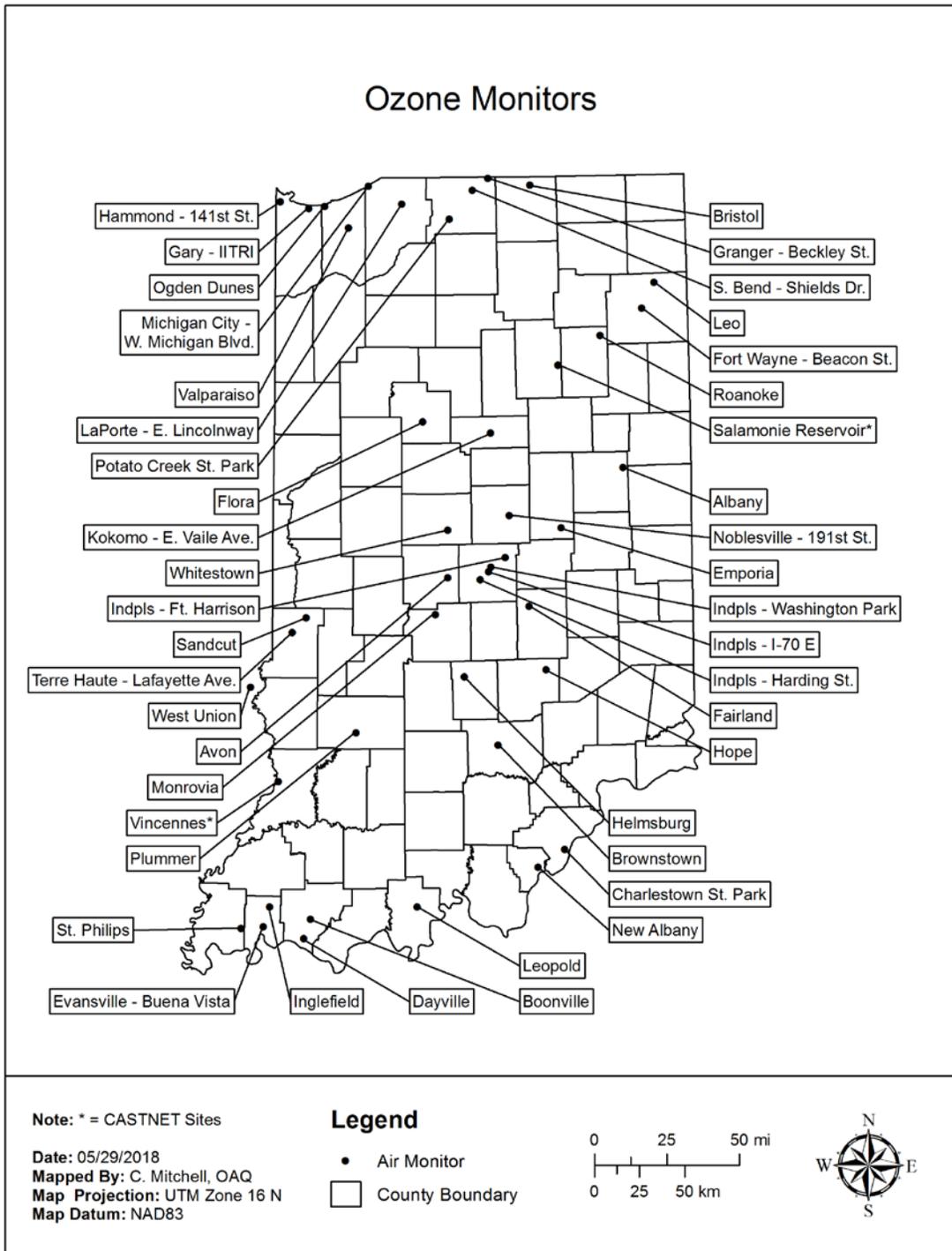


Table 7 – Ozone Monitoring Network

Parameter Code: 44201		O ₃ - Ozone												
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
170230001	West Union	Clark, IL		416 S. Hwy 1, West Union, IL	SLAMS	04/01/01	Continuous	047	Urban	General Bkqrd	39.210857	-87.668297	Non-MSA County	No
180030002	Leo HS	Allen	Leo	Leo HS, 14600 Amstutz Rd.	SLAMS	04/01/86	Continuous	047	Urban	Highest Conc	41.221418	-85.016821	Ft. Wayne	No
180030004	Ft Wayne - Beacon St.	Allen	Fort Wayne	2022 N. Beacon St.	SLAMS	07/01/79	Continuous	047	Neigh	Pop Exp	41.094965	-85.101816	Ft. Wayne	No
180050007	Hope	Bartholomew		Hauser Jr-Sr HS, 9404 N775 E.	SLAMS	05/28/13	Continuous	087	Urban	Pop Exp	39.294322	-85.766846	Columbus	No
180110001	Whitestown	Boone		Perry - Worth Elem Sch., 3900 E. 300 S, Lebanon	SLAMS	04/01/01	Continuous	087	Urban	Highest Conc	39.997773	-86.395394	Indianapolis-Carmel-Andersor	No
180130001	Helmsburg	Brown		Jackson Twp Fire Dept. 4831 Helmsburg Road, Nashville	SLAMS	05/16/14	Continuous	047	Urban	Highest Conc	39.263914	-86.292261	Indianapolis-Carmel-Andersor	No
180150002	Flora	Carroll		Flora Airport, 481 S. 150 W., Flora	SLAMS	04/01/01	Continuous	047	Urban	Pop Exp	40.540455	-86.553035	Lafayette-West Lafayette	No
180190008	Charlestown State Park	Clark		Charlestown State Park, 12500 Hwy 62, Charlestown	SLAMS	05/04/07	Continuous	047	Urban	Highest Conc	38.393823	-85.664118	Louisville/Jefferson County, KY-IN	No
180350010	Albany	Delaware	Albany	Albany Elem. Sch., 706 W. State St.	SLAMS	04/01/01	Continuous	087	Urban	Pop Exp	40.300385	-85.245862	Muncie	No
180390007	Bristol	Elkhart	Bristol	Bristol Elem Sch., 705 Indiana Ave.	SLAMS	04/01/02	Continuous	047	Urban	Pop Exp	41.716959	-85.824696	Elkhart-Goshen	No
180431004	New Albany	Floyd	New Albany	Green Valley Elem. Sch., 2230 Green Valley Road	SLAMS	01/01/77	Continuous	087	Neigh	Highest Conc	38.307913	-85.834313	Louisville/Jefferson County, KY-IN	No
180550001	Plummer	Greene		2500 S. 275 W	SLAMS	04/03/00	Continuous	047	Regional	Upwind Bkqrd	38.985556	-86.990000	Non-MSA County	No
180570006	Noblesville - 191st St.	Hamilton	Noblesville	Our Lady of Grace Catholic Church, 9900 E. 191st St.	SLAMS	05/13/10	Continuous	047	Urban	Highest Conc	40.068297	-85.992451	Indianapolis-Carmel-Andersor	No
180630004	Avon	Hendricks	Avon	7203 E. US 36, Avon	SLAMS	04/01/00	Continuous	047	Urban	Pop Exp	39.758889	-86.398611	Indianapolis-Carmel-Andersor	No
180670004	Kokomo - E. Vaile Ave.	Howard	Kokomo	1802 E. Vaile Ave.	SLAMS	01/01/18	Continuous	087	Urban	Pop Exp	40.481347	-86.109688	Kokomo	No
180690002	Roanoke Elem School	Huntington	Roanoke	Roanoke Elem. Sch., 423 W. Vine St.	SLAMS	04/14/00	Continuous	047	Urban	Upwind Bkqrd	40.959604	-85.379610	Non-MSA County	No
180710001	Brownstown	Jackson		225 W & 300 N, Brownstown	SLAMS	04/04/00	Continuous	047	Regional	Upwind Bkqrd	38.920835	-86.080523	Non-MSA County	No
180839991	Vincennes	Knox		Southwest Purdue Agricultural Cente	CASTNET	04/04/11	Continuous	047	Regional	Highest Conc	38.740792	-87.484923	Non-MSA County	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	07/01/95	Continuous	047	Neigh	Pop Exp	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180892008	Hammond - 141st St.	Lake	Hammond	1300 E. 141st St.	SLAMS	01/01/76	Continuous	047	Neigh	Pop Exp	41.639444	-87.493611	Chicago-Naperville-Elgin, IL-IN-WI	No
180910005	Michiqan City - W. Michiqan Blvd.	La Porte	Michiqan City	NIPSCO Gas Station, 490 W. Michiqan Blvd.	SLAMS	05/24/90	Continuous	047	Urban	Pop Exp	41.717662	-86.907786	Michiqan City-LaPorte	No
180910010	LaPorte - E. Lincolnway	La Porte	La Porte	2011 E. Lincolnway	SLAMS	05/07/97	Continuous	047	Urban	Pop Exp	41.629167	-86.684444	Michiqan City-LaPorte	No

Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180950010	Emporia	Madison		East Elem. Sch., 893 E. US 36, Pendleton	SLAMS	04/05/93	Continuous	047	Urban	Pop Exp	40.002511	-85.656391	Indianapolis-Carmel-Andersor	No
180970050	Indpls - Ft Harrison	Marion	Indianapolis	5753 Glenn Rd	SLAMS	12/01/79	Continuous	087	Urban	Highest Conc	39.858889	-86.021389	Indianapolis-Carmel-Andersor	No
180970057	Indpls - Harding St.	Marion	Indianapolis	1321 S. Harding St.	SLAMS	03/01/82	Continuous	087	Neigh	Pop Exp	39.749027	-86.186269	Indianapolis-Carmel-Andersor	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE/PAMS)	04/01/09	Continuous	047	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Andersor	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	05/14/14	Continuous	047	Neigh	Pop Exp	39.787933	-86.130880	Indianapolis-Carmel-Andersor	No
181090005	Monrovia	Morgan	Monrovia	Monrovia HS., 135 S. Chestnut St,	SLAMS	04/01/97	Continuous	047	Urban	Pop Exp	39.575409	-86.477852	Indianapolis-Carmel-Andersor	No
181230009	Leopold	Perry		Perry Central HS, 18797 Old St Rd 37, Leopold	SLAMS	04/01/04	Continuous	047	Urban	Highest Conc	38.115152	-86.603250	Non-MSA County	No
181270024	Ogden Dunes	Porter	Ogden Dunes	Water Treatment Plant, 84 Diana Rd	SLAMS	11/01/83	Continuous	047	Urban	Highest Conc	41.617500	-87.199167	Chicago-Naperville-Elgin, IL-IN-WI	No
181270026	Valparaiso	Porter	Valparaiso	Valpo Water Department, 1000 Wesley St.	SLAMS	04/01/98	Continuous	047	Urban	Pop Exp	41.512118	-87.036236	Chicago-Naperville-Elgin, IL-IN-WI	No
181290003	St Philips	Posey		2027 South St. Phillips Rd., Evansville	SLAMS	07/01/96	Continuous	047	Urban	Upwind Bkqrd	38.005278	-87.718056	Evansville, IN-KY	No
181410010	Potato Creek State Park	St Joseph		Potato Creek St. Park, 25601 St. Rd 4, North Liberty	SLAMS	04/24/91	Continuous	047	Urban	Upwind Bkqrd	41.551667	-86.370556	South Bend-Mishawaka, IN-MI	No
181410015	South Bend-Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	SLAMS	06/06/06	Continuous	047	Neigh	Pop Exp	41.696667	-86.214722	South Bend-Mishawaka, IN-MI	No
181410016	Granger-Beckley St.	St Joseph	Granger	12441 Beckley St., Granger	SLAMS	04/01/12	Continuous	047	Urban	Highest Conc	41.754722	-86.110000	South Bend-Mishawaka, IN-MI	No
181450001	Fairland	Shelby		Triton Central MS, 4740 W. 600N , Fairland	SLAMS	04/01/00	Continuous	047	Urban	General Bkqrd	39.613367	-85.870669	Indianapolis-Carmel-Andersor	No
181630013	Inglefield	Vanderburgh		Scott School, 14940 Old State Road	SLAMS	05/01/80	Continuous	047	Urban	Highest Conc	38.113889	-87.536667	Evansville, IN-KY	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/08/09	Continuous	047	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	07/01/83	Continuous	047	Neigh	Pop Exp	39.485987	-87.401312	Terre Haute	No
181670024	Sandcut	Vigo		7597 N. Stevenson Rd., Terre Haute	SLAMS	04/01/01	Continuous	047	Urban	Pop Exp	39.558525	-87.312883	Terre Haute	No
181699991	Salamonie Reservoir	Wabash		Hamilton Rd., Largo	CASTNET	06/01/11	Continuous	047	Regional	Highest Conc	40.816038	-85.661407	Non-MSA County	No
181730008	Boonville	Warrick	Boonville	Boonville HS, 300 N. 1st St.	SLAMS	04/16/91	Continuous	047	Urban	Highest Conc	38.051667	-87.278056	Evansville, IN-KY	No
181730011	Dayville	Warrick		3488 Eble Rd., Newburgh	SLAMS	04/01/07	Continuous	047	Urban	Highest Conc	37.954444	-87.321667	Evansville, IN-KY	No

O3 MONITORING METHOD: 047 - THERMO ELECTRON 49C, 49I
087 - TELEDYNE API T400

Particulate Matter (PM₁₀)

Monitoring Requirements

The requirements for the design of the PM₁₀ monitoring network are listed in 40 CFR Part 58 Appendix D §4.6. Indiana must operate the minimum number of sites as defined by the CBSA population and the ambient PM₁₀ data of the area. Table 8 lists the sites required per CBSA along with the highest monitored PM₁₀ value in the proper category for each CBSA. The current and proposed networks are also listed. There are five CBSAs which cross state lines. Indiana meets the requirement for the number of sites for the full CBSA, in the multi-agency CBSAs, except for the Cincinnati, OH-KY-IN and Louisville/Jefferson County, KY-IN CBSAs. IDEM has multi-agency agreements with the Southwest Ohio Air Quality Agency (Cincinnati, OH) and the Louisville Metropolitan Air Pollution Control District (APCD) specifying the sites which will operate in each district to fulfill the PM₁₀ monitoring requirements in the Cincinnati, OH-KY-IN and Louisville/Jefferson County, KY-IN CBSAs.

Collocated samplers are required at 15% of the sites in the network to determine monitoring precision. IDEM is required to operate two collocated samplers.

Monitoring Methodology

Intermittent PM₁₀ samples are collected on a pre-weighed 46.2 mm diameter Teflon™ filter. Air is drawn through an inlet designed to pass only particles smaller than 10 microns in diameter and across the filter for 24 hours. The filter is then removed and weighed again. Concentrations are calculated by dividing the weight gain by the volume of air that passed through the filter.

Continuous PM₁₀ concentrations are obtained by using three different methods. A Thermo Scientific Model 1405 collects the particulate on a filter attached to an oscillating glass rod. The concentration of the particulate is proportional to the change in oscillating frequency. A second monitor method used is the Met One BAM 1020 which collects particulate matter through a sampling inlet onto a filter tape. The amount of particulate concentration is determined by measuring beta ray transmissions through the tape. The Teledyne API 602 Beta^{PLUS} is also used to collect continuous PM₁₀ on 47 mm diameter filters using direct beta attenuation to determine the mass measurement.

Monitoring Network

Indiana currently operates 11 monitoring sites in the State. The 2019 network is displayed in Figure 8. Concentrations at all sites except for two source-oriented sites in Northwest Indiana, Gary – IITRI (180890022) and Portage – Hwy 12 (181270023), are well under 50% of the 24-hour NAAQS of 150 µg/m³. Table 9 details the current PM₁₀ network.

Network Modifications

Continuous PM₁₀ will be added to East Chicago – Marina (180890034) to support enhanced monitoring.

NAAQS Comparison

All PM₁₀ samplers and monitors collect data which are compared to the NAAQS. At Indpls – Washington Park (180970078) and East Chicago – Marina, which have both an intermittent sampler and a continuous monitor, the intermittent sampler is designated as the Primary Monitor and the continuous monitor is designated as the Secondary Monitor.

Table 8 – PM₁₀ Site Requirements

CFR Requirement	MSA Population		High Conc. ¹	Medium Conc. ²	Low Conc. ³			
> 1,000,000		# of Required Sites =>	6-10	4-8	2-4			
	MSA	Population	MSA Highest Value			# of Sites 2018	# of Sites 2019	
	Chicago-Naperville-Elgin, IL-IN-WI	9,533,040			124 ^{4,6} / 67 ^{5,6}	9	-	
	Chicago-Naperville-Elgin, IL-IN-WI	9,533,040			124 ^{4,7} / 54 ^{5,7}	5	5	
	Cincinnati, OH-KY-IN	2,179,082			82 ^{4,6} / 46 ^{5,6}	8	-	
	Cincinnati, OH-KY-IN	2,179,082			No Data ⁷	0	0	
	Indianapolis-Carmel-Anderson	2,028,614			73	2	2	
	Louisville-Jefferson County, KY-IN	1,293,953			51 ⁶	3	-	
	Louisville-Jefferson County, KY-IN	1,293,953			36 ⁷	1	1	
	Sites in Indiana Network						11	11
CFR Requirement	MSA Population		High Conc. ¹	Medium Conc. ²	Low Conc. ³			
500,000 - 1,000,000		# of Required Sites =>	4-8	2-4	1-2			
	MSA	Population	MSA Highest Value			# of Sites 2018	# of Sites 2019	
	No MSAs in this category							
CFR Requirement	MSA Population		High Conc. ¹	Medium Conc. ²	Low Conc. ³			
250,000 - 500,000		# of Required Sites =>	3-4	1-2	0-1			
	MSA	Population	MSA Highest Value			# of Sites 2018	# of Sites 2019	
	Evansville, IN-KY	315,669			33 ⁶	2	-	
	Evansville, IN-KY	315,669			32 ⁷	1	1	
	Fort Wayne	434,617			No Data	0	0	
	South Bend-Mishawaka, IN-MI	321,815			No Data	0	0	
	South Bend-Mishawaka, IN-MI	321,815			No Data	0	0	
CFR Requirement	MSA Population		High Conc. ¹	Medium Conc. ²	Low Conc. ³			
100,000 - 250,000		# of Required Sites =>	1-2	0-1	0			
	MSA	Population	MSA Highest Value			# of Sites 2018	# of Sites 2019	
	Bloomington	167,825			No Data	0	0	
	Elkhart-Goshen	205,032			No Data	0	0	
	Kokomo	82,363			No Data	0	0	
	Lafayette-West Lafayette	219,239			No Data	0	0	
	Michigan City-LaPorte	110,029			No Data	0	0	
	Muncie	115,184			No Data	0	0	
	Terre Haute	169,965			35	1	1	
	Non MSA	Population	Highest Value			# of Sites 2018	# of Sites 2019	
	Jasper - Dubois Co.	54,923			33	1	1	
	Sites in Indiana Network						11	11

¹ Exceeds NAAQS by 20% (180ug/m3).
² Exceeds 80% of NAAQS (120 ug/m3).
³ <80% of NAAQS (120 ug/m3).
⁴ Highest value from source oriented site (not indicative of entire MSA).
⁵ Highest value from population oriented sites.
⁶ Information for full MSA.
⁷ Information for Indiana's portion of MSA

Figure 8 – PM₁₀ Monitoring Network

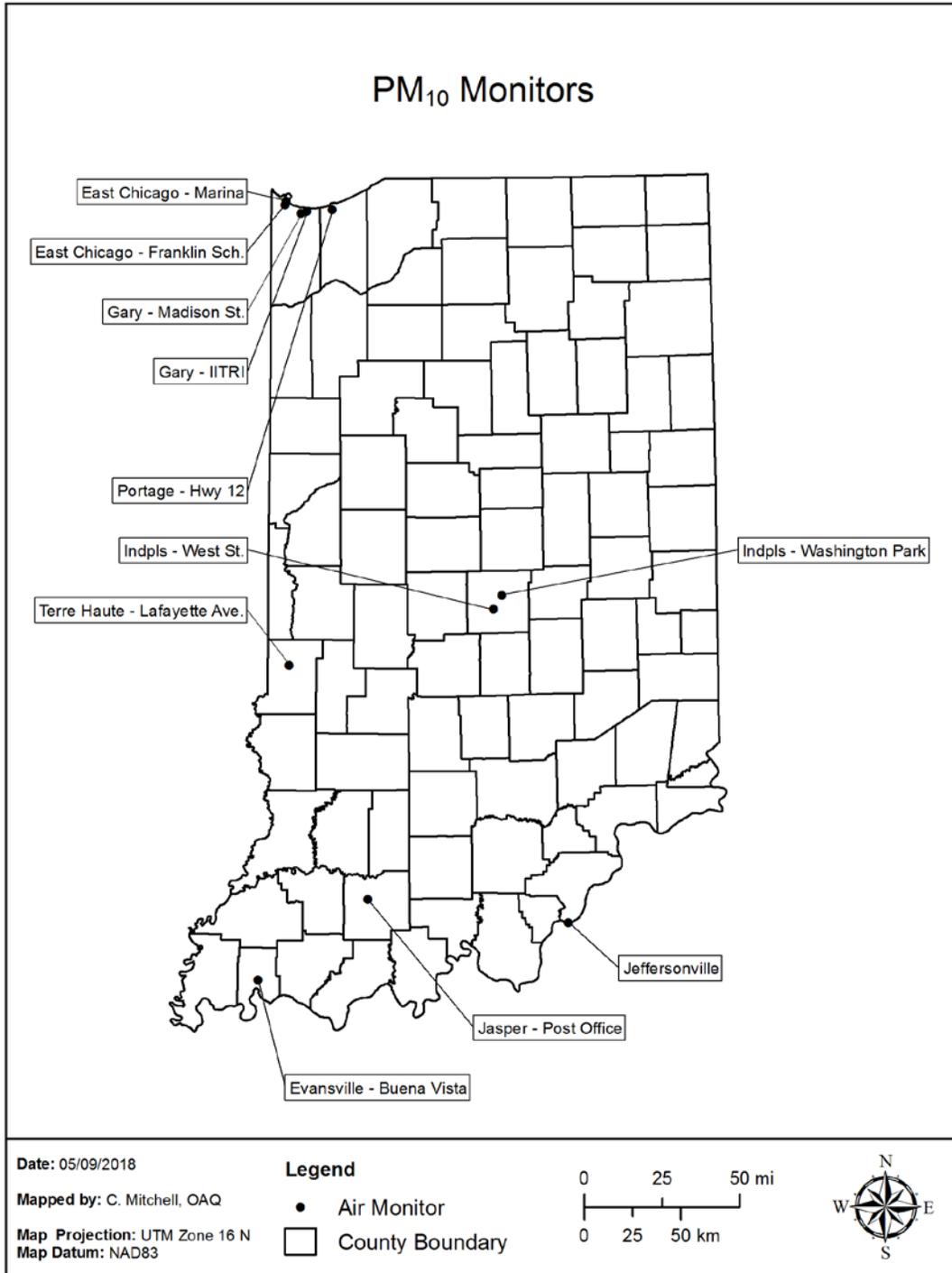


Table 9 – PM₁₀ Monitoring Network

Parameter Code: 81102 PM ₁₀ - Particulate Matter														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180190006	Jeffersonville - Walnut St.	Clark	Jeffersonville	Jeffersonville PFAU, 719 Walnut St.	SLAMS	06/26/03	6-Day	127	Neigh	Pop Exp	38.277719	-85.740111	Louisville/Jefferson County, KY-IN	Relocate
18019	Jeffersonville -	Clark	Jeffersonville		SPM		6-Day	127	Neigh	Pop Exp	38.289762	-85.722334	Louisville/Jefferson County, KY-IN	Relocation
180372001	Jasper - Post Office	Dubois	Jasper	Jasper Post Office, 206 E. 6th St.	SLAMS	07/01/87	6-Day	127	Neigh	Highest Conc	38.391389	-86.929167	Non-MSA County	No
180890006	East Chicago - Franklin Sch.	Lake	East Chicago	Washington (formerly Franklin) School, Alder & 142nd St.	SLAMS	10/01/87	6-Day	127	Middle	Highest Conc	41.636111	-87.440833	Chicago-Naperville-Elgin, IL-IN-WI	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	03/01/97	Continuous	079	Middle	Source Oriented	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180890031	Gary - Madison St.	Lake	Gary	Indiana American Water Co., 650 Madison St.	SLAMS	07/01/05	6-Day	127	Neigh	Pop Exp	41.598456	-87.342972	Chicago-Naperville-Elgin, IL-IN-WI	No
180890031	Gary - Madison St.	Lake	Gary	Indiana American Water Co., 650 Madison St.	SLAMS	07/01/05	6-Day	127	Neigh	Quality Assurance	41.598456	-87.342972	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SLAMS	10/30/12	6-Day	127	Middle	Source Oriented	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SPM	01/01/19	Continuous		Middle	Source Oriented	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	Add
180970043	Indpls - West St.	Marion	Indianapolis	1735 S. West St.	SLAMS	10/29/86	6-Day	127	Middle	Highest Conc	39.744957	-86.166496	Indianapolis-Carmel-Anderso	No
180970043	Indpls - West St.	Marion	Indianapolis	1735 S. West St.	SLAMS	01/01/13	6-Day	127	Middle	Quality Assurance	39.744957	-86.166496	Indianapolis-Carmel-Anderso	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St.	SLAMS	07/01/10	3-Day	127	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St.	SLAMS	08/02/11	Continuous	122	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
181270023	Portage - Hwy 12	Porter	Portage	Bethlehem Steel Waste Lagoon, Hwy 12	SLAMS	10/01/95	Continuous	079	Neigh	Highest Conc	41.616561	-87.146921	Chicago-Naperville-Elgin, IL-IN-WI	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/10/09	6-Day	127	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	07/01/88	6-Day	127	Neigh	Pop Exp	39.485987	-87.401312	Terre Haute	No

