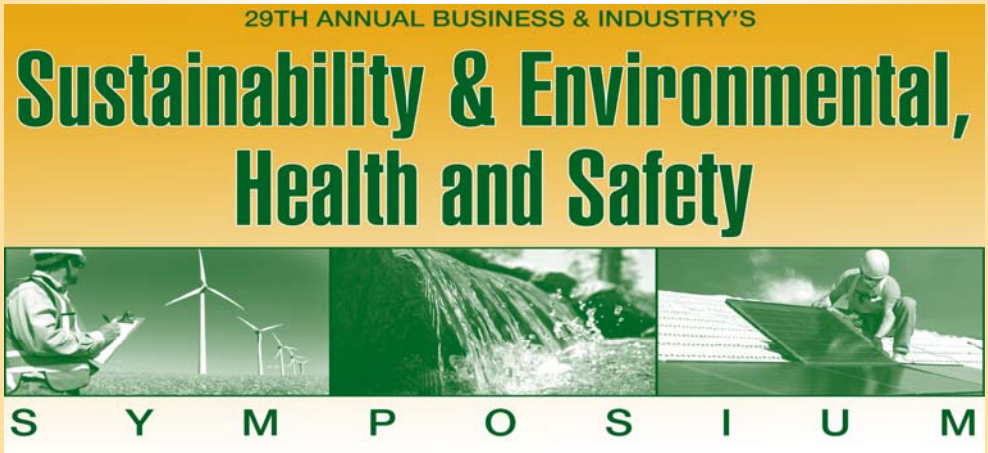

Workshop J

Air Quality & Ozone … Is It Possible to Reach Sustainable Compliance?

Tuesday, March 24, 2020
11:15 a.m. to 12:30 p.m.

Biographical Information

George J. Schewe, CCM, QEP
Principal Consultant
Trinity Consultants
1717 Dixie Hwy, Suite 900, Covington, Kentucky 41011
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Mobile: 513-312-7104
gschewe@trinityconsultants.com

Mr. Schewe is a Certified Consulting Meteorologist as well as a Qualified Environmental Professional who has 43 years of dispersion modeling and air quality management experience throughout the U.S. and prominently in Kentucky, Indiana, and Ohio. He has prepared permit applications, interfaced with state agencies, prepared overall air quality impact assessments as well as regulatory review requirements, prepared additional impacts analyses, and modeled both criteria and toxic chemical releases to assess potential air impacts. He has contributed to a wide variety of environmental assessment studies including Prevention of Significant Deterioration, non-attainment area net emission modeling, state and federal air toxics analyses and risk assessments, and State Implementation Plan (SIP) preparation. He has used modeling approaches for emergency as well as routine releases of air contaminants. He has prepared modeling studies covering plant wide point-source emissions as well as plant wide fugitives from roadways, materials handling, waste and scrap areas or other process related fugitive emissions. While with the U.S. EPA, he performed dispersion modeling in support of emission standards development and helped develop and improve industrial source dispersion models. He has conducted numerous workshops, seminars, and technical classes over the past 25 years for the U.S. EPA - Air Pollution Training Institute, Trinity's annual course offerings, CenSARA, MARAMA, WESTAR, Ohio EPA, and other regional air agencies.

Biographical Information

Anna Kelley, Monitoring & Analysis Supervisor
Southwest Ohio Air Quality Agency
250 William Howard Taft Rd. 1st Floor, Cincinnati, OH 45219-2660
anna.kelley@hamilton-co.org

Anna Kelley is the Monitoring and Analysis Supervisor for the Southwest Ohio Air Quality Agency, a division of the Hamilton County Department of Environmental Services, a local air quality agency located in Cincinnati, Ohio. She was been with the agency for 32 years with most of her time focused on the quality assurance and data review of the ambient air monitoring network. She leads a team of twelve in the operation and data collection of ambient air data to determine compliance with the National Ambient Air Quality Standards, NAAQS, as well as is part of a small team that provides the daily air quality forecast. In March 2004, she served in an Interagency Government Agreement in the Office of Air Quality Planning and Standards (OAQPS) United States Environmental Protection Agency (USEPA). During this time, she began the revisions to the Quality Assurance for Ambient Air Monitoring Systems, Volume II working with ambient air monitoring personnel from across the country developing consensus on the revisions. She is also a member of the Monitoring Steering Committee with the National Association of Clean Air Agencies. This group has worked with US EPA to bring air monitoring issues to the attention of US EPA for the betterment of ambient air monitoring work and attainment of the air quality.