*PM10 MONITORING METHODS: 079 - Thermo Scientific 1405
 122 - Met One - Beta Attenuation
 127 - R&P 2025A or 2025B Sequential
 205 - Teledyne 602 Beta^{PLUS}*

Fine Particulate Matter (PM_{2.5})

Monitoring Requirements

40 CFR Part 58, Appendix D §4.7 details the number of PM_{2.5} sites required in each CBSA. The number of sites is based on the population of a CBSA and if the design value for that area is greater or less than 85% of either NAAQS. Table 10 (Table D-5 of Appendix D) lists the minimum requirements as stated in Part 58. Table 11 lists the requirements as they relate to Indiana. Indiana meets the minimum number of sites for each CBSA within Indiana's boundaries. There are five CBSAs which cross state lines. Except for the Cincinnati, OH-KY-IN CBSA, Indiana meets the requirement for the number of sites for the full CBSA in the multi-agency CBSAs. An agreement between the SWOQA and IDEM specifies that the SWOQA will fulfill the PM_{2.5} monitoring requirements in the Cincinnati, OH-KY-IN CBSA. In the absence of an agreement, Indiana would be required to operate three sites in the Cincinnati, OH-KY-IN CBSA, and 15 additional monitoring sites.

In addition, 40 CFR, Appendix D §4.7.2 states that "State, or where appropriate, local agencies must operate continuous fine particulate analyzers equal to at least one-half (round up) the minimum required sites listed in Table D-5 of Appendix D. At least one required FRM/FEM monitor in each MSA must be collocated." As these requirements are applied to Indiana, 10 would be required. Indiana meets this requirement in all CBSAs, except in the Cincinnati, OH-KY-IN and Louisville/Jefferson County, KY-IN CBSAs. IDEM has multi-agency agreements with SWOQA (Cincinnati, OH) and APCD of Louisville specifying the sites which will operate in each district to fulfill the PM_{2.5} monitoring requirements in the Cincinnati, OH-KY-IN and Louisville/Jefferson County, KY-IN CBSAs.

Collocated samplers are required at 15% of the FRM/FEM sites operated by each PQAQO. IDEM is the sole PQAQO for Indiana and at the beginning of 2018 operated 36 sites requiring the operation of five collocated samplers. In July 2018 the number of FRM dropped to 27, as detailed later in this plan, requiring four collocated samplers.

Table 10 – SLAMS Minimum PM_{2.5} Monitoring Site Requirements

Number of Sites per MSA and Design Value		
MSA Population	3 yr DV ≥ 85% of either NAAQS	3 yr DV < 85% of either NAAQS
> 1,000,000	3	2
500,000 - 1,000,000	2	1
50,000 - 500,000	1	0
	also	
	Statewide Background Site	1
	Statewide Transport Site	1
85% of 24-hour NAAQS (35) = 29.75 µg/m ³		
85% of Annual NAAQS (12) = 10.2 µg/m ³		

Monitoring Methodology

Intermittent PM_{2.5} is sampled by drawing air through a specially designed inlet that excludes particles larger than 2.5 microns in diameter. The remaining particles are collected on a 46.2 mm diameter Teflon™ Microfiber filter that is weighed before and after the sampling period to determine the particulate mass. Indiana uses the R&P or Thermo Scientific Model 2025a,b,l Sequential Samplers (EQPM-0202-145) to collect intermittent data. A VSCC is used instead of the original WINS impactor to remove particles larger than 2.5 µg from the sample stream. This

modified setup was originally classified as an FEM in 2002, but was designated as an FRM in December 2006.

The normal sampling schedule varies, as determined by the regulations. Reporting monitors sample every third day. Collocated monitors used for assessing data precision operate on a one-in-six day schedule.

Continuous data are collected using one of the following monitors: Met One BAM 1020 PM_{2.5} (FEM) (EQPM-0308-170), Thermo Scientific Model 5030 SHARP (EQPM-0609-184), Teledyne Model 602 Beta PLUS Particle Measurement System (EQPM-0912-204), or Teledyne Model T640 PM Mass Monitor (EQPM-0516-238). The BAM 1020 collects fine particulate through a sampling inlet onto a filter tape, using a beta ray transmission to measure the amount of particulate concentration collected during a specific sampling period. The SHARP 5030 collects the particulate onto a filter tape and uses a beta ray transmission to measure the amount of particulate concentration, similar to the BAM 1020 FEM. In addition, the SHARP 5030 also has an optical assembly that senses light scattered by the aerosol and is constantly referenced to the measurement of the mass sensor. The TAPI 602 collects the particulate on a filter and uses beta ray transmission combined with dual-channel, sequential sampling technology to determine concentration. The Teledyne API Model T640 is a real-time, continuous particulate matter (PM) mass monitor that uses scattered light spectrometry for measurement.

Table 11 – Number of SLAMS PM_{2.5} Monitoring Sites Required for Indiana

MSA	MSA Population (Est 2017) ¹	Annual Design Value (µg/m ³) (2015-2017)	Daily Design Value (µg/m ³) (2015-2017)	# of Sites Required per CFR	2018 # of Sites	2019 # of Sites (IN)	2018 # of Cont. Mont.	2019 # of Cont. Mont. (IN)
Bloomington	167,825	7.9	17	0	1	1	1	1
Chicago-Naperville-Elgin, IL-IN-WI (total MSA)	9,533,040	10.5 ²	25 ²	3	23 ²	-	9 ²	-
Chicago-Naperville-Elgin, IL-IN-WI (IN only)	9,533,040	9.3 ³	23 ³	3	6 ³	6	3 ³	4
Cincinnati, OH-KY-IN (total MSA)	2,179,082	11.1 ²	23 ²	3	11 ²	-	8 ²	-
Cincinnati, OH-KY-IN (IN only)	2,179,082	No Data ³	No Data ³	3	0 ³	0	0 ³	0
Columbus	82,040	8.3	18	0	1	1	1	1
Elkhart-Goshen	205,032	9.1	25	0	1	1	1	1
Evansville, IN-KY (total MSA)	315,669	9.3 ²	19 ²	0	4 ²	-	2 ²	-
Evansville, IN-KY (IN only)	315,669	9.3 ³	19 ³	0	3 ³	2	1 ³	1
Fort Wayne	434,617	8.9	22	0	2	2	2	2
Indianapolis-Carmel-Anderson	2,028,614	10.5	22	3	8	8	5	5
Kokomo	82,363	9.5	21	0	1	1	1	1
Lafayette-West Lafayette	219,239	8.2	19	0	1	1	1	1
Louisville-Jefferson County, KY-IN (total MSA)	1,293,953	9.6 ²	22 ²	2	7 ²	-	5 ²	-
Louisville-Jefferson County, KY-IN (IN only)	1,293,953	9.6 ³	22 ³	2	3 ³	2	1 ³	2
Michigan City-LaPorte	110,029	8.1	20	0	1	1	0	0
Muncie	115,184	8.1	17	0	1	1	0	0
South Bend-Mishawaka, IN-MI (total MSA)	321,815	8.7 ²	22 ²	0	1 ²	-	1 ²	-
South Bend-Mishawaka, IN-MI (IN only)	321,815	8.7 ³	22 ³	0	1 ³	1	1 ³	1
Terre Haute	169,965	9	20	0	1	1	1	1
Other Requirements								
State Background Site - Green Co.		8.1	18	1	1	1		
State Transport Site - Henry Co.		7.5	16	1	1	1		
Non MSAs								
Jasper - Dubois Co.		8.9	20		1	1		
Dale - Spencer Co.		8.7	19		1	1		
Dugger - Sullivan Co.		8.1 ⁴	17 ⁴		1	1		
		Values above NAAQS						
		DV ≥ 85% of NAAQS						
# of sites needed if Indiana meets all multi-state MSA requirements				13				
# of continuous monitors required (1/2 of the required sites) (rounded up)				7				
Sites in Indiana Network					36	34	19	21
¹ Updated Population to 2017 US Census estimate								
² Information for full MSA.								
³ Information for Indiana's portion of MSA.								
⁴ Site began operation in April 2017								

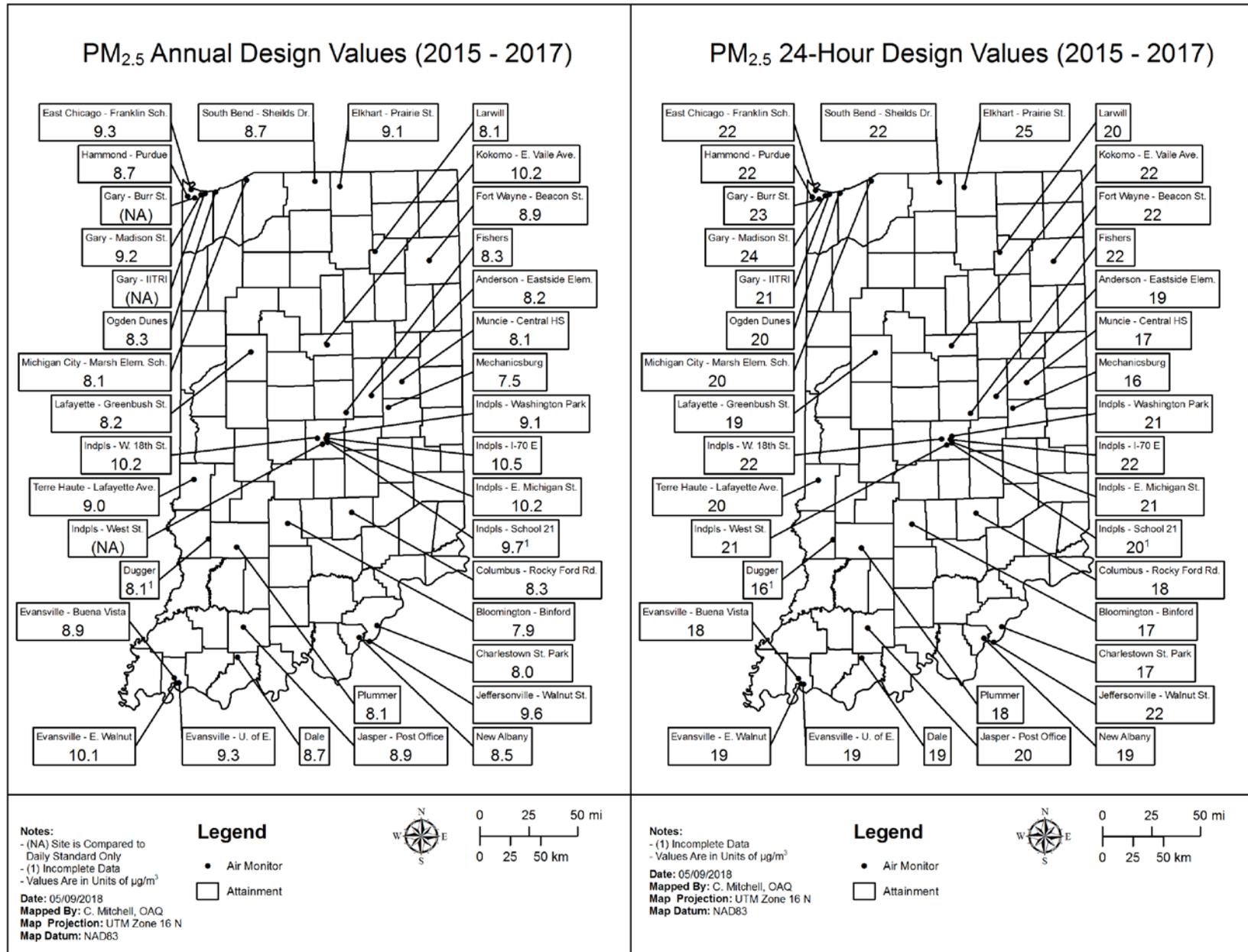
Data / Design Value

The data collected from the intermittent FEM samplers are considered eligible for comparison to the NAAQS and used for calculation of the design value for a site. The continuous data is also eligible for comparison to the NAAQS, with the exception of Bloomington – Binford (181050003) and Larwill (181830003). These sites have produced very poor comparison data and exclusion of the data for NAAQS comparison is being requested.

A site's annual design value is determined by first calculating the quarterly average concentrations, then calculating the weighted annual concentration by averaging the quarterly values, and then averaging the three consecutive annual averages. The highest site design value in a CBSA is generally determined to be the design value for the area. It is compared to the annual NAAQS of $12 \mu\text{g}/\text{m}^3$ to determine attainment/nonattainment for the area. Similarly, a site's 24-hour design value is obtained by averaging the 98th percentile value from three consecutive years. This value is then compared to the 24-hour NAAQS, $35 \mu\text{g}/\text{m}^3$, to determine attainment/nonattainment of the 24-hour standard.

The design values for all sites for the most recent sampling period (2015 - 2017), along with the designation status of areas for $\text{PM}_{2.5}$ are shown in Figure 9. Currently all counties in Indiana meet the 24-hour, and 2012 annual NAAQS for $\text{PM}_{2.5}$.

Figure 9 – PM_{2.5} Site Design Values



Unplanned Changes to the 2018 Network Plan

Due to the emphasis of using more continuous FEMs for NAAQS comparison and after comparing the correlations of the FRM to FEM data, the State of Indiana plans to discontinue the operation of the intermittent FRMs at eight sites and operate only the continuous monitors at these locations. Details of the FRM/FEM evaluation is in Appendix C, page 85. The FRMs at these sites will be discontinued on July 31, 2018 pending official approval from U.S. EPA:

- Ft. Wayne – Beacon St. (180030004)
- Columbus – Rocky Ford Rd (180050008)
- Elkhart – Prairie St (180390008)
- Fishers (180570007)
- Kokomo – E Vaile Ave (180670004)
- Anderson – Eastside Elem School (180950011)
- Ogden Dunes (181270024)
- Lafayette – Greenbush St (181570008), Reporting and Collocated

The FEMs installed at the above mentioned locations will become the primary reporting monitor for that site. Annual and seasonal data were reviewed from 2013 - 2017 for all of the state's monitoring network. Data substitution was also analyzed to support the decision.

Details regarding the monitors' NAAQS comparability and time frame are found in Appendix C.

With the reduction in FRMs from 36 to 28, (another FRM will be dropped; see Network Modifications) the state will be required to maintain collocated FRMs at only four monitoring locations. The State of Indiana currently operates five collocated FRMs. The Lafayette Greenbush St. collocated monitor will be discontinued on July 31, 2018 to reduce the collocated FRM's from five to four.

A school construction project at the Green Valley Elementary School made it necessary to suspend the PM_{2.5} monitoring at the New Albany (180431004) site at the end of January 2018. It is anticipated that a new monitoring location on the School grounds will be operational during the third quarter of 2018, and the PM_{2.5} sampling will be resumed. In order to keep the correct number of collocated FRMs, the collocated sampler was relocated to Charlestown State Park (180190008) during this period.

The sampling frequency at Dugger (181530007) was reduced from 1-day to 3-day on April 1, 2018 as no significantly high values were recorded during the first year of operation.

Network Modifications

Evansville – E. Walnut St. (181630023) will be discontinued on December 31, 2018 due to new construction near the monitoring location which will result in a change to the siting parameters. The PM_{2.5} monitor will no longer meet siting requirements. The State of Indiana will continue to operate two other sites in the Evansville CBSA; Evansville - University of Evansville (181630016) (1.4 miles to the east) and Evansville - Buena Vista (181630021) (2.9 miles to the northwest).

The Charlestown State Park FRM will be discontinued at the end of 2018 or when the New Albany relocation project is completed (whichever occurs later) and the reporting and collocated FRMs and continuous FEM monitor are reinstalled.

PM_{2.5} monitoring (intermittent FRM and continuous FEM) will be added at East Chicago - Marina (180890034) as part of an enhanced monitoring project.

Relocation of the Jeffersonville (180190006) site continues to be delayed due to lease negotiations between IDEM and property owners. When the new site is setup, continuous PM_{2.5} and black carbon will be installed. A real-time FEM will be installed, either a Thermo Fisher SHARP or a Teledyne API T640.

In 2019, the Indiana PM_{2.5} monitoring network will consists of 34 monitoring sites. Continuous monitors will be collecting data at 21 site locations. The PM_{2.5} monitoring network with the changes proposed for 2019 is shown in Table 12. A map of the 2019 network is shown in Figure 10.