Prior to joining Hamilton County Department of Environmental Services, Ms. Kelley was involved in water testing both of potable and effluent water. She is a graduate of Miami University, Oxford, Ohio.

Biographical Information

J. Michael Geers, P.E.
Manager of the Environmental Programs Group
Duke Energy Corp.
139 E. 4th St., EM 740, Cincinnati OH 45202-4003
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michael.geers@Duke-Energy.com

J. Michael Geers, P.E. is the Manager of the Environmental Programs Group for Duke Energy and is located in Cincinnati, Ohio. He has a diverse experience having been the Air Programs Manager, an EHS Manager, and other positions with Duke, Cinergy, and Cincinnati Gas & Electric for 38 years. He and his team analyze regulatory actions and identify their impacts on Duke, provide strategic and tactical guidance and then work with various groups to develop implementation programs and seek favorable outcomes for to the company. His specific areas of expertise include mercury, pollution control technologies, emission allowance programs, MACT, NAAQS, New Source Performance Standards, and climate. On many occasions he has represented Duke Energy and promoted its interests to Federal and state regulators, other utilities, trade groups and other organizations. He is also a program advisor to the Electric Power Research Institute. Previously Michael has many years of power plant operation, maintenance and engineering experience with Cinergy Corp and the Cincinnati Gas & Electric Co. In this role, he had his first of many experiences balancing competing technical, financial and environmental demands. He has a Chemical Engineering degree from the University of Dayton and an MBA from the University of Cincinnati. He is a Registered Professional Engineer in the State of Ohio.

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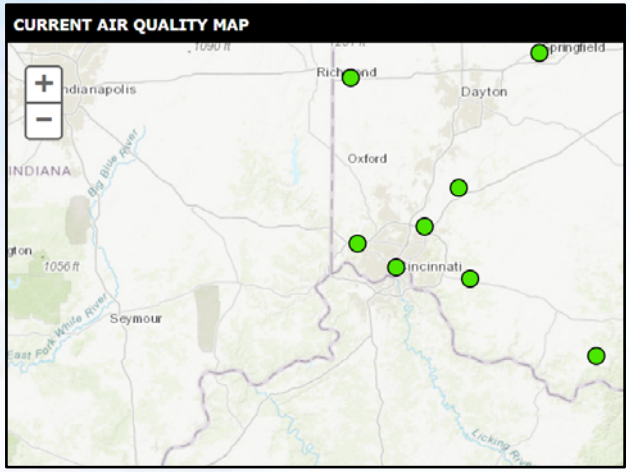
MEC
Manufacturers' Education Council

29th Annual Business & Industry's
Sustainability and Environmental, Health & Safety Symposium

Workshop J – Air Quality & Ozone …. Is It Possible to Reach Sustainable Compliance?

Tuesday March 24,2020
1115 - 1230

George J. Schewe, CCM, QEP, Trinity
J. Michael Geers, P.E., Duke Energy
Anna Kelley, SWOAPCA



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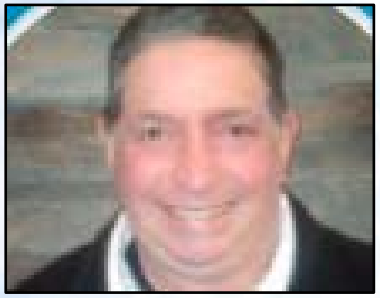
DUKE ENERGY
HAMILTON COUNTY ENVIRONMENTAL SERVICES
Air Quality • Solid Waste

Presenters

George Schewe
Trinity Covington

J. Michael Geers
Duke Energy



Anna Kelley
SWOAPCA

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Workshop J Overview

- Three Presentations
  - Anna - overview of area ozone monitors & historical/current concentrations
  - George - history of the ozone NAAQS and how it has played out in the region
  - Mike – effectiveness of NOx control applications on sources in the region in reducing emissions & ambient ozone; Duke's climate activities projecting emissions to 2030 and 2050
- Sustainability of reaching the ozone NAAQS