Figure 10 – PM_{2.5} Monitoring Network

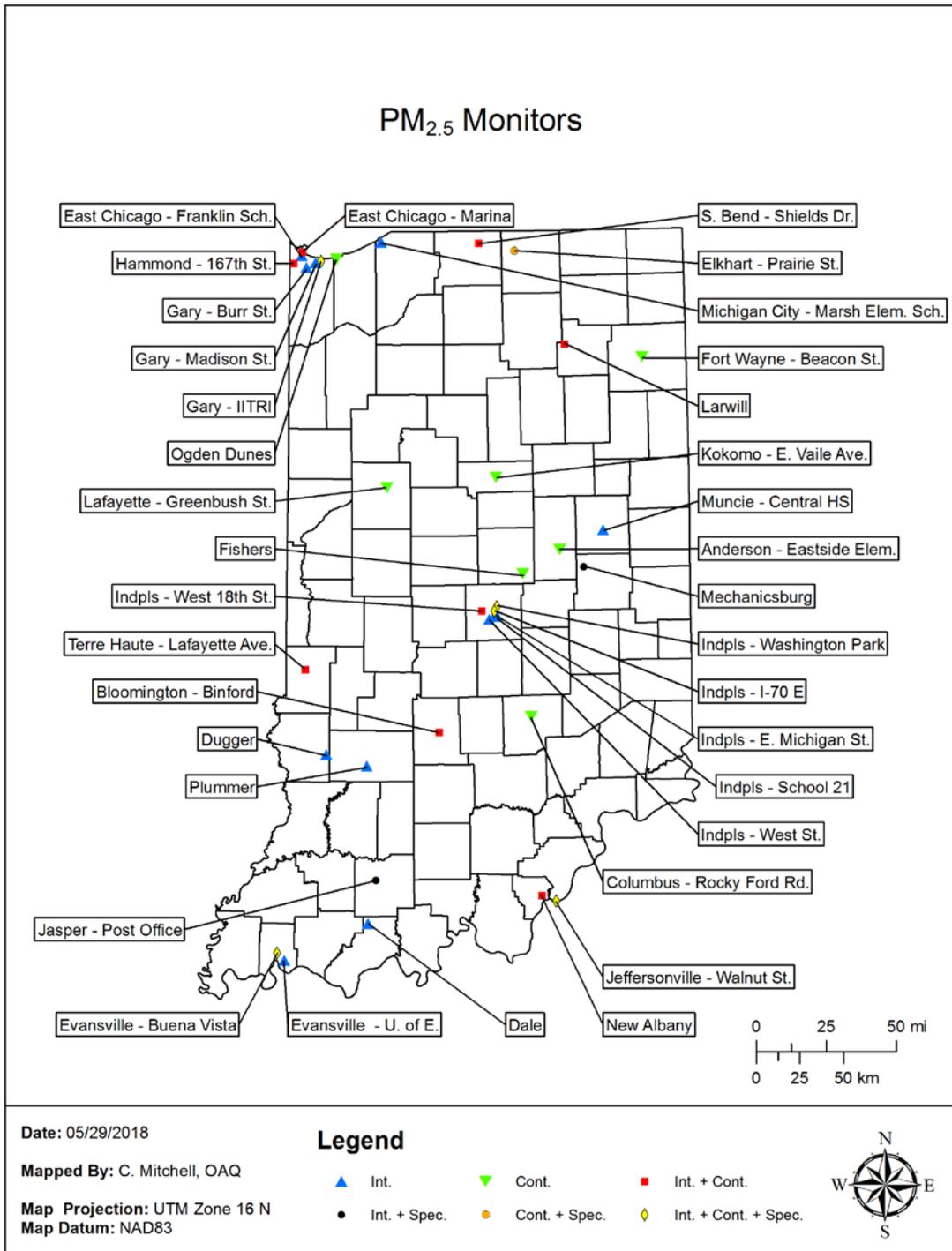


Table 12 – PM_{2.5} Monitoring Network

PM _{2.5} Monitoring Network																
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	NAAQS Comparable (2019)	CBSA	Site Change Proposed?	
180030004	Ft Wayne - Beacon St.	Allen	Fort Wayne	2022 North Beacon St.	SLAMS	01/01/99	3-Day	145	Neigh	Pop Exp	41.094965	-85.101816	NA	Ft. Wayne	Disc 07/31/1	
180030004	Ft Wayne - Beacon St.	Allen	Fort Wayne	2022 North Beacon St.	SLAMS	01/01/02	Continuous	170	Neigh	Pop Exp	41.094965	-85.101816	Primary	Ft. Wayne	No	
180050008	Columbus - Rocky Ford Rd.	Bartholomew	Columbus	3475 Trestle Dr.	SLAMS	07/16/14	3-Day	145	Neigh	Pop Exp	39.237457	-85.891332	NA	Columbus	Disc 07/31/1	
180050008	Columbus - Rocky Ford Rd.	Bartholomew	Columbus	3475 Trestle Dr.	SLAMS	07/25/14	Continuous	170	Neigh	Pop Exp	39.237457	-85.891332	Primary	Columbus	No	
180190006	Jeffersonville - Walnut St.	Clark	Jeffersonville	Jeffersonville PFAU, 719 Walnut St.	SLAMS	06/26/03	3-Day	145	Neigh	Pop Exp	38.277719	-85.740111	Primary	Louisville/Jefferson County, KY-IN	Relocate	
18019	Jeffersonville	Clark	Jeffersonville		SLAMS		3-Day	145	Neigh	Pop Exp	38.289762	-85.722334	Primary	Louisville/Jefferson County, KY-IN	Relocation	
18019	Jeffersonville	Clark	Jeffersonville		SLAMS		Continuous	184	Neigh	Pop Exp	38.289762	-85.722334	Exclude	Louisville/Jefferson County, KY-IN	Add	
180190008	Charlestown State Park	Clark		Charlestown State Park, 12500 Hwy 62, Charlestown	SLAMS	07/01/08	3-Day	145	Urban	Pop Exp	38.393823	-85.664118	NA	Louisville/Jefferson County, KY-IN	Disc 12/31/1	
180350006	Muncie - Central HS	Delaware	Muncie	Muncie Central HS, 801 N. Walnut St.	SLAMS	10/15/99	3-Day	145	Neigh	Pop Exp	40.199502	-85.387908	Primary	Muncie	No	
180372001	Jasper - Post Office	Dubois	Jasper	Post Office, 206 E. 6th St.	SLAMS	01/01/00	3-Day	145	Neigh	Pop Exp	38.391389	-86.929167	Primary	Non-MSA County	No	
180390008	Elkhart - Prairie St.	Elkhart	Elkhart	2745 Prairie St.	SLAMS	01/01/08	3-Day	145	Neigh	Pop Exp	41.657155	-85.968446	NA	Elkhart-Goshen	Disc 07/31/1	
180390008	Elkhart - Prairie St.	Elkhart	Elkhart	2745 Prairie St.	SLAMS	11/23/10	Continuous	170	Neigh	Pop Exp	41.657155	-85.968446	Primary	Elkhart-Goshen	No	
180431004	New Albany	Floyd	New Albany	Green Valley Elem. Sch., 2230 Green Valley Rd.	SLAMS	01/18/99	3-Day	145	Neigh	Pop Exp	38.307913	-85.834313	Primary	Louisville/Jefferson County, KY-IN	No	
180431004	New Albany	Floyd	New Albany	Green Valley Elem. Sch., 2230 Green Valley Rd.	SLAMS	01/18/99	6-Day	145	Neigh	Quality Assurance	38.307913	-85.834313	No	Louisville/Jefferson County, KY-IN	No	
180431004	New Albany	Floyd	New Albany	Green Valley Elem. Sch., 2230 Green Valley Rd.	SLAMS	11/01/03	Continuous	170	Neigh	Pop Exp	38.307913	-85.834313	Secondary	Louisville/Jefferson County, KY-IN	No	
180550001	Plummer	Greene		2500 S. 275 W	SLAMS	01/12/12	3-Day	145	Regional	Upwind Bkrd	38.985556	-86.990000	Primary	Non-MSA County	No	
180570007	Fishers	Hamilton	Fishers	11775 Brooks School Rd.	SLAMS	01/02/14	3-Day	145	Urban	Pop Exp	39.960884	-85.939546	NA	Indianapolis-Carmel-Anderson	Disc 07/31/1	
180570007	Fishers	Hamilton	Fishers	11775 Brooks School Rd.	SLAMS	12/06/13	Continuous	170	Urban	Pop Exp	39.960884	-85.939546	Primary	Indianapolis-Carmel-Anderson	No	
180650003	Mechanicsburg	Henry		Shenandoah HS, 7354 W. Hwy. 36, Pendleton	SLAMS	09/06/00	3-Day	145	Regional	Regional Transport	40.009544	-85.523470	Primary	Non-MSA County	No	
180670004	Kokomo - E. Vaile Ave.	Howard	Kokomo	1802 E. Vaile Ave.	SLAMS	04/03/14	3-Day	145	Urban	Pop Exp	40.481347	-86.109688	NA	Kokomo	Disc 07/31/1	
180670004	Kokomo - E. Vaile Ave.	Howard	Kokomo	1802 E. Vaile Ave.	SLAMS	04/03/14	Continuous	170	Urban	Pop Exp	40.481347	-86.109688	Primary	Kokomo	No	
180890006	East Chicago - Franklin Sch.	Lake	East Chicago	Washington (formerly Franklin) School, Alder & 142nd St.	SLAMS	01/27/99	3-Day	145	Neigh	Pop Exp	41.636111	-87.440833	Primary	Chicago-Naperville-Elgin, IL-IN-WI	No	

Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	NAAQS Comparable (2019)	CBSA	Site Change Proposed?
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	03/04/99	3-Day	145	Middle	Source & Pop Exp	41.606667	-87.304722	Primary**	Chicago-Naperville-Elgin, IL-IN-WI	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	01/01/03	Continuous	170	Middle	Source & Pop Exp	41.606667	-87.304722	Secondary**	Chicago-Naperville-Elgin, IL-IN-WI	No
180890026	Gary - Burr St	Lake	Gary	Truck Stop, 25th Ave & Burr St.	SLAMS	02/12/00	3-Day	145	Middle	Source & Pop Exp	41.573056	-87.405833	Primary**	Chicago-Naperville-Elgin, IL-IN-WI	No
180890031	Gary - Madison St.	Lake	Gary	Indiana American Water Co., 650 Madison St.	SLAMS	07/01/05	3-Day	145	Neigh	Pop Exp	41.598456	-87.342972	Primary	Chicago-Naperville-Elgin, IL-IN-WI	No
180890031	Gary - Madison St.	Lake	Gary	Indiana American Water Co., 650 Madison St.	SLAMS	07/01/05	6-Day	145	Neigh	Quality Assurance	41.598456	-87.342972	No	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SPM	01/01/19	3-Day	145	Middle	Source Oriented	41.653501	-87.435561	Primary	Chicago-Naperville-Elgin, IL-IN-WI	Add
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SPM	01/01/19	Continuous		Middle	Source Oriented	41.653501	-87.435561	No	Chicago-Naperville-Elgin, IL-IN-WI	Add
180890036	Hammond - 167th St.	Lake	Hammond	NIPSCO maintenance facility 1 167th St.	SLAMS	02/01/18	3-Day	145	Neigh	Pop Exp	41.594427	-87.495044	Primary	Chicago-Naperville-Elgin, IL-IN-WI	No
180890036	Hammond - 167th St.	Lake	Hammond	NIPSCO maintenance facility 1 167th St.	SLAMS	02/01/18	Continuous	236	Neigh	Pop Exp	41.594427	-87.495044	No	Chicago-Naperville-Elgin, IL-IN-WI	No
180910011	Michigan City - Marsh Elem. Sch.	La Porte	Michigan City	Marsh Elem. Sch., 400 E. Homer St.	SLAMS	12/17/99	3-Day	145	Neigh	Pop Exp	41.706944	-86.891111	Primary	Michigan City-LaPorte	No
180950011	Anderson - Eastside Elem.	Madison	Anderson	Eastside Elementary Sch., 844 N. Scatterfield Rd.	SLAMS	07/22/10	3-Day	145	Middle	Pop Exp	40.125690	-85.652127	NA	Indianapolis-Carmel-Anderson	Disc 07/31/1
180950011	Anderson - Eastside Elem.	Madison	Anderson	Eastside Elementary Sch., 844 N. Scatterfield Rd.	SLAMS	07/08/10	Continuous	184	Middle	Pop Exp	40.125690	-85.652127	Primary	Indianapolis-Carmel-Anderson	No
180970043	Indpls - West St.	Marion	Indianapolis	1735 South West Street	SLAMS	01/24/99	3-Day	145	Middle	Pop Exp	39.744957	-86.166496	Primary**	Indianapolis-Carmel-Anderson	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE)	03/07/99	3-Day	145	Neigh	Pop Exp	39.810833	-86.114444	Primary	Indianapolis-Carmel-Anderson	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE)	01/01/04	Continuous	170	Neigh	Pop Exp	39.810833	-86.114444	Secondary	Indianapolis-Carmel-Anderson	No
180970081	Indpls - W. 18th St.	Marion	Indianapolis	Ernie Pyle Sch 90, 3351 W. 18th St.	SLAMS	02/03/99	3-Day	145	Neigh	Pop Exp	39.788889	-86.214722	Primary	Indianapolis-Carmel-Anderson	No
180970081	Indpls - W. 18th St.	Marion	Indianapolis	Ernie Pyle Sch 90, 3351 W. 18th St.	SLAMS	02/11/99	6-Day	145	Neigh	Quality Assurance	39.788889	-86.214722	No	Indianapolis-Carmel-Anderson	No
180970081	Indpls - W. 18th St.	Marion	Indianapolis	Ernie Pyle Sch 90, 3351 W. 18th St.	SLAMS	11/01/07	Continuous	184	Neigh	Pop Exp	39.788889	-86.214722	Secondary	Indianapolis-Carmel-Anderson	No
180970083	Indpls - E. Michigan St.	Marion	Indianapolis	Thomas Gregg Sch 15, 2302 E. Michigan St.	SLAMS	01/22/99	3-Day	145	Neigh	Pop Exp	39.774896	-86.122000	Primary	Indianapolis-Carmel-Anderson	No
180970084	Indpls - School 21	Marion	Indianapolis	IPS Sch 21, 2815 English Ave.	SLAMS	02/16/09	3-Day	145	Neigh	Pop Exp	39.759167	-86.114722	Primary	Indianapolis-Carmel-Anderson	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	02/01/14	3-Day	145	Middle	Highest Conc	39.787933	-86.130880	Primary	Indianapolis-Carmel-Anderson	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	11/05/15	Continuous	184	Middle	Highest Conc	39.787933	-86.130880	Secondary	Indianapolis-Carmel-Anderson	No
181050003	Bloomington - Binford	Monroe	Bloomington	Binford Elementary Sch, 2300 E. 2nd St.	SLAMS	04/01/09	3-Day	145	Neigh	Pop Exp	39.159372	-86.504747	Primary	Bloomington	No
181050003	Bloomington - Binford	Monroe	Bloomington	Binford Elementary Sch, 2300 E. 2nd St.	SLAMS	04/01/09	Continuous	170	Neigh	Pop Exp	39.159372	-86.504747	No	Bloomington	No

Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	NAAQS Comparable (2019)	CBSA	Site Change Proposed?
181270024	Oqden Dunes	Porter	Oqden Dunes	Water Treatment Plant, 84 Diana Rd	SLAMS	01/27/99	3-Day	145	Neigh	Pop Exp	41.617500	-87.199167	NA	Chicago-Naperville-Elgin, IL-IN-WI	Disc 07/31/1
181270024	Oqden Dunes	Porter	Oqden Dunes	Water Treatment Plant, 84 Diana Rd	SLAMS	12/03/03	Continuous	170	Neigh	Pop Exp	41.617500	-87.199167	Primary	Chicago-Naperville-Elgin, IL-IN-WI	No
181410015	South Bend - Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	SLAMS	06/01/06	3-Day	145	Neigh	Pop Exp	41.696667	-86.214722	Primary	South Bend-Mishawaka, IN-MI	No
181410015	South Bend - Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	SLAMS	06/01/06	6-Day	145	Neigh	Quality Assurance	41.696667	-86.214722	No	South Bend-Mishawaka, IN-MI	No
181410015	South Bend - Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	SLAMS	06/01/06	Continuous	170	Neigh	Pop Exp	41.696667	-86.214722	Secondary	South Bend-Mishawaka, IN-MI	No
181470009	Dale	Spencer	Dale	David Turnham School, Dunn & Locust	SLAMS	02/01/00	3-Day	145	Urban	Regional Trans	38.167500	-86.983333	Primary	Non-MSA County	No
181530007	Dugger	Sullivan		Greene Sullivan State Forest, ; IN-159	SPM	04/01/17	3-Day	145	Neigh	Source & Pop Exp	39.044992	-87.258969	Primary	Terre Haute	No
181570008	Lafayette - Greenbush St.	Tippecanoe	Lafayette	Cinergy Substation, 3401 Greenbush St	SLAMS	10/01/02	3-Day	145	Neigh	Pop Exp	40.431667	-86.852500	NA	Lafayette-West Lafayette	Disc 07/31/1
181570008	Lafayette - Greenbush St.	Tippecanoe	Lafayette	Cinergy Substation, 3401 Greenbush St	SLAMS	10/01/02	6-Day	145	Neigh	Quality Assurance	40.431667	-86.852500	NA	Lafayette-West Lafayette	Disc 07/31/1
181570008	Lafayette - Greenbush St.	Tippecanoe	Lafayette	Cinergy Substation, 3401 Greenbush St	SLAMS	04/01/05	Continuous	170	Neigh	Pop Exp	40.431667	-86.852500	Primary	Lafayette-West Lafayette	No
181630016	Evansville - U of E	Vanderburgh	Evansville	Carson Center, Walnut St.	SLAMS	06/05/99	3-Day	145	Neigh	Pop Exp	37.974444	-87.532222	Primary	Evansville, IN-KY	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/10/09	3-Day	145	Neigh	Pop Exp	38.013333	-87.577222	Primary	Evansville, IN-KY	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/14/09	Continuous	204	Neigh	Pop Exp	38.013333	-87.577222	Secondary	Evansville, IN-KY	No
181630023	Evansville - E. Walnut	Vanderburgh	Evansville	500 E. Walnut St.	SLAMS	01/01/13	3-Day	145	Neigh	Pop Exp	37.974460	-87.558018	NA	Evansville, IN-KY	Disc 12/31/1
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	03/19/99	3-Day	145	Neigh	Pop Exp	39.485987	-87.401312	Primary	Terre Haute	No
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	07/02/03	Continuous	170	Neigh	Pop Exp	39.485987	-87.401312	Secondary	Terre Haute	No
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	01/01/13	Continuous	170	Neigh	Quality Assurance	39.485987	-87.401312	No	Terre Haute	No
181830003	Larwill	Whitley	Larwill	Whitko Middle School, 710 N. State Rd. 5	SLAMS	04/08/10	3-Day	145	Regional	Regional Transport	41.169722	-85.629444	Primary	Ft. Wayne	No
181830003	Larwill	Whitley	Larwill	Whitko Middle School, 710 N. State Rd. 5	SLAMS	04/08/10	Continuous	170	Regional	Regional Transport	41.169722	-85.629444	No	Ft. Wayne	No

** According to 40 CFR Part 58 Subpart D, PM2.5 data that is representative of a unique population-oriented scale or localized hot spot are only eligible for comparison to the 24-hour PM2.5 NAAQS. The annual standard does not apply. A waiver has been requested.

MONITORING METHODS: 145 - R&P 2025A or B or Thermo 2025i
170 - MET ONE BAM - FEM
184 - Thermo SHARP
204 - Teledyne 602 Beta ^{PLUS}
236 - Teledyne T640

Sulfur Dioxide (SO₂)

Monitoring Requirements

The monitoring requirements for SO₂ are detailed in 40 CFR Part 58 Appendix D §4.4. Section 4.4.2 of the Appendix lists the number of monitors to be located in a CBSA based on the Population Weighted Emissions Index, PWEI. The PWEI combines the population of the area and the SO₂ emissions from the 2014 National Emissions Inventory for each county. The 2017 population estimates from the U.S. Census Bureau is multiplied by the emissions and divided by one million. The PWEI dictates the number of sites required:

PWEI	# of Sites
>1,000,000	3
100,000 to 1,000,000	2
5,000 to 100,000	1
<5,000	0

As depicted in Table 13, the CBSAs in Indiana which require monitoring sites are the Chicago-Naperville-Elgin, IL-IN-WI CBSA, the Cincinnati, OH-KY-IN CBSA, the Indianapolis-Carmel-Anderson, IN CBSA, the Evansville, IN-KY CBSA, the Louisville/Jefferson County, KY-IN CBSA, and the Terre Haute, IN CBSA. Indiana meets the minimum monitoring requirements in four of the six areas which require monitors. For the Chicago-Naperville-Elgin, IL-IN-WI CBSA Indiana has a Memorandum of Agreement, MOA with Illinois EPA for the remaining required site to be operated by them. For the Cincinnati, OH-KY-IN CBSA, SWOQA meets the monitoring requirements in that area as per an agreement between Indiana and SWOQA.

Industrial Monitoring

AES/IPL operates three SO₂ monitors, one each in Daviess, Morgan and Pike Counties monitoring the air near their electrical power generating facilities. Townships in these counties have been designated nonattainment for SO₂ since 2010. Duke Energy operates two SO₂ monitors, one in Gibson County and the other across the state line in Wabash County, Illinois to monitor the air around the Gibson Station power plant. In addition to the SO₂ monitoring requirements above (PWEI), on August 21, 2015, U.S. EPA published its final Data Requirements Rule (DRR) for the 2010 1-hour SO₂ NAAQS (<https://www.gpo.gov/fdsys/pkg/FR-2015-08-21/pdf/2015-20367.pdf>). This rule directed states to provide data to U.S. EPA to characterize current air quality in areas with large sources of SO₂ emissions to identify maximum 1-hour SO₂ concentrations in ambient air. The DRR required states to indicate the approach to be used for each listed source to characterize air quality in the respective area: air quality characterization through air quality modeling or ambient monitoring, or establishment of a federally enforceable emission limit (or facility shut down). As required by the DRR, IDEM identified to U.S. EPA the approach it used to characterize the air quality in each of the areas identified under the DRR. Throughout the state of Indiana, one source, ArcelorMittal characterized the air quality around their facilities using ambient monitoring. Based on modeling conducted in accordance with U.S. EPA's SO₂ NAAQS Monitoring Technical Assistance Document, and in consultation with U.S. EPA, a monitoring site location was selected to meet this requirement. As required by the DRR, this monitor was installed and operational by January 1, 2017. In addition the NIPSCO – Dunes Acres SO₂ site with wind speed and wind direction monitoring was transferred to ArcelorMittal as the reporting agency.

All industrial facilities monitoring for SO₂ are their own PQAQO operating similar to the monitoring at other SO₂ sites operated by IDEM and their data is NAAQS comparable.

Table 13 – Number of SO₂ Sites Required by CFR

CBSA Name - Required Areas	2014 NEI Data (tons/year) ¹	2017 Pop. Estimate ²	PWEI Values	PWEI Required Sites	Current No. of Sites	2019 No. of Sites
Chicago-Naperville-Elgin, IL-IN-WI (total CBSA)	72,832	9,533,040	694,310	2	6	-
Chicago-Naperville-Elgin, IL-IN-WI (IN only)					2	3
Cincinnati, OH-KY-IN (total CBSA)	91,423	2,165,139	197,944	2	6	-
Cincinnati, OH-KY-IN (IN only)					0	0
Indianapolis-Carmel-Anderson, IN	2,312	2,028,614	4,690	0	2	2
Evansville, IN-KY (total CBSA)	18,299	315,669	5,776	1	2	-
Evansville, IN-KY (IN only)					1	1
Louisville-Jefferson County, KY-IN (total CBSA)	43,546	1,293,953	56,346	1	4	-
Louisville-Jefferson County, KY-IN (IN only)					1	1
Terre Haute, IN	14,615	169,965	2,484	0	1	1
# of sites needed to meet full CBSA requirements				6		
Sites in Indiana Network					7	8
¹ Emissions data (IN - 2016) (Other States - 2014)						
² Population estimates from US Census Bureau						

Monitoring Methodology

Indiana's SO₂ monitoring network collects data with Thermo Scientific Models 43c and 43i using pulsed ultra-violet fluorescence monitoring methodology. A Thermo Scientific Model 43i Trace Level-Enhanced is used to collect trace level SO₂ data at the NCore, Indpls – Washington Park site (180970078).

Monitoring Network

In November, 2017 the shelter at New Albany (180431004) was relocated on school property to allow construction of a new building. The shelter will be moved approximately 150 meters east-southeast of its current location.

Monitoring of SO₂ is also required at the NCore sites as per 40 CFR Part 58 Appendix D, 4.4.5. Indiana operates eight SO₂ monitors located throughout the state, as displayed in Figure 11. This Figure includes ten townships designated nonattainment for SO₂. The current network is listed in Table 14 and includes the Industrial network.

Network Modifications

The addition of one SO₂ monitor at East Chicago - Marina is planned for the network in 2019 for enhanced monitoring.

Figure 11 – SO₂ Monitoring Network

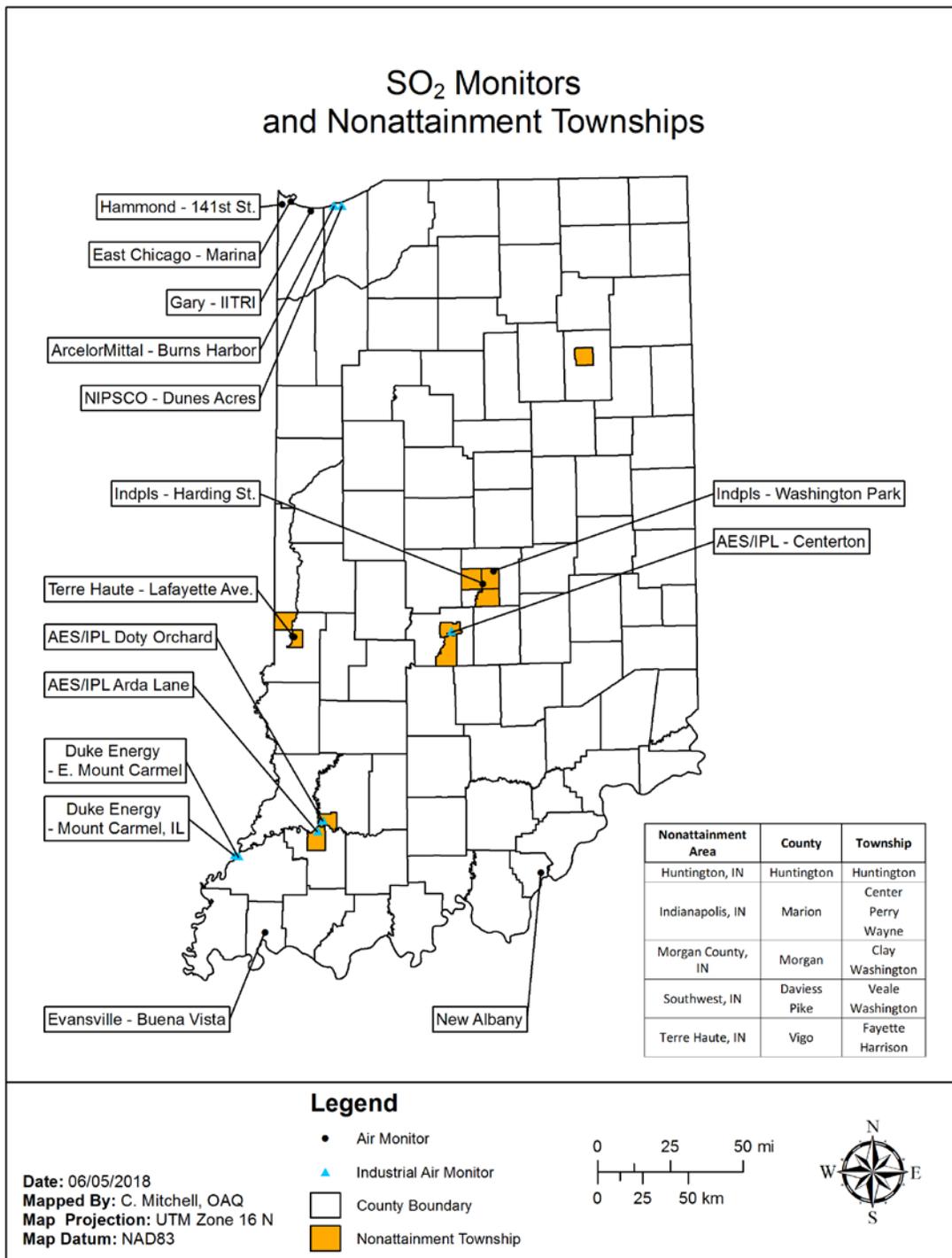


Table 14 – SO₂ Monitoring Network

Parameter Code: 42401		SO ₂ - Sulfur Dioxide												
PQAQ: 0520 REPORTING AGENCY: Indiana Department of Environmental Management														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180431004	New Albany	Floyd	New Albany	Green Valley Elem. Sch., 2230 Green Valley Rd.	SLAMS	11/01/76	Continuous	060	Neigh	Pop Exp	38.307913	-85.834313	Louisville/Jefferson County, KY-IN	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	06/12/97	Continuous	060	Neigh	Pop Exp	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	SLAMS	01/01/19	Continuous	060	Middle	Source Oriented	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	Add
180892008	Hammond - 141st St.	Lake	Hammond	1300 E. 141st St.	SLAMS	08/01/75	Continuous	060	Neigh	Highest Conc	41.639444	-87.493611	Chicago-Naperville-Elgin, IL-IN-WI	No
180970057	Indpls - Harding St.	Marion	Indianapolis	1321 S. Harding St.	SLAMS	03/04/82	Continuous	060	Neigh	Highest Conc	39.749027	-86.186269	Indianapolis-Carmel-Andersor	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE)	01/01/10	Continuous	560	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Andersor	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/08/09	Continuous	060	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No
181670018	Terre Haute - Lafayette Ave.	Vigo	Terre Haute	961 N. Lafayette Ave.	SLAMS	07/01/83	Continuous	060	Neigh	Pop Exp	39.485987	-87.401312	Terre Haute	No
PQAQ: 0524 REPORTING AGENCY: Indianapolis Power & Light														
180270002	AES/IPL - Doty Orchard	Daviess		West off of State Route 57	Industrial	01/01/78	Continuous	060	Middle	Source Oriented	38.573278	-87.214613	Non-MSA County	No
181091001	AES/IPL - Centerton	Morgan	Centerton	6075 High St.	Industrial	01/01/78	Continuous	060	Middle	Source Oriented	39.514203	-86.391777	Non-MSA County	No
181250005	AES/IPL - Arda Lane	Pike		1587 East Arda Lane	Industrial	11/20/95	Continuous	060	Middle	Source Oriented	38.518934	-87.248598	Non-MSA County	No
PQAQ: 1324 REPORTING AGENCY: Duke Energy														
171850001	Duke Energy - Mount Carmel	Wabash, IL		Division St	Industrial	01/01/79	Continuous	060	Middle	Source Oriented	38.397789	-87.773853	Non-MSA County	No
180510002	Duke Energy - E. Mount Carmel	Gibson		Gibson Coal Road	Industrial	01/01/81	Continuous	060	Middle	Source Oriented	38.392887	-87.748341	Non-MSA County	No
PQAQ: 0788 REPORTING AGENCY: ArcelorMittal														
181270011	NIPSCO - Dunes Acres	Porter	Dunes Acres	246 Bailey Station Rd.	Industrial	06/01/76	Continuous	100	Middle	Source Oriented	41.634104	-87.101452	Chicago-Naperville-Elgin, IL-IN-WI	No
PQAQ: 2354 REPORTING AGENCY: ArcelorMittal														
181270028	ArcelorMittal - Burns Harbor	Porter		E. Boundary Rd	Industrial	01/01/17	Continuous	060	Middle	Source Oriented	41.635404	-87.150567	Chicago-Naperville-Elgin, IL-IN-WI	No
<p>MONITORING METHOD: 060 - THERMO ELECTRON 43C, 43i SO₂ 100 - TELEDYNE ADVANCED POLLUTION INST. T100 SO₂ 560 - THERMO ELECTRON 43i TRACE LEVEL SO₂</p>														

PM_{2.5} Speciation

Monitoring Requirements

Monitoring requirements in 40 CFR Part 58 Appendix D §4.7.4 states that “each state shall continue to conduct chemical speciation monitoring and analyses at sites designated to be part of the STN PM_{2.5}.” The STN PM_{2.5} is part of the CSN.

Monitoring Methodology

Intermittent speciation samples are collected on three different filter mediums, each for a specific analysis and list of compounds. A Teflon™ filter, using the Energy Dispersive X-ray Fluorescence analysis methodology, is used to target 33 trace metals. A nylon filter, using Ion Chromatography for an analytical method, is used to target sulfates, nitrates, and three cations (ammonium, potassium, and sodium). A quartz fiber filter, using Thermal Optical Analysis, is used to target organic, elemental, and total carbon.

The Met One SASS and SuperSASS is used to collect PM_{2.5}, trace elements, Cations-PM_{2.5}, Nitrate-PM_{2.5}, and Sulfate-PM_{2.5} data. The URG-3000N sampler is used to collect organic and elemental carbon data. Samples are collected on a 1/6 day sampling frequency at all sites except the Indpls – Washington Park (180970078) site, which samples every third day.

Indiana also operates continuous speciation monitors at five different locations. A Magee Aethalometer, using optical absorption analysis methodology, is used for sampling black carbon at the Indpls – Washington Park, Gary – IITRI (180890022), Evansville – Buena Vista (181630021), and Elkhart – Prairie St. (180390008) sites. A Teledyne API Aethalometer, using optical adsorption analysis methodology, is used for sampling black carbon at the Indpls – I-70 E. (180970087) site.

Monitoring Network

Currently the Indiana speciation network consists of six STN PM_{2.5} and five continuous monitors across the state. The current network, along with any changes planned for 2019, is listed in Table 15 and displayed in Figure 12.

Network Modifications

Relocation of the Jeffersonville (180190006) site continues to be delayed due to lease negotiations between IDEM and property owners. When the new site is setup, continuous PM_{2.5} and black carbon will be installed. A Teledyne API 633 Aethalometer will be deployed at this site.

Figure 12 – Speciation Monitoring Network

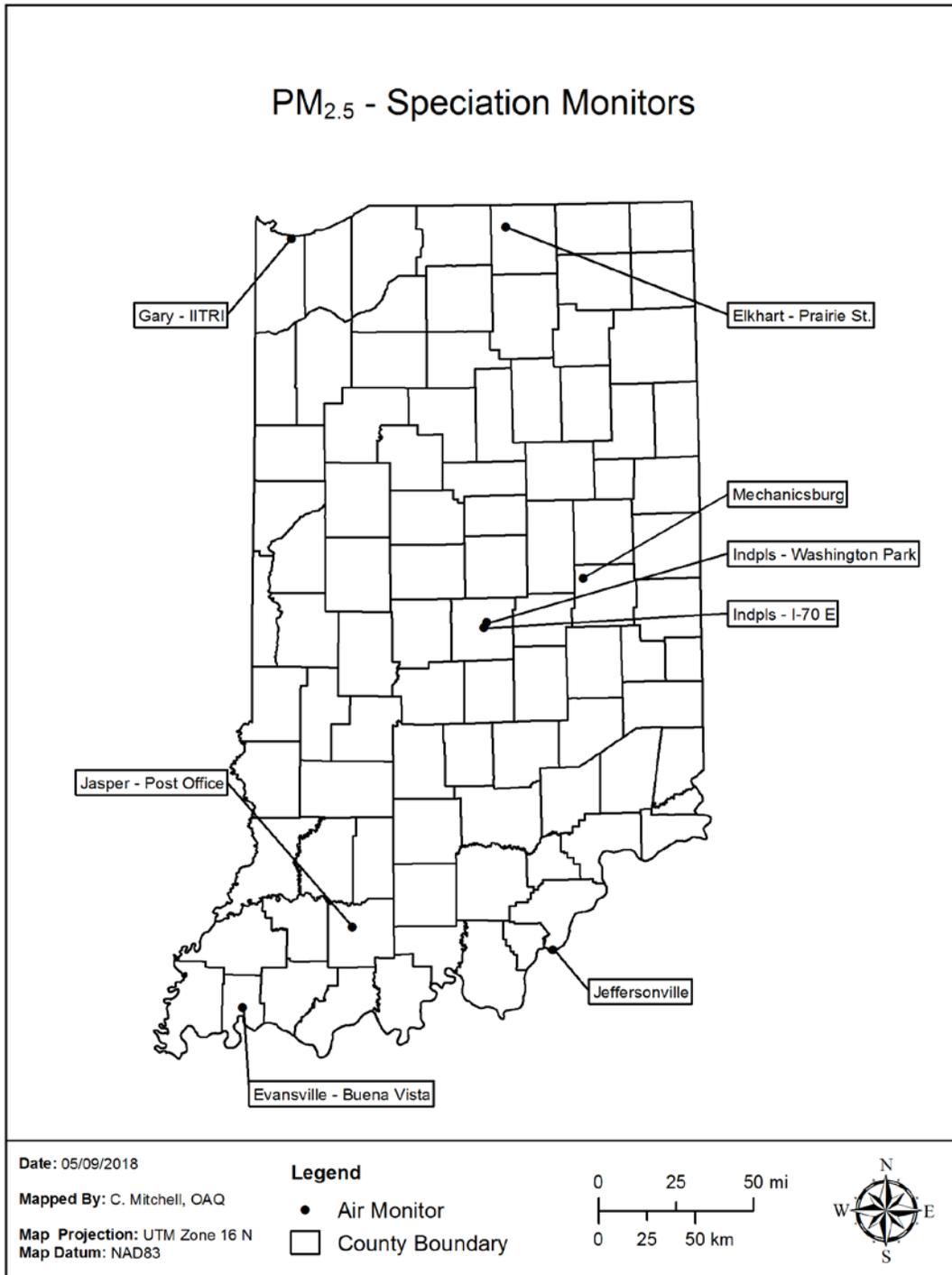


Table 15 – PM_{2.5} Speciation Monitoring Network

PM _{2.5} Speciation (Sulfate, Nitrate, Carbon, etc.)														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180190006	Jeffersonville-Walnut St.	Clark	Jeffersonville	Jeffersonville PFAU, 719 Walnut St.	SLAMS (CSN) SUPPLEMENTAL	07/01/08	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Neigh	Pop Exp	38.277719	-85.740111	Louisville/Jefferson County, KY-IN	Relocate
18019	Jefersonville	Clark	Jeffersonville		SLAMS (CSN) SUPPLEMENTAL	01/01/18	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Neigh	Pop Exp	38.289762	-85.722334	Louisville/Jefferson County, KY-IN	Relocation
18019	Jefersonville	Clark	Jeffersonville		SLAMS (CSN) SUPPLEMENTAL	01/01/18	Continuous Black Carbon	894	Neigh	Pop Exp	38.289762	-85.722334	Louisville/Jefferson County, KY-IN	Add
180372001	Jasper - Post Office	Dubois	Jasper	Post Office, 206 E. 6th St	SLAMS (CSN) SUPPLEMENTAL	01/04/05	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Neigh	Pop Exp	38.391389	-86.929167	Non-MSA County	No
180390008	Elkhart - Prairie St.	Elkhart	Elkhart	2745 Prairie St.	SLAMS	02/01/12	Continuous Black Carbon	876	Neigh	Pop Exp	41.657155	-85.968446	Elkhart-Goshen	No
180650003	Mechanicsburg	Henry		Shenandoah HS, 7354 W. Hwy. 36	SLAMS (CSN) SUPPLEMENTAL	02/01/02	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Regional	Regional Trans	40.009544	-85.523470	Non-MSA County	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS (CSN) SUPPLEMENTAL	04/03/03	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Middle	Pop Exp	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	04/01/05	Continuous Black Carbon	866	Middle	Pop Exp	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (CSN STN) (NCORE)	12/13/00	3-Day	810,811,812,826,8 31,838,839,840,8 41,842	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Andersc	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS	10/01/03	Continuous Black Carbon	866	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Andersc	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	05/06/15	Continuous Black Carbon	894	Middle	Source Oriented	39.787933	-86.130880	Indianapolis-Carmel-Andersc	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS (CSN) SUPPLEMENTAL	07/12/09	6-Day	810,811,812,826,8 31,838,839,840,8 41,842	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No
181630021	Evansville - Buena Vista	Vanderburgh	Evansville	1110 W. Buena Vista Rd	SLAMS	07/08/09	Continuous Black Carbon	876	Neigh	Pop Exp	38.013333	-87.577222	Evansville, IN-KY	No

MONITORING METHOD: 810 - MET ONE SASS NYLON / GRAVIMETRIC
 811 - MET ONE SASS TEFLON / ANALYSIS METHOD: ENERGY DISPERSIVE XRF
 812 - MET ONE SASS NYLON / ANALYSIS METHOD: ION CHROMATOGRAPHY
 826 - URG 3000 w PALL QUARTZ FILTER AND CYCLONE INLET / IMPROVE_A TOT
 831 - URG 3000 w PALL QUARTZ FILTER AND CYCLONE INLET / EC1+EC2+EC3-(OP(TOR))
 838 - URG 3000 w PALL QUARTZ FILTER AND CYCLONE INLET / IMPROVE TOT
 839 - URG 3000 w PALL QUARTZ FILTER AND CYCLONE INLET/OC1+OC2+OC3+OC4+(OP(TOT))
 840 - URG 3000 w PALL QUARTZ FILTER AND CYCLONE INLET / EC1+EC2+EC3-(OP(TOT))
 841 - URG 3000N w PALL QUARTZ FILTER AND CYCLONE INLET / IMPROVE_A
 842 - URG 3000N w PALL QUARTZ FILTER AND CYCLONE INLET / IMPROVE_A TOR
 866 - MAGEE AETHALOMETER AE21 / ANALYSIS METHOD: OPTICAL ABSORPTION
 876 - MAGEE AETHALOMETER AE22 / ANALYSIS METHOD: OPTICAL ABSORPTION
 894 - TELEDYNE API MODEL 633 AETHALOMETER / ANALYSIS METHOD: OPTICAL ABSORPTION

NCore/PAMS

Monitoring Requirements

40 CFR Part 58 Appendix D §3 requires each state to operate at least one NCore site and lists the minimum parameters which must be measured at that site. Currently the required parameters are continuous and intermittent PM_{2.5}, PM_{2.5} speciation, PM_{10-2.5} particle mass, CO, O₃, SO₂, NO/NO_y, wind speed, wind direction, relative humidity, and ambient temperature.

Ozone precursor monitoring is required as part of the PAMS program. PAMS measurements are required at each NCore site located in a CBSA with a population of 1,000,000 or more, based on the latest available census figures. Monitoring must start by June 1, 2019. Indpls – Washington Park (180970078) is Indiana’s NCore site. The specific requirements are addressed in 40 CFR Part 58 Appendix D §5. PAMS measurements include: (1) hourly averaged speciated VOCs; (2) carbonyl sampling; (3) hourly averaged O₃; (4) hourly averaged NO, true NO₂, and NO_y; (5) hourly averaged ambient temperature; (6) hourly vector-averaged wind direction; (7) hourly vector-averaged wind speed; (8) hourly averaged barometric pressure; (9) hourly averaged relative humidity; (10) hourly precipitation; (11) hourly averaged mixing-height; (12) hourly averaged solar radiation; and (13) hourly averaged ultraviolet radiation.

This section deals with hourly averaged speciated VOCs. The other parameters are addressed in their own area. According to the plan, 59 speciated VOCs are to be collected at Indiana’s PAMS.

Monitoring Methodology

Ozone precursor VOCs are collected continuously using a Perkin Elmer Clarus 500 GC, with dual Flame Ionization Detectors (FID)s and a TurboMatrix thermal desorber. In addition, canister samples are collected on a one-in-six day sampling schedule. These canisters are analyzed using U.S. EPA Method TO-15. The 60 PAMS target compounds are shown in Table 16.

Table 16 – PAMS Target Compounds

Priority Compounds				Optional Compounds			
1	1,2,3-trimethylbenzene ^a	19	n-pentane	1	1,3,5-trimethylbenzene	19	isopropylbenzene ^b
2	1,2,4-trimethylbenzene ^a	20	o-ethyltoluene ^a	2	1-pentene	20	m-diethylbenzene
3	1-butene	21	o-xylene ^{a,b}	3	2,2-dimethylbutane	21	methylcyclohexane
4	2,2,4-trimethylpentane ^b	22	p-ethyltoluene ^a	4	2,3,4-trimethylpentane	22	methylcyclopentane
5	acetaldehyde ^{b,c}	23	Propane	5	2,3-dimethylbutane	23	n-decane
6	benzene ^{a,b}	24	propylene	6	2,3-dimethylpentane	24	n-heptane
7	c-2-butene	25	styrene ^{a,b}	7	2,4-dimethylpentane	25	n-nonane
8	ethane ^d	26	tnmoc	8	2-methylheptane	26	n-octane
9	ethylbenzene ^{a,b}	27	toluene ^{a,b}	9	2-methylhexane	27	n-propylbenzene ^a
10	Ethylene	28	t-2-butene	10	2-methylpentane	28	n-undecane
11	formaldehyde ^{b,c}			11	3-methylheptane	29	p-diethylbenzene
12	Isobutane			12	3-methylhexane	30	t-2-pentene
13	Isopentane			13	3-methylpentane		
14	Isoprene			14	acetone ^{c,d}		
15	m&p-xylenes ^{a,b}			15	Acetylene		
16	m-ethyltoluene ^a			16	c-2-pentene		
17	n-butane			17	cyclohexane		
18	n-hexane ^b			18	cyclopentane		
Other Compounds				1	n-dodecane ^e	2	1-hexene ^e

^a Important SOAP (Secondary Organic Aerosols Precursor) Compounds

^b HAP (Hazardous Air Pollutant) Compounds

^c Carbonyl compounds

^d Non-reactive compounds, not considered to be VOC for regulatory purposes

^e Compounds measured and reported, not required for regulatory purposes

Carbonyl data are collected using Method TO-11A of the U.S. EPA's Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Compendium of Method. Currently Indiana uses the ATEC 2200 2C for one-in-six day sampling at the Indpls – Washington Park (180970078) site. Samples are collected by drawing a known volume of air through a cartridge filled with silica gel coated with activated DNPH. These samples are analyzed using HPLC with a UV absorption detector.

Monitoring Network

As shown in Figure 13, Indiana's NCore site is Indpls – Washington Park. The details for all the NCore parameters are listed in Table 17. Except for PM_{10-2.5}, parameters are also listed in the individual parameter sections.

Indiana operates a PAMS monitoring site collecting ozone precursor VOCs at Indpls – Washington Park NCore for the Indianapolis-Carmel-Anderson CBSA. The normal PAMS monitoring season is June, July, and August, but Indiana began collecting data year-round in 2011 to observe values outside the season as well. Since Indiana's PAMS is already operational IDEM has elected to be an early adopter, meaning PAMS data will be collected and submitted one year prior to the mandatory start date of June 1, 2019. The monitor location is shown in Figure 13 and site details are in Tables 17 & 18.

Network Modifications

There are no planned network modifications for 2019.

Table 17 – NCore/PAMS Required Parameters

Parameter	Monitor Type	Start Date	Sampler or Monitor	Method Code	Analysis Method	Sample Frequency	Requirement	
							NCore	PAMS
CO – trace level	SLAMS	1/1/2010	Teledyne API 300EU	593	Automated reference method utilizing trace level non-dispersive infrared analysis.	Continuous	X	
NO	SLAMS	3/10/2010	Teledyne API 200EU	699	Automated reference method utilizing chemiluminescence analysis.	Continuous	X	X
NO _y	SLAMS	3/10/2010	Teledyne API 200EU	699	Automated reference method utilizing chemiluminescence analysis.	Continuous	X	X
O ₃	SLAMS	4/1/2009	Thermo Scientific 49i	047	Automated equivalent method utilizing uv photometry analysis.	Continuous	X	X
SO ₂ – trace level	SLAMS	1/1/2010	Thermo Scientific 43i TLE	560	Automated equivalent method utilizing Trace Level UV Fluorescence Analysis	Continuous	X	
Intermittent PM _{2.5}	SLAMS	3/7/1999	Thermo Scientific 2025	145	Manual reference method utilizing gravimetric analysis.	1/3 day	X	
Continuous PM _{2.5}	SLAMS	1/1/2004	Met One Instruments BAM-1020 System	170	Automated equivalent method utilizing beta ray transmission	Continuous	X	
Intermittent PM _{10-2.5}	SLAMS	7/1/2010	Thermo Scientific Partisol-Plus Model 2025 Sequential sampler pair	176	Manual reference method utilizing gravimetric analysis.	1/3 day	X	
Continuous PM _{10-2.5}	SLAMS	7/22/2011	Met One Instruments BAM-1020 System	185	Automated equivalent method utilizing beta ray transmission	Continuous	X	
PM _{2.5} Speciation	SLAMS	12/13/2000	Met One SASS & URG 3000N	811 / 812 / 833	Multi-species manual collection method utilizing thermal optical, ion chromatography, gravimetric, and x-ray fluorescence analyses.	1/3 day	X	
WS/WD	SLAMS	10/11/2009	RM Young 05305-AQ	020	Air quality measurements approved instrumentation for wind speed and wind direction	Continuous	X	X
OT/RH	SLAMS	10/11/2009	RM Young 41372VF	040 / 020	Air quality measurements approved instrumentation for humidity and temperature	Continuous	X	X
PAMS	SLAMS	7/1/2011	Perkin Elmer Clarus 500 Gas Chromatograph	128	Cryogenic Preconcentration GC/FID Detection	Continuous	X	X
Mixing Height	SLAMS	6/1/2018	Vaisala CL51 Ceilometer	128	Optical scattering pulsed diode laser LIDAR (Light Detection And Ranging)	Continuous	X	X
Carboynls	SLAMS	4/18/1999	ATEC 2200 2C	102	Silica DNPH cartridge w/KI O3 scrubber with HPLC (TO-11A)	1/6 day 1/3 day Jun-Aug	X	X
NO ₂	SLAMS	1/1/2013	Teledyne API T500U	212	Direct-read Cavity Attenuated Phase Shift (CAPS)	Continuous	X	X
Precipitation	OTHER	10/11/2009	RM Young 52202E	014	Air quality measurements approved instrumentation for rainfall	Continuous	X	X
BP	OTHER	10/11/2009	Met One 594	011	Air quality measurements approved instrumentation for barometric pressure	Continuous	X	X
Solar Radiation	OTHER	1/1/2013	Eppley Precision Spectral Pyranometer	011	First Class Radiometer	Continuous	X	X
Ultraviolet Radiation	OTHER	1/1/2013	Eppley Total Ultraviolet Radiometer	011	Hermetically sealed selenium barrier-layer cell	Continuous	X	X
Intermittent PM ₁₀	SLAMS	7/1/2010	Thermo Scientific 2025	127	Manual reference method utilizing gravimetric analysis.	1/3 day		
Continuous PM ₁₀	SLAMS	8/2/2011	Met One Instruments BAM-1020 System	122	Automated equivalent method utilizing beta ray transmission	Continuous		
Continuous Black Carbon	SLAMS	10/1/2003	Magee AE21	866	Optical Absorption	Continuous		
Toxics	OTHER	4/18/1999	Meriter MCS-1-R	126 / 150	SS 6l canister with cryogenic GC/MS	1/6 day		

Figure 13 – NCore / Ozone Precursors Network

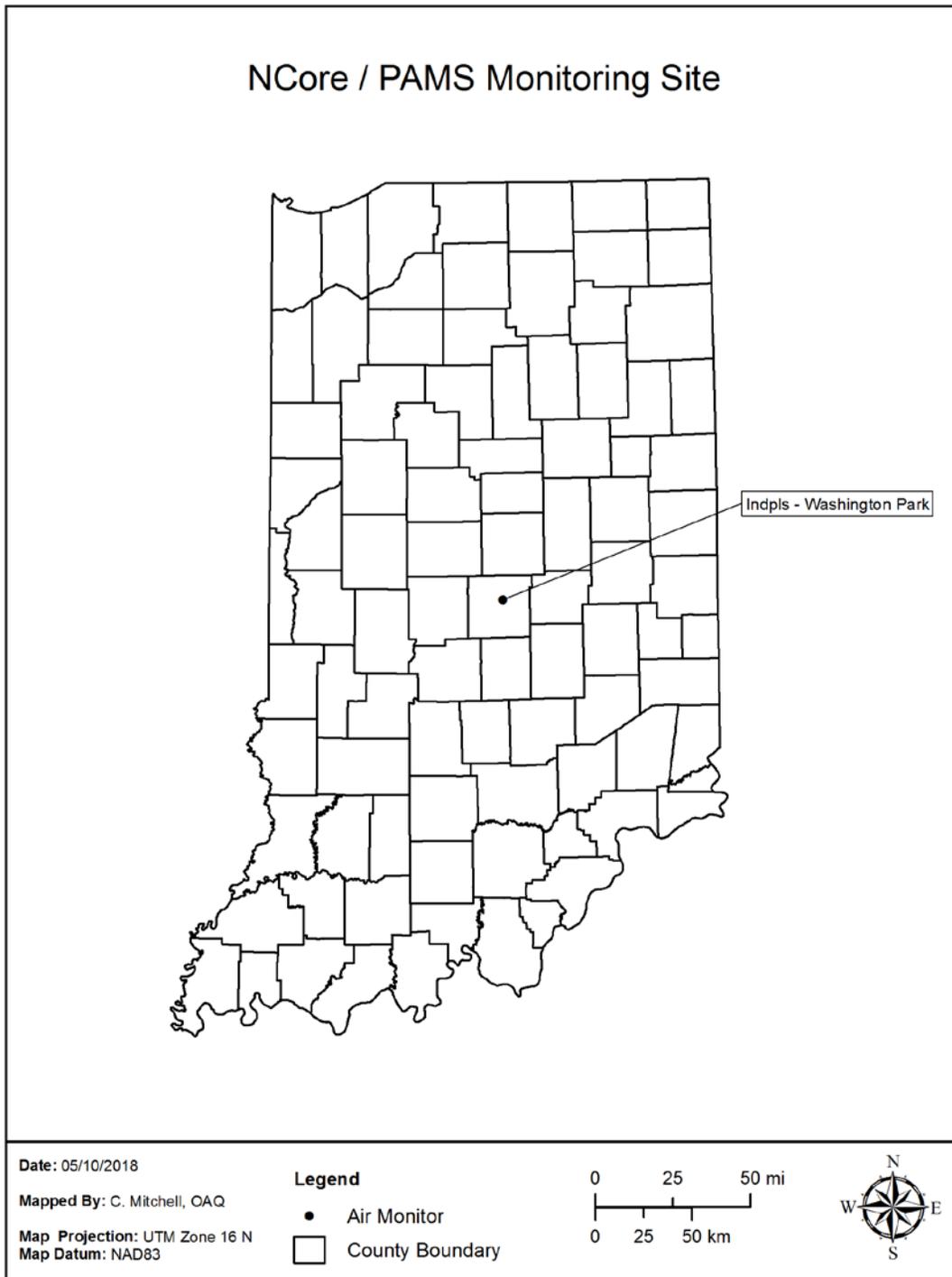


Table 18 – Ozone Precursor Monitoring Network

Ozone Precursors														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE/PAMS)	07/01/11	Continuous	128	Middle	Max Prec. Em. Impact	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
<p>MONITORING METHOD: 128 - AUTO GC; SUBAMBIENT - DUAL FID 146 - AUTO GC; SUBAMBIENT - DUAL FID</p>														

Near-Road

Monitoring Requirements

40 CFR Part 58 Appendix D § 4.3.2 promulgated new NO₂ monitoring requirements. These included the requirement for establishing near-road NO₂ monitoring stations to be operational by January 1, 2014. The requirements for the near-road site as they apply to Indiana are as follows:

- (a) Within the NO₂ network, there must be one microscale near-road NO₂ monitoring station in each CBSA with a population of 500,000 or more persons to monitor a location of expected maximum hourly concentrations sited near a major road with high AADT counts as specified in paragraph 4.3.2(a)(1) of this appendix. CBSA populations shall be based on the latest available census figures.
- (1) The near-road NO₂ monitoring stations shall be selected by ranking all road segments within a CBSA by AADT and then identifying a location or locations adjacent to those highest ranked road segments, considering fleet mix, roadway design, congestion patterns, terrain, and meteorology, where maximum hourly NO₂ concentrations are expected to occur and siting criteria can be met in accordance with Appendix E of this part. Where a State or local air monitoring agency identifies multiple acceptable candidate sites where maximum hourly NO₂ concentrations are expected to occur, the monitoring agency shall consider the potential for population exposure in the criteria utilized to select the final site location.

From the most recent census data from 2010 for Indiana's CBSAs there are four CBSAs which have more than 1,000,000 persons:

<u>CBSA</u>	<u>Population</u>
Chicago-Naperville-Elgin, IL-IN-WI	9,461,405
Cincinnati, OH-KY-IN	2,114,580
Indianapolis-Carmel-Anderson, IN	1,887,862
Louisville-Jefferson County, KY-IN	1,235,708

Indiana has a MOA with Illinois and agreements in place with Ohio, and Kentucky with regard to how the monitoring requirements are shared in these multi-state CBSAs. The near-road monitoring in these areas will be the responsibility of the adjoining states. Indiana will be responsible for and deploy the near-road site in the Indianapolis-Carmel-Anderson CBSA.

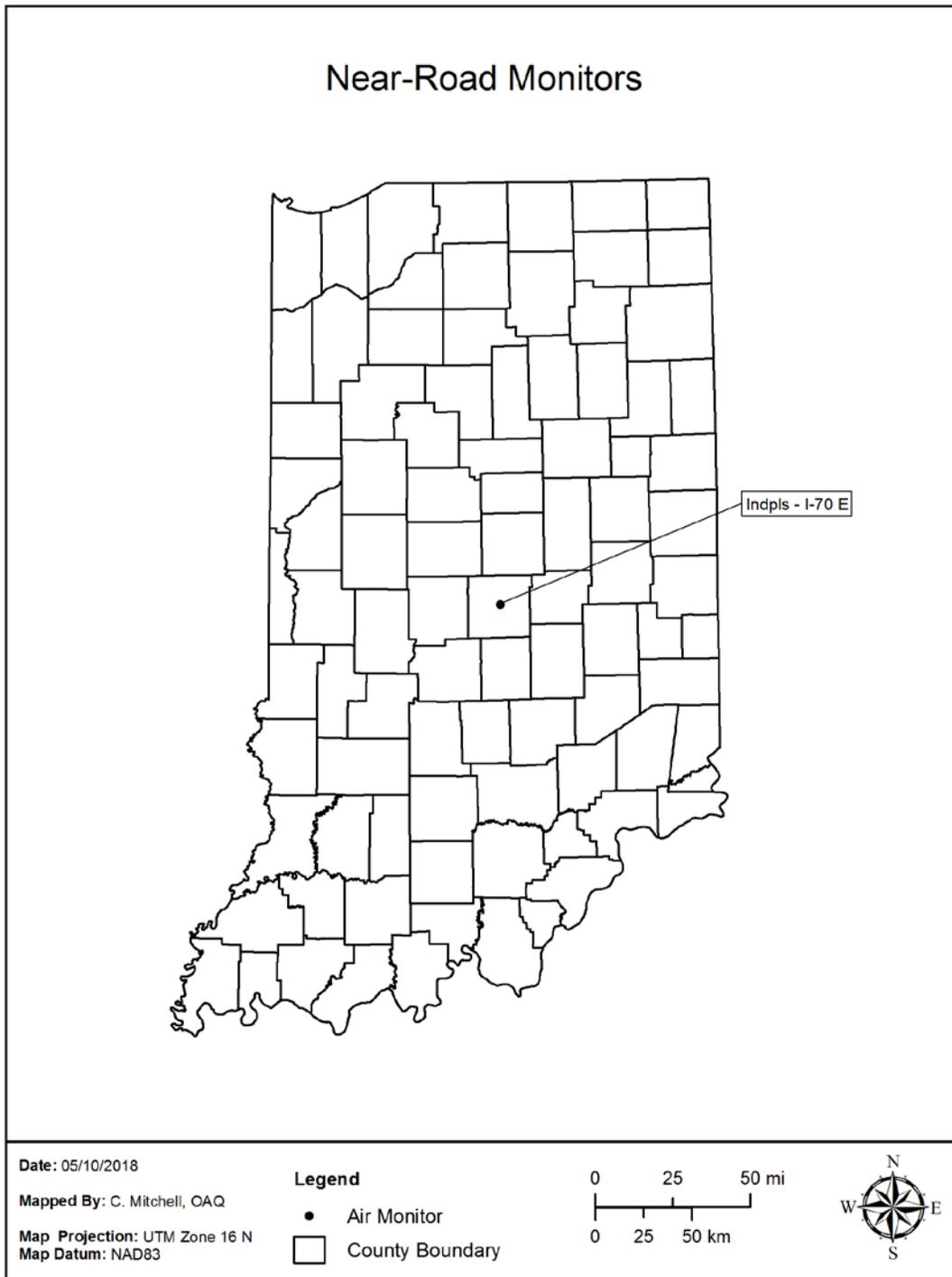
Monitoring Network

IDEM worked with the INDOT to obtain a location for this site along Interstate 70, between the northeast interchange of I-70 and I-65 and the Keystone Ave. exit. As shown in Figure 14, Indiana's near-road site is Indpls – I-70 E. (180970087). Monitors at the site include NO₂, CO, O₃, wind speed, wind direction, ambient temperature, relative humidity, black carbon, air toxics, and PM_{2.5}. These parameters are also listed in the individual parameter sections.

Network Modifications

IDEM will add a TSI Model 3783 Ultrafine Particle Monitor as a secondary parameter in 2019.

Figure 14 – Near-Road Monitoring Network



Toxics (VOCs)

Monitoring Requirements

There are no requirements for toxics monitoring listed in 40 CFR Part 58.

Monitoring Methodology

Indiana uses a modification of the TO-15 method to collect toxics VOC data. TO-15 is part of U.S. EPA's Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air and consists of guidance for the sampling and analysis of volatile organic compounds in air. Ambient air is collected in a stainless steel canister in the field using either the Meriter MCS-1-R or the ATEC 2200 Air Toxic Samplers and analyzed using a GC/MS to determine the concentration of the compounds found in the sample obtained. Samples are collected for 24 hours on a one-in-six day sampling schedule. Table 19 lists the 62 different VOCs, and an aggregate currently being analyzed and reported.

Table 19 – VOCs

Propene	Freon-12	Chloromethane	Freon-114
Vinyl Chloride	1,3-Butadiene	Bromomethane	Chloroethane
Ethanol	Acrolein	Acetone	Freon-11
Isopropanol	Vinylidene Chloride	Dichloromethane	Carbon Disulfide
Freon-113	t-1,2-Dichloroethene	1,1-Dichloroethane	Methyl Tert-Butyl Ether
Vinyl acetate	Methyl Ethyl Ketone	c-1,2-Dichloroethene	Hexane
Ethyl Acetate	Chloroform	Tetrahydro-Furan	1,2-Dichloroethane
1,1,1-Trichloroethane	Benzene	Carbon Tetrachloride	Cyclohexane
1,2-Dichloropropane	Bromodichloromethane	Trichloroethene	1,4-dioxane
Heptane	c-1,3-Dichloropropene	Methyl Isobutyl Ketone	t-1,3-Dichloropropene
1,1,2-Trichloroethane	Toluene	Methyl Butyl Ketone	Dibromochloromethane
1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene
m+p-Xylenes	Bromoform	Styrene	1,1,2,2-Tetrachloroethane
o-Xylene	p-Ethyltoluene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene
Benzyl Chloride	m-Dichlorobenzene	p-Dichlorobenzene	o-Dichlorobenzene
1,2,4-Trichlorobenzene	Hexachloro-1,3-butadiene	Total NMOC	

Monitoring Network

Indiana will operate ten toxics sites. The current network, along with any changes planned in 2019, is listed in Table 20 and shown in Figure 15.

Network Modifications

Monitoring for 1-hour Benzene averages will be added to East Chicago – Marina in support of enhanced monitoring at the site in 2019.

Figure 15 – Toxics Monitoring Network

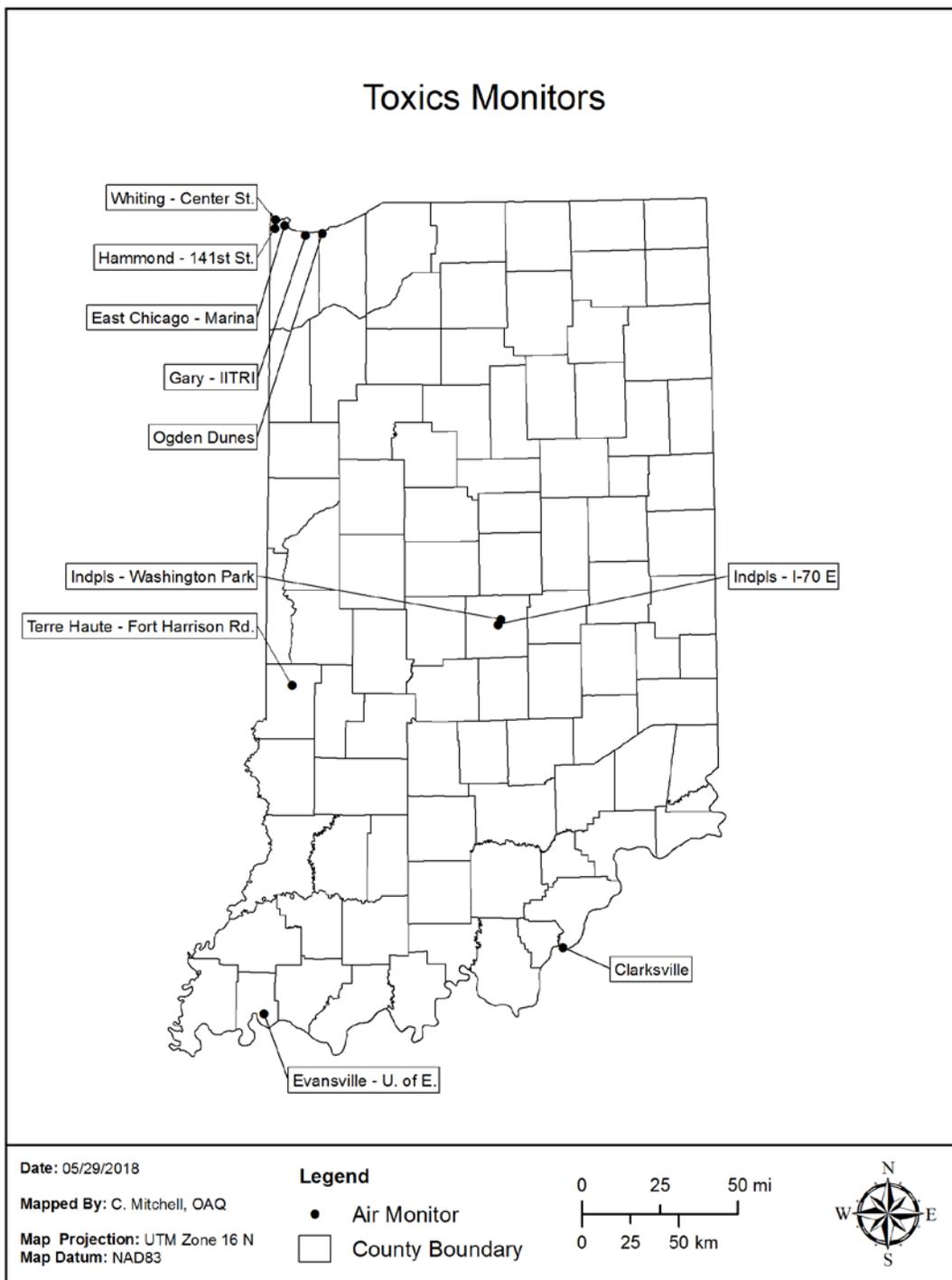


Table 20 – Toxics Monitoring Network

Toxics - VOC														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180190009	Clarksville	Clark	Clarksville	Falls of the Ohio SP, 201 W. Riverside Dr.	OTHER	03/07/08	6-Day	126,150	Neigh	Pop Exp	38.276557	-85.763791	Louisville/Jefferson County, KY-IN	No
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	OTHER	07/06/95	6-Day	126,150	Middle	Pop Exp	41.606667	-87.304722	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	OTHER	10/30/12	6-Day	126,150	Neigh	Pop Exp	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	OTHER	2019	1-Hour Benzene		Neigh	Pop Exp	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	Add
180890035	Whiting - Center St.	Lake	Whiting	1500 Center St. (H.S. Admin. Bldg.)	OTHER	12/26/15	6-Day	126,150	Neigh	Pop Exp	41.681393	-87.490233	Chicago-Naperville-Elgin, IL-IN-WI	No
180892008	Hammond - 141st St.	Lake	Hammond	1300 E. 141st St.	OTHER	02/01/89	6-Day	126,150	Neigh	Pop Exp	41.639444	-87.493611	Chicago-Naperville-Elgin, IL-IN-WI	No
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St.	OTHER	04/18/99	6-Day	126,150	Neigh	Pop Exp	39.810833	-86.114444	Indianapolis-Carmel-Anderso	No
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	01/01/16	6-Day	126,150	Middle	Source Oriented	39.787933	-86.130880	Indianapolis-Carmel-Anderso	No
181270024	Ogden Dunes	Porter	Ogden Dunes	Water Treatment Plant, 84 Diana Rd.	OTHER	08/05/98	6-Day	126,150	Neigh	Pop Exp	41.617500	-87.199167	Chicago-Naperville-Elgin, IL-IN-WI	No
181630016	Evansville - U of E	Vanderburgh	Evansville	Carson Center, Walnut St.	OTHER	06/23/99	6-Day	126,150	Neigh	Pop Exp	37.974444	-87.532222	Evansville, IN-KY	No
181670025	Terre Haute - Fort Harrison Rd.	Vigo	Terre Haute	INDOT Maintenance, 2400 Fort Harrison Rd.	OTHER	10/13/13	6-Day	126,150	Neigh	Pop Exp	39.507688	-87.374440	Terre Haute	No

MONITORING METHOD: 126 - CRYOGENIC PRECONCENTRATION GC/FID DETECTION
150 - Cryogenic Preconcentration GC/MS

Metals

Monitoring Requirements

There are no requirements for metals monitoring listed in 40 CFR Part 58.

Monitoring Methodology

Metals data are collected using a TSP sampler. The sample is collected on high purity glass microfiber filters for a 24-hour period according to an every sixth day sampling schedule. Filters are analyzed using the flameless atomic absorption method.

Monitoring Network

There are four sites that monitor TSP metals in Indiana. Manganese is the only metal (other than Pb) monitored in Lake and Porter counties. Due to concern over possible elevated manganese values reported in the School Air Toxics monitoring program in 2009, it was decided to analyze all the Pb samples collected in Lake and Porter Counties for manganese. These sites began reporting the additional metals data on January 2, 2010. These sites are detailed in Table 21 and shown in Figure 16.

Unplanned Changes to the 2018 Network Plan

Discontinued East Chicago – E. 135 St. (180890033) Pb and Mn monitoring on July 1, 2017 because the school closed where the monitoring site was located and the building was to be demolished. Due to the much improved lead concentrations in the area, the decrease in the lead emissions from the surrounding sources, and the improved modeling results a new site did not need to be found.

Network Modifications

A Pb and Mn 3-day intermittent monitoring site will be installed at a Hammond wastewater pumping station. It will be a source-oriented site on Whiting Metals.

Figure 16 – Metals Monitoring Network

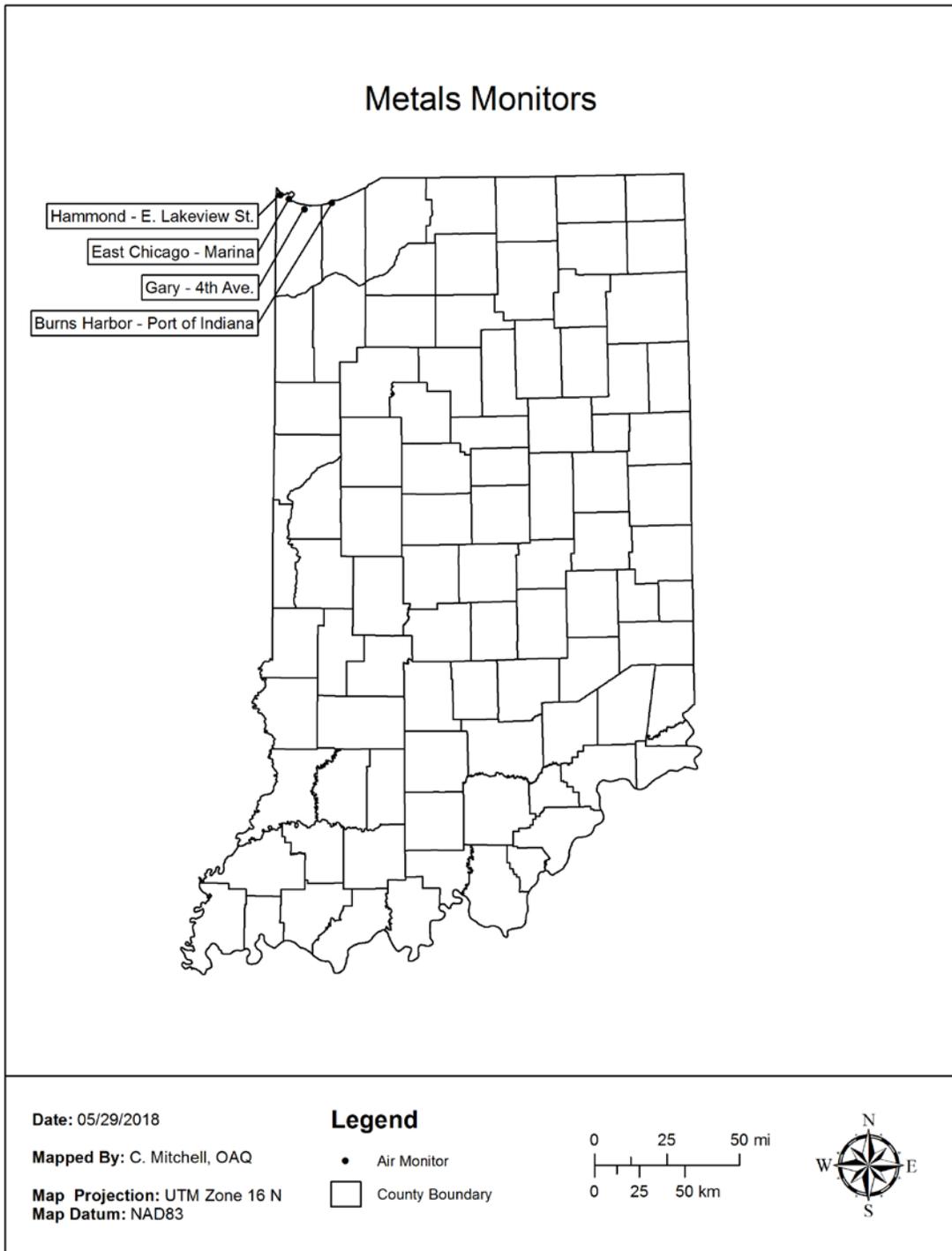


Table 21 – Metals Monitoring Network

Metals														
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Start Date	Operating Schedule	Monitoring Method	Scale	Monitoring Objective	Latitude	Longitude	CBSA	Site Change Proposed?
180890032	Gary - 4th. Ave	Lake	Gary	Gary SouthShore RailCats, One Stadium Plaza	OTHER	01/02/10	6-Day	107	Middle	Source Oriented	41.603582	-87.332658	Chicago-Naperville-Elgin, IL-IN-WI	No
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis St.	OTHER	10/30/12	6-Day	107	Middle	Source Oriented	41.653501	-87.435561	Chicago-Naperville-Elgin, IL-IN-WI	No
18089	Hammond - E. Lakeview St	Lake	Hammond	2141 E. Lakeview St	SPM	2019	3-Day	107	Middle	Source Oriented	41.674189	-87.495024	Chicago-Naperville-Elgin, IL-IN-WI	Add
181270027	Burns Harbor-Port of Indiana	Porter		E. Boundary Rd	OTHER	08/18/11	6-Day	107	Middle	Source Oriented	41.635161	-87.150376	Chicago-Naperville-Elgin, IL-IN-WI	No
<p><u>Metals Monitored</u> Manganese</p>														
<p>MONITORING METHOD: 107 - HI-VOL SAMPLER / ANALYSIS METHOD: FLAMELESS ATOMIC ABSORPTION</p>														

Meteorological Monitoring

Monitoring Requirements

Meteorological monitoring is generally not required for SLAMS, however meteorological monitoring data support the suitability of the site along with other data sets. Many factors determine the amount and types of meteorological data that are collected in Indiana. Some of the factors include the intended use of the data and the availability of representative meteorological data that is already being collected by the National Weather Service in any given area of interest. Meteorological monitoring is required at two types of sites: NCore and PAMS. 40 CFR Part 58 Appendix D §3(b) specifies that at a minimum wind speed, wind direction, relative humidity, and ambient temperature be measured at NCore sites. Meteorology measurements are required at PAMS according to 40 CFR Appendix D §5. The required meteorological measurements are as follows; hourly averaged ambient temperature, hourly vector-averaged wind direction, hourly vector-averaged wind speed, hourly average atmospheric pressure, hourly averaged relative humidity, hourly precipitation, hourly averaged mixing height, hourly averaged solar radiation and hourly averaged ultraviolet radiation. Hourly average mixing height will be added at Indpls – Washington Park (180970078) PAMS by June 1, 2018.

The near-road NO₂ monitoring sites do not require meteorological monitoring according to 40 CFR Part 58. However, meteorological monitoring is listed as a recommended Primary Priority in the Near-Road NO₂ Monitoring TAD. U.S. EPA suggests (at a minimum) to monitor wind speed, wind direction, temperature and relative humidity. If possible, other measurements such as precipitation, solar radiation and barometric pressure (among others) should be considered as well.

Monitoring Methodology

Monitoring sites in Indiana use a number of different sensors to record meteorological conditions. For wind data collection there are four sites with RM Young 3D Ultrasonic wind units. These sites are Gary – IITRI (180890022), Mechanicsburg (180650003), Indpls – I-70 E (180970087) and St. Philips (181290003). The remainder of sites collect wind data with RM Young propeller based wind units.

One instrument collects both Outdoor Temperature and Relative Humidity data at each site where these parameters are collected. The RM Young model 41372VF and 41382VF are both currently in use. They both use platinum RTD for temperature and a Rotronic Hygromer for humidity detection.

There are several different types of Barometric Pressure sensors deployed throughout the network. The manufacturers are Novalynx, Met One and RM Young but the technology used in each is a similar electronic barometer with a lower level of 500 millibars and an upper level of 1100 millibars.

Solar Radiation data are collected at three sites in Indiana with one type of precision spectral pyranometer, model PSP, manufactured by The Eppley Laboratory, Inc. Ultraviolet Radiation data are also collected at the same three sites with one type of Total Ultraviolet Radiometer, model TUVR, also manufactured by The Eppley Laboratory, Inc.

Precipitation data are collected at two sites in Indiana with one type of tipping bucket rain gauge, model 52202-E, manufactured by RM Young.

Monitoring Network

Figure 17 shows meteorological data are to be collected at 18 sites across Indiana in 2019. Sites are established to provide coverage in all areas of the state where pollutant monitoring is

conducted. Table 22 details the meteorological sites and the parameters collected. Included in Table 22 are five additional Industrial meteorological sites in support of SO₂ monitoring.

Network Modifications

Meteorological monitoring will be added at East Chicago – Marina to support enhanced monitoring.

Figure 17 – Meteorological Monitoring Network

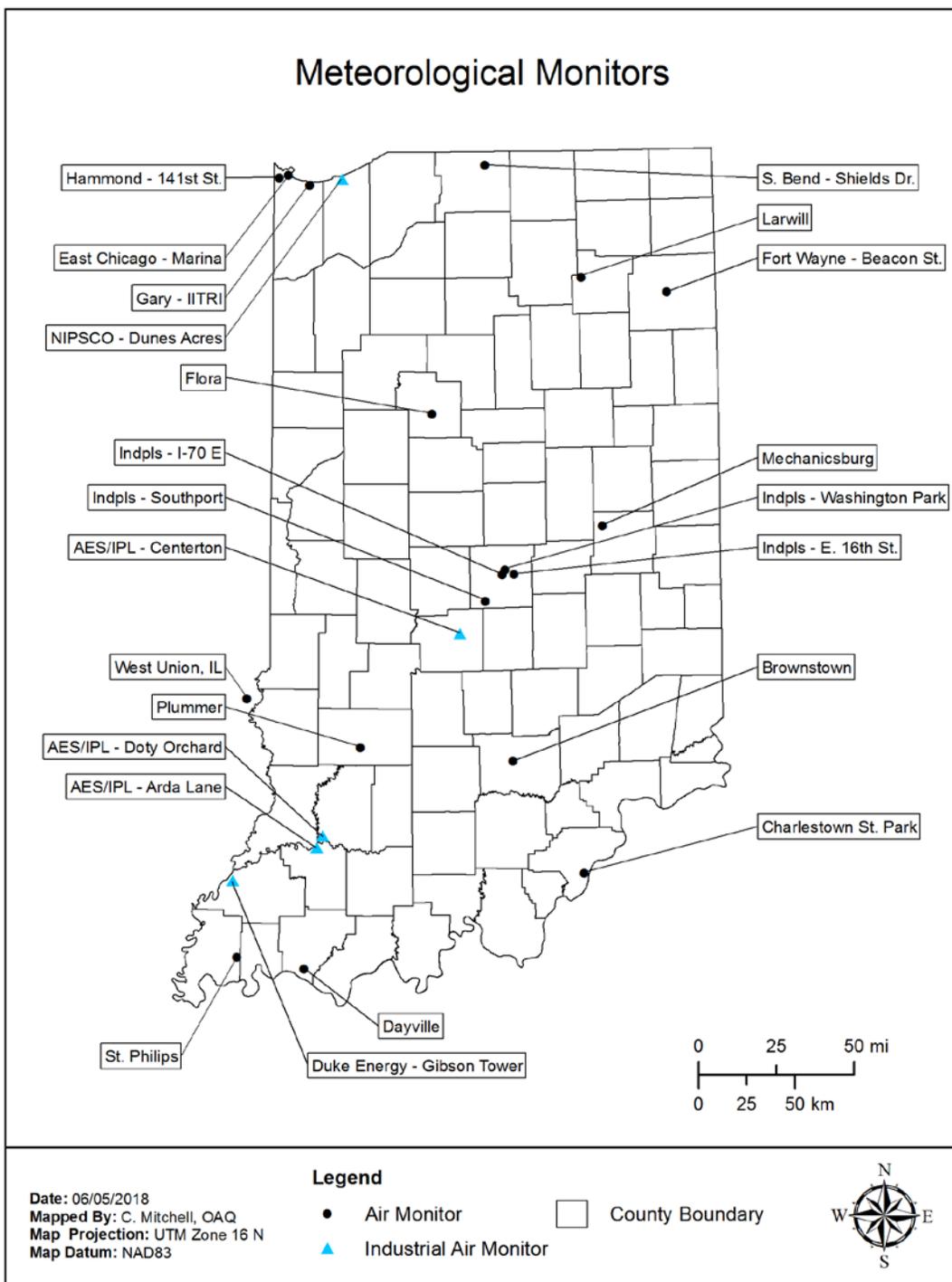


Table 22 – Meteorological Monitoring Network

Meteorological Parameters by Site																		
PQAO: 0520 REPORTING AGENCY: Indiana Department of Environmental Management																		
Site ID	Site Name	County	City	Address	Monitor Type (Network)	Latitude	Longitude	61103/61104 WS / WD	62201 RH	64101 Baro Press	62101 Outside Temp	63302 UV Rad	63301 Solar Rad	61112 Vertical WD	65102 Precip	61301 Ceilometer Mixing Height	Site Change Proposed?	
170230001	West Union	Clark Co., IL	West Union	416 S. St. Hwy 1	OTHER	39.210857	-87.668297	■	■	■	■						No	
180030004	Ft Wayne - Beacon St.	Allen	Fort Wayne	2022 North Beacon	OTHER	41.094965	-85.101816	■	■	■	■						No	
180150002	Flora	Carroll		Flora Airport, 481 S. 150 W	OTHER	40.540455	-86.553035	■	■		■						No	
180190008	Charlestown State Park	Clark		Charlestown State Park, 12500 Hwy 62	OTHER	38.393823	-85.664118	■	■	■	■						No	
180550001	Plummer	Greene		2500 S. 275 W	OTHER	38.985556	-86.990000	■	■		■						No	
180650003	Mechanicsburg	Henry		Shenandoah HS, 7354 W. Hwy. 36	OTHER	40.009544	-85.523470	■	■	■	■			■			No	
180710001	Brownstown	Jackson		225 W & 300 N	OTHER	38.920835	-86.080523	■	■		■						No	
180890022	Gary - IITRI	Lake	Gary	IITRI Bunker, 201 Mississippi St.	SLAMS	41.606667	-87.304722	■	■	■	■	■	■	■	■		No	
180890034	East Chicago-Marina	Lake	East Chicago	East Chicago Marina, 3301 Aldis	OTHER	41.653501	-87.435561	■	■		■						Add	
180892008	Hammond - 141st St.	Lake	Hammond	1300 E. 141st St.	OTHER	41.639444	-87.493611	■	■		■						No	
180970073	Indpls - E. 16th St.	Marion	Indianapolis	6125 E. 16th St.	OTHER	39.789167	-86.060833	■									No	
180970078	Indpls - Washington Park	Marion	Indianapolis	Washington Park, 3120 E. 30th St	SLAMS (NCORE/PAMS)	39.810833	-86.114444	■	■	■	■	■	■		■	■	No	
180970086	Indpls - Southport	Marion	Indianapolis	Southport Wastewater Treatment Plant, 38 Southport Rd	OTHER	39.664498	-86.234898	■									No	
180970087	Indpls - I-70 E	Marion	Indianapolis	1650 Ludlow Ave.	SLAMS (NEAR ROAD)	39.787933	-86.130880	■	■	■	■			■			No	
181290003	St Philips	Posey		2027 S. St. Phillips Rd., Evansville	OTHER	38.005278	-87.718056	■	■	■	■	■	■	■			No	
181410015	South Bend - Shields Dr.	St Joseph	South Bend	2335 Shields Dr.	OTHER	41.696667	-86.214722	■	■	■	■						No	
181730011	Dayville	Warrick		3488 Eble Rd., Newburgh	OTHER	37.954444	-87.321667	■	■	■	■						No	
181830003	Larwill	Whitley		Whitko Middle School, 710 N. State Rd. 5	OTHER	41.169722	-85.629444	■	■		■						No	
PQAO: 0524 REPORTING AGENCY: Indianapolis Power & Light																		
180270002	AES/IPL - Doty Orchard	Daviess		West off of State Route 57	INDUSTRIAL	38.573278	-87.214613	■									No	
181091001	AES/IPL - Centerton	Morgan	Centerton	6075 High St.	INDUSTRIAL	39.514203	-86.391777	■									No	
181250005	AES/IPL - Arda Lane	Pike		1587 East Arda Lane	INDUSTRIAL	38.518934	-87.248598	■									No	
PQAO: 1324 REPORTING AGENCY: Duke Energy																		
180510001	Duke Energy - Gibson Tower	Gibson		ESE of Plant	INDUSTRIAL	38.362450	-87.746419	■									No	
PQAO: 0788 REPORTING AGENCY: ArcelorMittal																		
181270011	NIPSCO - Dunes Acres	Porter	Dunes Acres	246 Bailey Station Rd.	INDUSTRIAL	41.634104	-87.101452	■	■		■						No	

Appendix A - Comment Submittal Information

The 2019 Ambient Air Monitoring Network Plan is posted on the IDEM website at <http://www.in.gov/idem/airquality/2389.htm> for review and comment for thirty (30) days. The Plan has been posted from June 22 to July 23, 2018.

Comments should be emailed to:

Steve Lengerich (slengeri@idem.IN.gov)

or mailed to:

Steve Lengerich
IDEM/OAQ/AMB
100 North Senate Avenue
Shadeland
Indianapolis, IN 46204-2251

or faxed to: (317) 308-3239

Network Comments

No Comments were received.

Feedback and corrections received from U.S. EPA Region 5:

1. Clarify the Bloomington MSA O₃ monitoring location.
2. Identify primary monitor designations for 180890034 and 180970078.
3. Reconcile PM_{2.5} AQS numbers for a few sites and number of continuous monitors.
4. Reconcile the number of collocated PM_{2.5} sites.
5. Clarify the PM_{2.5} sites comparable to NAAQS and those excluded.
6. Address the proposed monitor method change from 2018 ANP which was not completed.
7. Clarify the primary and secondary monitors used for PM_{2.5} NAAQS comparison.
8. Address current status of monitoring agreements with neighboring states.
9. No Enhanced O₃ Monitoring Plan Addressed.
10. Specify whether the Industrial SO₂ data is NAAQS comparable.

Response to U.S. EPA Feedback:

1. Explanation of monitored MSA is on pages 35-36.
2. Primary monitor designations identified on page 42.
3. AQS numbers and number of continuous PM_{2.5} monitor corrected in appropriate areas.
4. Clarified on page 46.
5. Indpls – I-70 E (180970087) and Evansville – Buena Vista (181630021) are removed as excluded monitors from page 48. Due to the timing of the final report submitted to Region 5, the FRM discontinuation date for the eight sites was changed to 7/31/18 from 6/30/18. The dates for the change of the FEMs at those sites were also changed to 8/1/18 from 7/1/18.
6. The monitoring method change at South Bend – Shields Dr. (181410015) was not accomplished and is clarified on page 17.
7. Definition of Primary Monitor added to Network Review Description on page 20. Table 12 & Table 1, Appendix C updated.
8. Addressed on page 21.
9. The Enhanced O₃ Monitoring Plan will be addressed in next year's submittal.
10. Addressed on page 56.

Appendix B

Lead Monitoring Waiver Request for Lehigh

Provided by OAQ Modeling

Air Quality Analysis

Lehigh Cement Co. (formerly ESSROC)

Logansport, Indiana (Cass County)

Purpose

The purpose of this analysis is to determine the impact of lead emissions from Lehigh Cement Company (formerly ESSROC – Logansport) on the surrounding area and whether ambient monitoring for lead is necessary to assess air quality in the area.

Analysis Summary

An air quality analysis was performed for lead based on the actual emissions after controls for 2016 at the Lehigh facility, located at 3084 W. CR 224 S, Logansport in Cass County. The facility's impact was found to be below monitor detection threshold.

Air Quality Impact Objectives

The purpose of the air quality impact analysis is to accomplish the following objectives. Each objective is individually addressed in each section outlined below.

- A. Facility Emissions.
- B. Provide analyses of actual stack heights with respect to Good Engineering Practice (GEP), the meteorological data used, a description of the model used in the analysis, and the receptor grid utilized for the analyses.
- C. Determine the maximum impacts of lead and the area impacted from the latest emissions from the source.
- D. Summarize the Air Quality Analysis for lead.

Section A – Facility Emissions

Lead is the pollutant that is the subject of interest from Lehigh, which is below in Table 1.

TABLE 1: ESSROC Actual Emissions

Process	STACK	EMISSION RATE (TPY)
Finish Mill #2	EP401	1.571
Finish Mill #1	EP401	1.826
TOTAL	TOTAL	3.397

Section B – Good Engineering Practice (GEP), Met Data, Model Used, Receptor Grid and Terrain

Stack Height Compliance with Good Engineering Practice (GEP)

Stacks should comply with GEP requirements established in 326 IAC 1-7-4. If stacks are lower than GEP, excessive ambient concentrations due to aerodynamic downwash may occur. Dispersion modeling credit for stacks taller than 65 meters (213 feet) is limited to GEP for the purpose of establishing emission limitations. The GEP stack height takes into account the distance and dimensions of nearby structures, which affects the downwind wake of the stack. The downwind wake is considered to extend five times the lesser of the structure's height or width. A GEP stack height is determined for each nearby structure by the following formula:

$$H_g = H + 1.5L$$

Where: H_g is the GEP stack height
 H is the structure height
 L is the structure's lesser dimension (height or width)

Meteorological Data

The National Weather Service (NWS) 1-minute Automated Surface Observation Station (ASOS) meteorological data used in the air quality analysis consisted of 2012 through 2016 surface data from South Bend, Indiana and upper air measurements taken at Lincoln, Illinois. The meteorological data was preprocessed using the latest versions of AERMINUTE, AERSURFACE, and AERMET.

Model Description

The Office of Air Quality (OAQ) used AERMOD version 16216r in the air quality analysis review to determine maximum off-property concentrations or impacts for lead. All regulatory default options were utilized in the U.S. EPA approved model, as listed in the 40 Code of Federal Regulations Part 51, Appendix W "Guideline on Air Quality Models".

Receptor Grid

OAQ modeling used multi-nested receptor grids generated from its initial 1-hour SO₂ modeling analysis conducted for Cass County as outlined below:

- 100 meter spacing in a 5 kilometers by 9 kilometers rectangular grid, including Lehigh and Logansport Electric Power Plant,
- 250 meter spacing in a 6 kilometer by 11 kilometer rectangular grid including those two sources,
- 500 meter spacing in a 10 kilometer by 14 kilometer rectangular grid including those two sources,
- 1,000 meter spacing in a 15 kilometer by 20 kilometer rectangular grid including those two sources,
- 2,000 meter spacing in a 32 kilometer by 26 kilometer rectangular grid including those two sources,
- 2,500 meter spacing in a 110 kilometer by 108 kilometer rectangular grid including those two sources

Treatment of Terrain

Receptor terrain elevation inputs were interpolated from NED (National Elevation Dataset) data obtained from the USGS. NED terrain data was preprocessed using AERMAP.

Section C - Impact Analysis

Modeling Results

AERMOD was used to calculate the highest modeled monthly average impact for the years 2012 - 2016 using South Bend surface and Lincoln, Illinois upper air meteorology. The modeled monthly results are considered conservative, as the National Ambient Air Quality Standard (NAAQS) for lead is based on 3-month rolling averages and is 0.15 µg/m³. Modeling results are shown in Table 2.

TABLE 2: Modeling Results*

POLLUTANT	TIME AVERAGING PERIOD	MAXIMUM MODELED IMPACTS (µg/m ³)	DETECTABLE MONITORING THRESHOLD (µg/m ³)	ABOVE MONITORING THRESHOLD	NATIONAL AMBIENT AIR QUALITY STANDARD (µg/m ³)	ABOVE NAAQS
Lead	1-month**	0.0076	0.01	No	0.15	No

*Impacts are from Lehigh only.

** Highest monthly average was used as a conservative assumption

Section D - Summary of Air Quality Analysis

The peak modeled lead impact from Lehigh on the surrounding area, based on actual emissions, was 0.0076 µg/m³, below the Lead NAAQS and monitoring threshold for lead of 0.01 µg/m³.

Appendix C

Evaluation of Indiana's Continuous PM_{2.5} Data Use and Exclusion of Data for Comparison to the NAAQS July 1, 2018

Introduction

The State of Indiana through the Office of Air Quality of IDEM has operated continuous PM_{2.5} monitors since 2000. Over the years the network has expanded to 19 sites. The monitors had been converted from available non FEM monitors to FEM monitors as they became approved, the reliability was considered adequate, and funding was sufficient to purchase them. All data from the continuous FEM monitors currently are used for AQI purposes and for submittal to AirNow for national and regional mapping purposes. At certain sites, where past FRM to FEM data comparison was deemed adequate, the FEM data were used along with the FRM data for comparison to the NAAQS.

Due to better comparison over the past several years and a revised grant funding formula from U.S. EPA, Indiana plans to use more FEMs for NAAQS comparison and to discontinue the intermittent FRM samplers at several sites. The criteria for comparison between the data from the intermittent FRMs and the continuous FEMs is set forth in 40CFR Part 53. This analysis and proposal details Indiana's determination of the data which are acceptable for use in NAAQS calculations and provides assistance to determine which sites should have FRMs discontinued.

Rules and Guidance

The rules and procedures for the testing and approval of ambient air monitoring reference and equivalent methods are contained in 40CFR part 53. Table C-4 of Subpart C contains the specific criteria for the determination of Class III FEM monitors for the collection of PM_{2.5} concentrations.

On January 15, 2013 U.S. EPA promulgated new requirements (78 FR 3086) for assessing the continuous PM_{2.5} data. These included amending "§58.11 Network Technical Requirements" by adding a new subsection (e) which defined the data and the requirements needed to determine if continuous FEM data from a State's or Local Agency's network should be used for comparison to the NAAQS.

§58.11(e) is summarized as follows:

1. State and local governments must assess the data from the Class III FEM PM_{2.5} monitors using the performance criteria in Table C-4 of subpart C to identify data which does not meet criteria and should not be used in comparison to the NAAQS.
2. The assessment should be included in the agency's annual network plan.
3. Values down to 0 µg/m³ can be included.
4. A minimum of one test site with one FRM and at least one FEM is required.
5. The precision statistic does not apply.
6. All seasons must be covered, with no more than 36 consecutive months aggregated together.
7. The key statistic metric is the bias (both additive and multiplicative) of the FEM compared to the FRM. Correlation is required to be reported, but failure to meet these criteria is not cause to exclude the data.

In April 2013, detailed instructions and a template for requesting exclusion of the data were distributed by OAQPS. It provided a detailed summary of the items required, explanation of the required statistics, and a variety of analysis tools available to aid in the analysis. The procedures for submitting the exclusion request outside of the annual network review were also included.

All FEM data collected during the past three years were assessed using this analytical tool.

Indiana's Network

At the end of 2017 Indiana operated FEMS at 19 continuous sites across the state. All the FEMs are collocated with intermittent FRMs (R&P/Thermo 2025 w/VSCC). The Met One BAM 1020 is used at 13 sites, four sites use the Thermo 5030 SHARP, and one site has a Teledyne 602 deployed. Table 1 lists the current PM_{2.5} Continuous Network and a summary of the overall results.

Data Period to Review

In general, Indiana evaluated the data for the current monitor being used at the sites for the past three years, 2015 thru 2017. Even if a site had not been collecting data with the current monitor for a minimum of 24 months, it was still evaluated. Past monitors which were replaced with another monitoring method in 2017 were not included.

Analysis Results

The current analysis results for each site are listed and graphed on the top half of Tables 2 through 19.

The following information for each site is listed on the bottom half of Tables 2 through 19:

In addition to the current analysis to determine NAAQS Data Comparability, the design values for each of the three years were calculated using the FRM data only, the FEM data only, and the FRM data with the FEM data substituted for missing days. The design values showed very good comparison and were generally within one $\mu\text{g}/\text{m}^3$.

Results from past evaluations and U.S. EPA responses, along with the current data analyses, were reviewed to determine which POC, or monitoring method, to be used as the primary and secondary data source for design value calculations. The decision on which intermittent FRMs could be discontinued was based on this information, as well as the need for the need to maintain the required FRMs for programs such as NCore, Near-Road, speciation, and method collocation.

Network Requests

All but two of the FEM monitors have very good comparison and are acceptable for use in NAAQS calculations at this time. Bloomington - Binford and Larwill have produced very poor comparison data. The slope, intercept, and correlation for these site are not in the acceptable range and exclusion of the data for NAAQS comparison is requested.

All FEM acceptable data are listed as and requested to be the secondary monitor when there is an FRM operating at the same site.

Eight FRMs are requested to be discontinued as soon as approval is granted by U.S. EPA. The anticipated shut-down date is July 31, 2018. The sites are:

- Fort Wayne – Beacon St. (180030004)
- Columbus – Rocky Ford Rd. (180050008)
- Elkhart – Prairie St. (180390008)
- Fishers (180570007)
- Kokomo – Vaile Ave. (180670004)
- Anderson – Eastside Elem. (180950011)
- Ogden Dunes (181270024)
- Lafayette – Greenbush St. (181570008)

The FEMs at these sites will then be considered the primary monitor.

**Table 1
PM2.5 Continuous Network Summary**

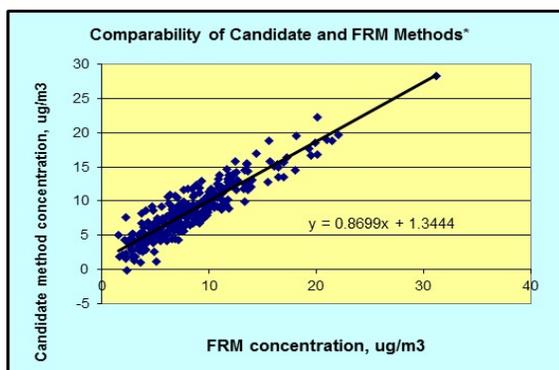
Site Name	County	City	AQS#	POC	Current FEM Sampler	Current FEM Method Start Date	Monitoring Criteria Met	Siting Criteria Met	FEM NAAQS Data Usage	Date Range	Anticipated FRM Disc. Date
Fort Wayne - Beacon St.	Allen	Fort Wayne	180030004	3	Met One BAM 1020	10/27/2012	1/1/2013	8/5/2015	Exclude	10/27/12 to 8/4/15	7/31/2018
									Secondary	8/5/15 to 7/31/18	
									Primary	8/1/18 on	
Columbus - Rocky Ford Rd	Bartholomew	Columbus	180050008	3	Met One BAM 1020	7/25/2014	7/25/2014	7/25/2014	Secondary	7/25/14 to 7/31/18	7/31/2018
									Primary	8/1/18 on	
Elkhart - Prairie St.	Elkhart	Elkhart	180390008	3	Met One BAM 1020	11/17/2010	1/1/2013	7/21/2015	Exclude	11/17/10 to 7/21/15	7/31/2018
									Secondary	7/22/15 to 7/31/18	
									Primary	8/1/18 on	
New Albany - Green Valley Rd.	Floyd	New Albany	180431004	3	Met One BAM 1020	6/8/2011	1/1/2013	3/1/2014	Exclude	6/8/11 to 2/28/14	NA
									Secondary	3/1/14 on	
Fishers	Hamilton	Fishers	180570007	3	Met One BAM 1020	1/1/2014	1/1/2014	1/1/2014	Secondary	1/1/14 to 7/31/18	7/31/2018
									Primary	8/1/18 on	
Kokomo - Vaile Ave.	Howard	Kokomo	180670004	3	Met One BAM 1020	4/3/2014	4/3/2014	4/3/2014	Secondary	4/3/14 to 7/31/18	7/31/2018
									Primary	8/1/18 on	
Gary - IITRI	Lake	Gary	180890022	3	Met One BAM 1020	10/18/2011	1/1/2013	Not met (waiver)	Exclude	10/18/11 to 12/31/12	NA
									Secondary	1/1/13 on	
Anderson - Eastside Elem.	Madison	Anderson	180950011	3	Thermo Scientific 5030 SHARP	7/13/2010	1/1/2013	7/22/2015	Exclude	7/12/10 to 7/21/15	7/31/2018
									Secondary	7/22/15 to 7/31/18	
									Primary	8/1/18 on	
Indpls - Washington Park	Marion	Indianapolis	180970078	3	Met One BAM 1020	7/21/2011	1/1/2013	7/21/2011	Exclude	7/21/11 to 12/31/12	NA
									Secondary	1/1/13 on	
Indpls - W. 18th St	Marion	Indianapolis	180970081	3	Thermo Scientific 5030 SHARP	9/25/2014	1/1/2013	12/4/2013	Secondary	9/24/14 on	NA
Indpls - I70 East	Marion	Indianapolis	180970087	3	Thermo Scientific 5030 SHARP	1/1/2016	1/1/2016	1/1/2016	Secondary	1/1/16 on	NA
Bloomington - Binford	Monroe	Bloomington	181050003	3	Thermo Scientific 5030 SHARP	4/9/2009	1/1/2013	7/14/2015	Exclude	4/9/09 to 12/31/17	NA
Ogden Dunes	Porter	Ogden Dunes	181270024	3	Met One BAM 1020	6/11/2012	1/1/2013	8/5/2015	Exclude	6/11/12 to 12/31/12	7/31/2018
									Secondary	1/1/13 to 7/31/18	
									Primary	8/1/18 on	
South Bend - Shields Dr.	St. Joseph	South Bend	181410015	3	Met One BAM 1020	10/16/2008	1/1/2013	10/16/2008	Exclude	10/16/08 to 12/31/12	NA
									Secondary	1/1/13 on	
Lafayette - Greenbush St.	Tippecanoe	Lafayette	181570008	3	Met One BAM 1020	11/15/2007	1/1/2013	7/16/2015	Exclude	11/15/07 to 7/15/15	7/31/2018
									Secondary	7/16/15 to 7/31/18	
									Primary	8/1/18 on	
Evansville - Buena Vista	Vanderburgh	Evansville	181630021	3	Teledyne 602	8/1/2016	8/1/2016	8/1/2016	Secondary	8/1/16 on	NA
Terre Haute - Lafayette Ave.	Vigo	Terre Haute	181670018	3	Met One BAM 1020	12/3/2009	1/1/2013	7/1/2015	Exclude	12/3/09 to 12/31/12	NA
									Secondary	1/1/2013 on	
Larwill	Whitley		181830003	3	Met One BAM 1020	4/7/2010	1/1/2013	7/21/2015	Exclude	4/7/10 to 12/31/17	NA

Table 2
Fort Wayne - Beacon St.

Site Name	Fort Wayne - Beacon St.	FEM Installed	10/27/2012
City	Fort Wayne	Siting Criteria Met	8/5/2015
AQS #	180030004		
POC	3		
Instrument	Met One BAM-1020 PM-2.5 w/VSCC		
Method Description	Beta Attenuation		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
8/5/2015	12/31/2017	Winter =	59	Yes	1 +/-0.10	0.8699	No	2.0000	1.3444	Yes	>=0.9500	0.91916	No	Accept
		Spring =	52											
		Summer =	75											
		Fall =	87											
		Total =	273											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	8/5/15 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	8/5/15 to 12/31/16	Data Acceptable (<24 mos)	Concur
2019	8/5/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	10.4	10.7	10.5
2016	8.2	8.9	8.7
2017	8.2	8.2	8.2

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018		2019
			Time Period			1/1 to 8/4	8/5 to 12/31			1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Exclude	Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Primary	Primary

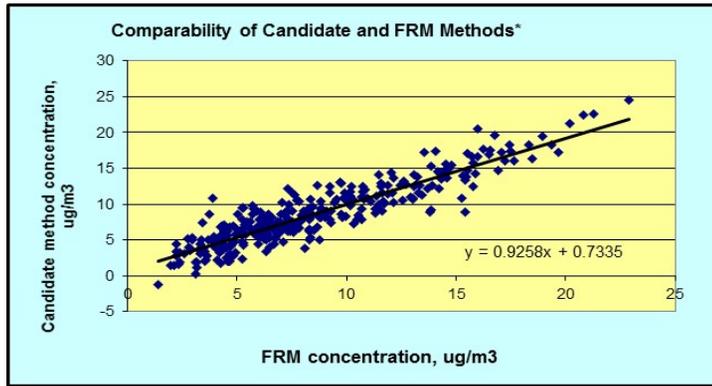
Table 3
Columbus - Rocky Ford rd.

Site Name Columbus - Rocky Ford Rd.
 City Columbus
 AQS # 180050008
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 7/25/2014
 Siting Criteria Met 7/25/2014

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	89	Yes	1 +/-0.10	0.9258	Yes	2.0000	0.7335	Yes	>=0.9500	0.91076	No	Accept
		Spring =	78											
		Summer =	78											
		Fall =	88											
		Total =	333											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/25/14 to 12/31/15	No Eval - <24 mos	Concur
2018	7/25/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.4	9.7	9.6
2016	8.2	8.6	8.3
2017	7.6	6.9	7.0

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2014	2015	2016	2017	2018		2019
			Time Period	7/25 to 12/31				1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary	Secondary	Primary	Primary

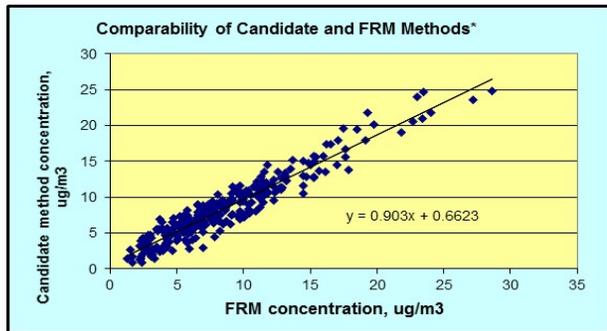
Table 4
Elkhart - Prairie St.

Site Name Elkhart - Prairie St.
 City Elkhart
 AQS # 180390008
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 11/17/2010
 Siting Criteria Met 7/21/2015

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
7/21/2015	12/31/2017	Winter =	78	Yes	1 +/-0.10	0.9030	Yes	2.0000 to -0.5900	0.6620	Yes	>=0.9500	0.95282	Yes	Accept
		Spring =	86											
		Summer =	61											
		Fall =	56											
		Total =	281											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/22/15 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	7/22/15 to 12/31/16	Data Acceptable (<24 mos)	Concur
2019	7/22/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	10.3	11.2	11.0
2016	8.5	9.3	9.1
2017	8.5	7.6	7.8

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018		2019
			Time Period			1/1 to 7/21	7/22 to 12/31			1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Exclude	Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Primary	Primary

Table 5
New Albany - Green Valley Rd.

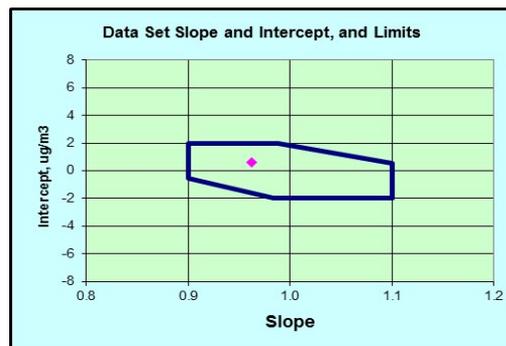
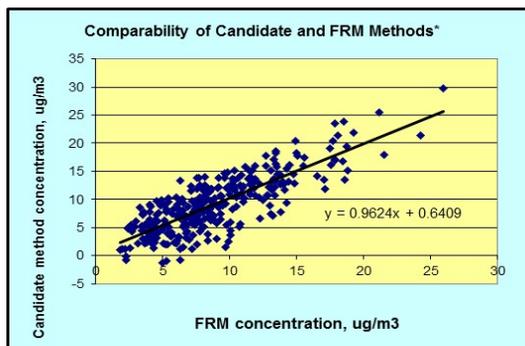
Site Name New Albany - Green Valley Rd.
City New Albany
AQS # 180431004
POC 3
Instrument Met One BAM-1020 PM-2.5 w/VSCC
Method Description Beta Attenuation

FEM Installed
Siting Criteria Met

6/8/2011
3/1/2014

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	89	Yes	1 +/-0.10	0.9624	No	2.0000 to -1.6188	0.6409	Yes	>=0.94569	0.80788	No	Accept
		Spring =	69											
		Summer =	88											
		Fall =	88											
		Total =	334											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	3/1/14 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	3/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.3	10.3	10.1
2016	8.3	7.3	7.7
2017	8.1	9.00	8.7

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period		1/1 to 2/28 3/1 to 12/31					
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary
FEM	Continuous	3		Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Secondary

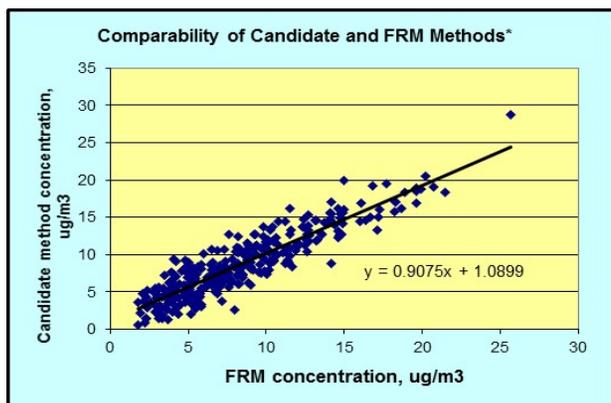
**Table 6
Fishers**

Site Name Fishers
 City Fishers
 AQS # 190570007
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 1/1/2014
 Siting Criteria Met 1/1/2014

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	88	Yes	1 +/-0.10	0.9075	Yes	2.0000 to -0.6679	1.0899	Yes	>=0.9500	0.90919	No	Accept
		Spring =	81											
		Summer =	83											
		Fall =	89											
		Total =	341											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/14 to 12/31/15	Data Acceptable	Concur
2018	1/15/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.0	8.8	8.9
2016	8.1	8.9	8.6
2017	7.7	7.6	7.6

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2014	2015	2016	2017	2018		2019
			Time Period					1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary	Secondary	Primary	Primary

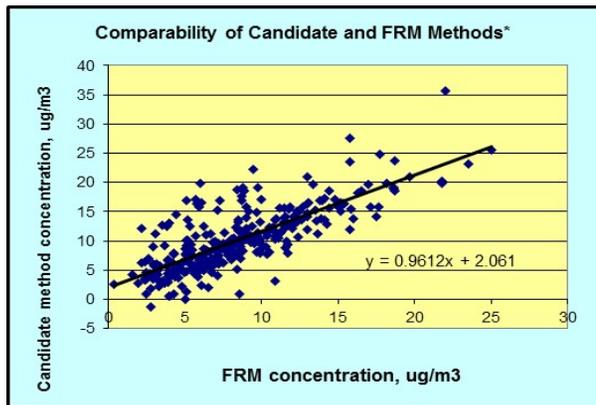
Table 7
Kokomo - E. Vaile Ave.

Site Name Kokomo - E. Vaile Ave.
 City Kokomo
 AQS # 180670004
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 4/3/2014
 Siting Criteria Met 4/3/2014

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	85	Yes	1 +/-0.10	0.9612	Yes	2.0000	2.0610	No	>=0.9500	0.77669	No	Accept
		Spring =	76											
		Summer =	86											
		Fall =	80											
		Total =	327											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	4/3/14 to 12/31/15	No Eval - <24 mos	Concur
2018	4/3/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.3	12.6	11.5
2016	7.8	9.5	8.9
2017	7.8	8.5	8.2

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2014	2015	2016	2017	2018		2019
			Time Period	4/3 to 12/31				1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary	Secondary	Primary	Primary

Table 8
Gary ITRI

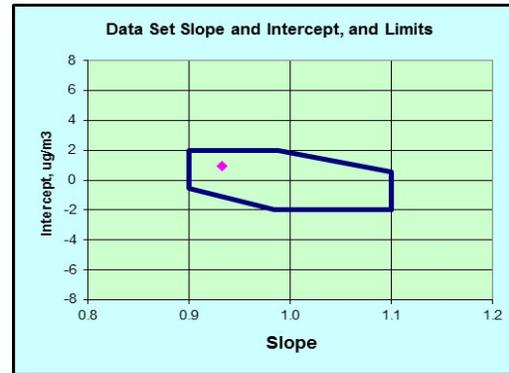
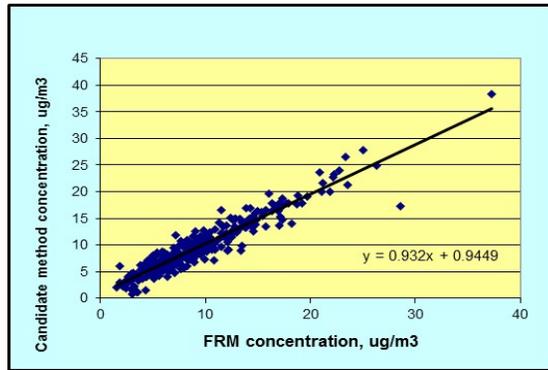
Site Name Gary ITRI
 City Gary
 AQS # 18
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed
 Siting Criteria Met

10/18/2011
 Waiver

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	85	Yes	1 +/-0.10	0.9320	Yes	2.0000	0.9449	Yes	>=0.9500	0.94667	No	Accept
		Spring =	81											
		Summer =	77											
		Fall =	79											
		Total =	322											



Data from this site are only compared to the daily NAAQS.
 When comparing the Design Values for the past three years, the daily values were used.

FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/13 to 12/31/15	Data Acceptable w/waiver	Concur
2018	1/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation Daily NAAQS

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	23.4	25.3	25.1
2016	17.9	19.9	20.2
2017	20.9	19.8	20.5

NAAQS Comparable Data Usage

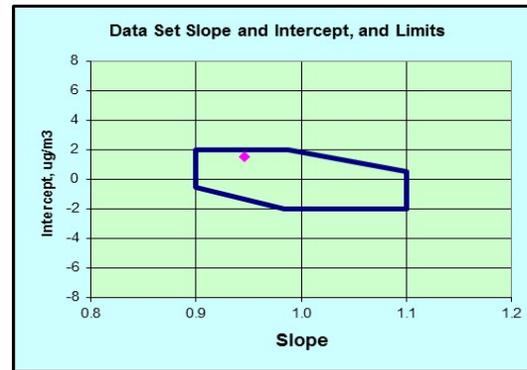
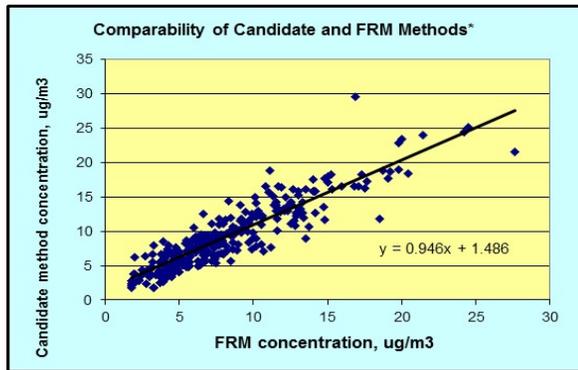
Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period	Primary						
FRM	Intermittent	1		Primary						
FEM	Continuous	3		Secondary						

Table 9
Anderson - Eastside Elem. School

Site Name	Anderson - Eastside Elem.	FEM Installed	7/13/2010
City	Anderson	Siting Criteria Met	7/22/2015
AQS #	180910011		
POC	3		
Instrument	Thermo Scientific Model 5030 SHARP		
Method Description	Beta Attenuation w/Nephelometer Correction		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	64	Yes	1 +/-0.10	0.9460	Yes	2.0000	1.4860	Yes	>=0.9500	0.90386	No	Accept
		Spring =	56											
		Summer =	80											
		Fall =	86											
		Total =	286											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/22/15 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	7/22/15 to 12/31/16	Data Acceptable (<24 mos)	Concur
2019	7/22/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.0	9.4	9.1
2016	7.7	8.1	8.1
2017	7.8	8.80	8.4

NAAQS Comparable Data Usage

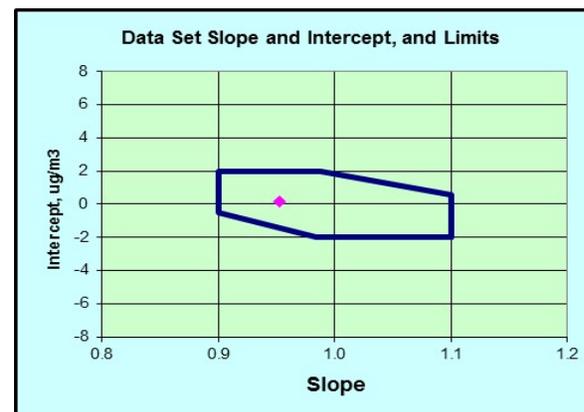
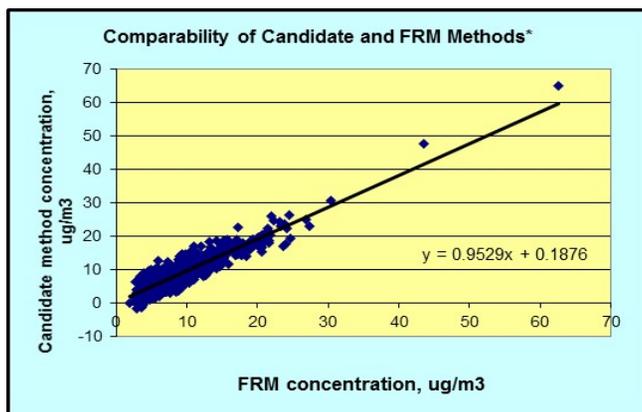
Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018		2019
			Time Period			1/1 to 7/22	7/23 to 12/31			1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Exclude	Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Primary	Primary

Table 10
Indianapolis - Washington Park

Site Name	Indpls - Washington Park	FEM Installed	7/21/2011
City	Indianapolis	Siting Criteria Met	7/21/2011
AQS #	180970078		
POC	3		
Instrument	Met One BAM-1020 PM-2.5 w/VSCC		
Method Description	Beta Attenuation		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	189	Yes	1 +/-0.10	0.9529	Yes	2.0000	0.1876	Yes	>=0.9500	0.92419	No	Accept
		Spring =	165											
		Summer =	205											
		Fall =	190											
		Total =	749											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2016	1/1/13 to 12/31/14	Data Acceptable	Concur
2017	1/1/13 to 12/31/15	Data Acceptable	Concur
2018	1/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2014	11.5	11.7	11.3
2015	10.6	9.4	10.2
2016	8.9	9.5	9.0
2017	8.9	7.9	8.2

NAAQS Comparable Data Usage

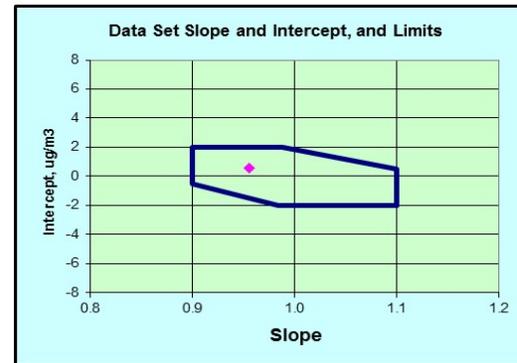
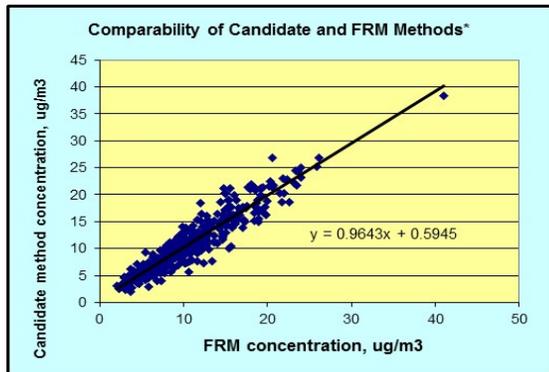
Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period							
FRM	Intermittent	1		Primary						
FEM	Continuous	3		Secondary						

Table 11
Indianapolis - W. 18th St.

Site Name	Indpls - W. 18th St.	FEM Installed	9/25/2014
City	Indianapolis	Siting Criteria Met	12/4/2013
AQS #	180970081		
POC	3		
Instrument	Thermo Scientific Model 5030 SHARP		
Method Description	Beta Attenuation w/Nephelometer Correction		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	183	Yes	1 +/-0.10	0.9643	Yes	2.0000	0.5945	Yes	>=0.94760	0.93781	No	Accept
		Spring =	190											
		Summer =	153											
		Fall =	176											
		Total =	702											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	9/25/14 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	9/25/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	11.2	11.0	11.2
2016	8.8	9.8	9.8
2017	9.7	9.7	9.6

NAAQS Comparable Data Usage

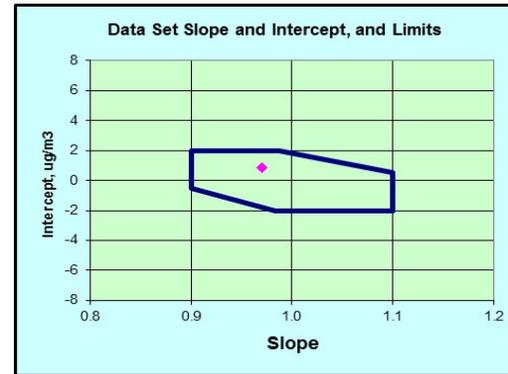
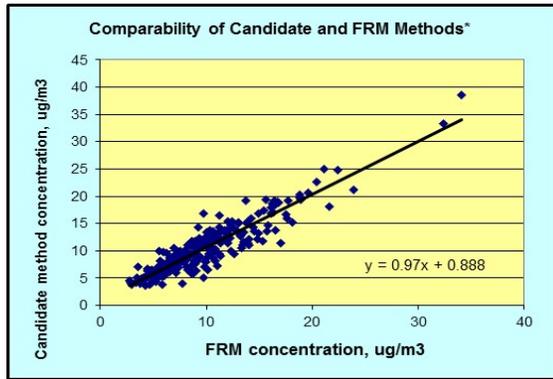
Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period		1/1 to 9/24	9/25 to 12/31				
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary
FEM	Continuous	3		Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Secondary

Table 12
Indianapolis - I-70 East

Site Name	Indpls - I-70 E	FEM Installed	1/1/2016
City	Indianapolis	Siting Criteria Met	1/1/2016
AQS #	180970087		
POC	3		
Instrument	Thermo Scientific Model 5030 SHARP		
Method Description	Beta Attenuation w/Nephelometer Correction		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2016	12/31/2017	Winter =	61	Yes	1 +/-0.10	0.9700	Yes	2.0000 to -1.7504	0.8880	Yes	>=0.94497	0.92224	No	Accept
		Spring =	55											
		Summer =	61											
		Fall =	59											
		Total =	236											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2018	1/1/16 to 12/31/16	Exclude Data (<24 mos)	Concur
2019	1/1/16 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2016	10.1	10.0	10.0
2017	9.7	10.6	10.2

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2016	2017	2018	2019
			Time Period				
FRM	Intermittent	1		Primary	Primary	Primary	Primary
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary

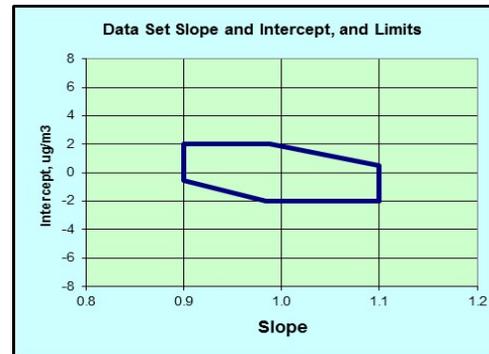
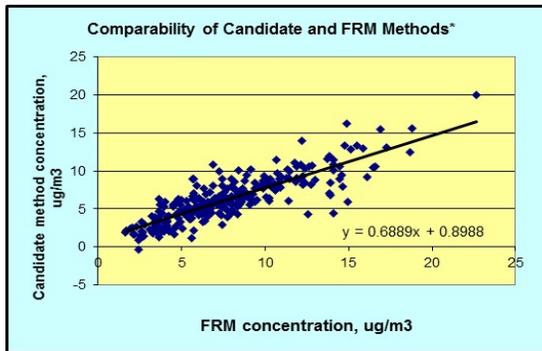
Table 13
Bloomington - Binford ES

Site Name Bloomington - Binford
 City Bloomington
 AQS # 181050003
 POC 3
 Instrument Thermo Scientific Model 5030 SHARP
 Method Description Beta Attenuation w/Nephelometer Correction

FEM Installed 4/9/2009
 FEM Discontinued 6/4/2018
 Siting Criteria Met 7/14/2015
 New FEM Installed 6/4/2018

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
7/14/2015	12/31/2017	Winter =	64	Yes	1 +/-0.10	0.6889	No	2.0000	0.8988	No	>=0.94364	0.84743	No	Exclude
		Spring =	58											
		Summer =	80											
		Fall =	77											
		Total =	279											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/14/15 to 12/31/15	Exclude Data (<24 mos)	Concur
2018	7/14/15 to 12/31/16	Exclude Data (<24 mos)	Concur
2019	7/14/15 to 12/31/17	Exclude Data	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.7	7.4	7.9
2016	7.6	5.9	6.5
2017	7.5	6.4	6.7

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018		2019
			Time Period			1/1 to 7/13	7/14 to 12/31			1/1 to 6/4	6/4 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
FEM	Continuous	3		Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Future Analysis	Future Analysis	Future Analysis

Table 14
Ogden Dunes

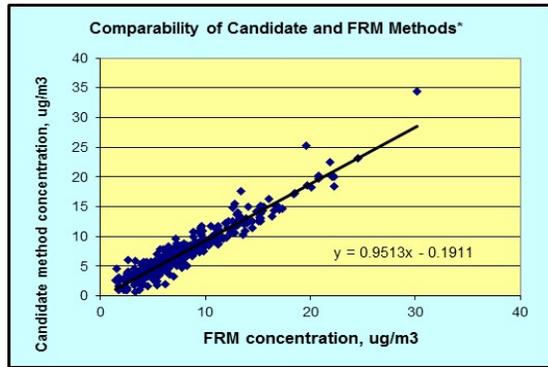
Site Name Ogden Dunes
 City Ogden Dunes
 AQS # 181270024
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed
 Siting Criteria Met

6/11/2012
 8/5/2015

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	88	Yes	1 +/-0.10	0.9513	Yes	2.0000	0.1911	Yes	>=0.9500	0.95479	Yes	Accept
		Spring =	85											
		Summer =	78											
		Fall =	83											
		Total =	334											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/13 to 12/31/15	Data Acceptable w/waiver	Concur
2018	1/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.1	9.1	9.2
2016	8.0	7.4	7.6
2017	7.9	7.4	7.5

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018		2019
				Time Period					1/1 to 7/31	8/1 to 12/31	
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary	Secondary	Secondary	Primary	Primary

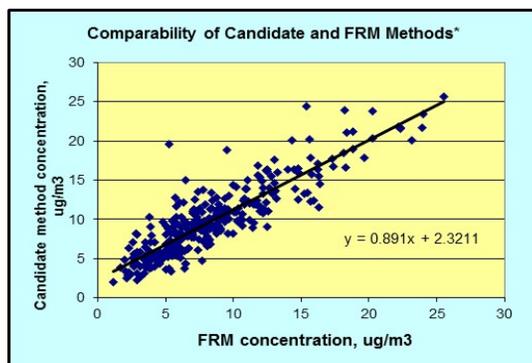
Table 15
South Bend - Shields Dr.

Site Name South Bend - Shields Dr.
 City South Bend
 AQS # 181410015
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 10/16/2008
 Siting Criteria Met 10/16/2008

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	78	Yes	1 +/-0.10	0.8910	No	2.0000	2.3211	No	>=0.9500	0.87109	No	Accept
		Spring =	78											
		Summer =	81											
		Fall =	78											
		Total =	315											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/13 to 12/31/15	Data Excluded	Denied
2018	1/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.5	11.4	10.7
2016	8.3	9.8	9.3
2017	8.2	7.8	7.9

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period							
FRM	Intermittent	1		Primary						
FEM	Continuous	3		Secondary						

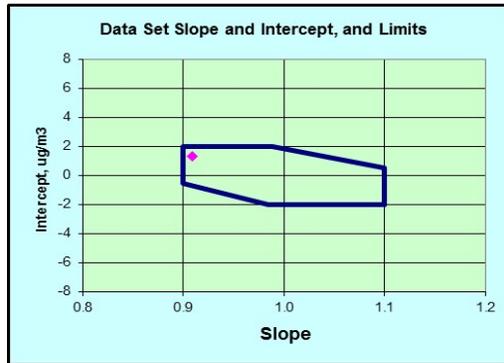
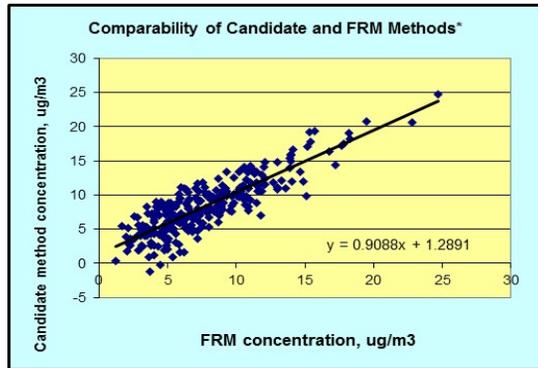
Table 16
Lafayette - Greenbush St.

Site Name Lafayette - Greenbush St.
City Lafayette
AQS # 181570008
POC 3
Instrument Met One BAM-1020 PM-2.5 w/VSCC
Method Description Beta Attenuation

FEM Installed 11/15/2007
Siting Criteria Met 7/16/2015

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
7/17/2015	12/31/2017	Winter =	62	Yes	1 +/-0.10	0.9088	Yes	2.0000	1.2891	Yes	>=0.9500	0.86533	No	Accept
		Spring =	58											
		Summer =	71											
		Fall =	86											
		Total =	277											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/17/15 to 12/31/15	Data Excluded (< 24mos)	Concur
2018	7/17/15 to 12/31/16	Data Excluded (< 24mos)	Concur
2019	7/17/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.1	10.1	9.7
2016	7.7	7.4	7.5
2017	7.8	8.9	8.5

NAAQS Comparable Data Usage

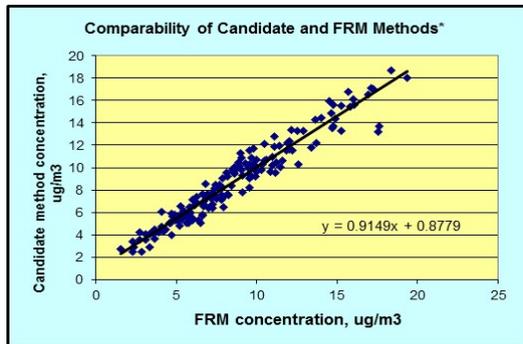
Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018		2019
				Time Period			1/1 to 7/16	7/17 to 12/31			1/1 to 7/31	8/1 to 12/31
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Sampler Removed	No Monitor
FEM	Continuous	3		Exclude	Exclude	Exclude	Secondary	Secondary	Secondary	Secondary	Primary	Primary

Table 17
Evansville - Buena Vista Rd.

Site Name	Evansville - Buena Vista	Current FEM Installed	8/1/2016
City	Evansville	Siting Criteria Met	3/4/2016
AQS #	181630021		
POC	3		
Instrument	Teledyne Model 602 Beta ^{PLUS} Particle Measurement System		
Method Description	Beta Attenuation		

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
8/1/2016	12/31/2017	Winter =	33	Yes	1 +/-0.10	0.9149	Yes	2.0000	0.8779	Yes	>=0.9500	0.96786	Yes	Accept
		Spring =	26											
		Summer =	45											
		Fall =	60											
		Total =	164											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/13 to 12/31/15	Data Excluded (< 24mos)	Denied
2018	1/1/14 to 7/31/16	Data Acceptable (w/waiver)	Concur
	New FEM Installed		
2018	8/1/16 to 12/31/16	Data Excluded (< 24 mos)	Concur
2019	8/1/16 to 12/31/17	Data Acceptable (< 24 mos)	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.6	11.4	10.7
2016 (1/1 to 7/31)	8.6	8.9	8.7
		New FEM Installed	
2016 (8/1 to 12/31)	8.8	10.5	9.1
2017	8.5	8.5	8.5

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016		2017	2018	2019
				Time Period			1/1 to 7/31	8/1 to 12/31			
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
FEM	Continuous	3		Secondary	Secondary	Secondary	Secondary	Secondary (new FEM)	Secondary	Secondary	Secondary

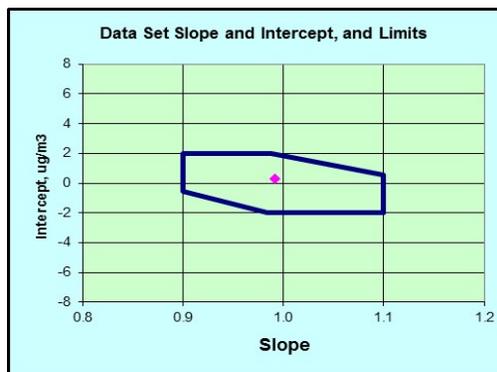
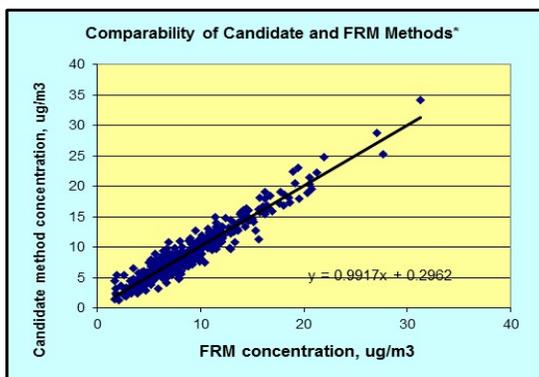
Table 18
Terre Haute - Lafayette Ave.

Site Name Terre Haute - Lafayette Ave.
 City Terre Haute
 AQS # 181670018
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed 12/3/2009
 Siting Criteria Met 7/1/2015

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
1/1/2015	12/31/2017	Winter =	85	Yes	1 +/-0.10	0.9917	Yes	1.9596	0.2962	Yes	>=0.9500	0.96926	Yes	Accept
		Spring =	82											
		Summer =	88											
		Fall =	88											
		Total =	343											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	1/1/13 to 12/31/15	Data Acceptable w/Waiver	Concur
2018	1/1/14 to 12/31/16	Data Acceptable	Concur
2019	1/1/15 to 12/31/17	Data Acceptable	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.5	10.3	10.1
2016	8.7	9.5	9.2
2017	8.8	9.3	9.2

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015	2016	2017	2018	2019
			Time Period							
FRM	Intermittent	1		Primary						
FEM	Continuous	3		Secondary						

Table 19
Larwill

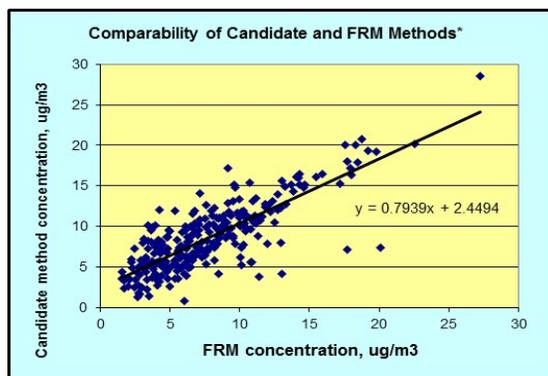
Site Name Larwill
 City
 AQS # 181830003
 POC 3
 Instrument Met One BAM-1020 PM-2.5 w/VSCC
 Method Description Beta Attenuation

FEM Installed
 Siting Criteria Met

4/7/2010
 7/21/2015

Current Data Evaluation

PM2.5 Continuous Data Period		Sample Pairs Evaluated			Slope Criteria			Intercept Criteria			Correlation Criteria			Data Status
Begin Date	End Date	Total	Min. Req.	Meets Req?	Acceptable Range	Slope (m)	Meets Req?	Acceptable Range	Intercept (y)	Meets Req?	Acceptable Correlation Range	Correlation	Meets Req?	
7/21/2015	12/31/2017	Winter =	61	Yes	1 +/-0.10	0.7939	No	2.0000	2.4494	No	>=0.9500	0.80496	No	Exclude
		Spring =	54											
		Summer =	78											
		Fall =	77											
		Total =	270											



FEM Data Evaluations

Network Plan Year	Data period	Indiana Plan Submittal	EPA Response
2017	7/21/15 to 12/31/15	Data Excluded (< 24mos)	Concur
2018	7/21/15 to 12/31/16	Data Excluded (< 24mos)	Concur
2019	7/21/15 to 12/31/17	Data Excluded	Pending

DV Evaluation

Year	FRM Data	FEM Data	FRM w/FEM Sub
2015	9.2	10.0	9.7
2016	7.7	7.8	7.7
2017	7.5	8.3	8.0

NAAQS Comparable Data Usage

Monitor	Sample Frequency	POC	Year	2013	2014	2015		2016	2017	2018	2019
				Time Period			1/1 to 7/20	7/21 to 12/31			
FRM	Intermittent	1		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
FEM	Continuous	3		Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Future Analysis	Future Analysis