Anna Kelley – Overview of Ozone in the Greater Cincinnati Area

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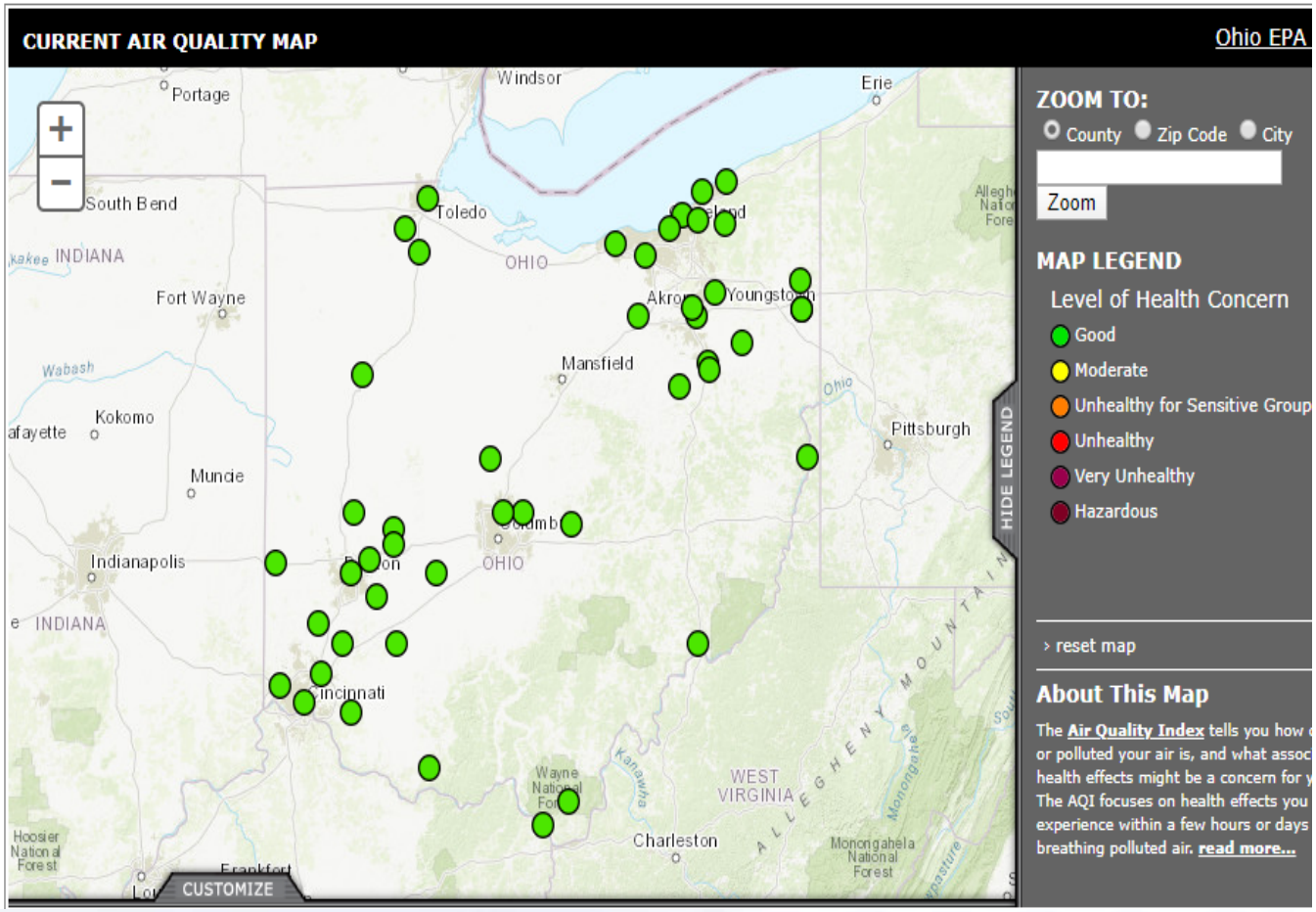
Ozone/ $PM_{2.5}$ Sites in Ohio



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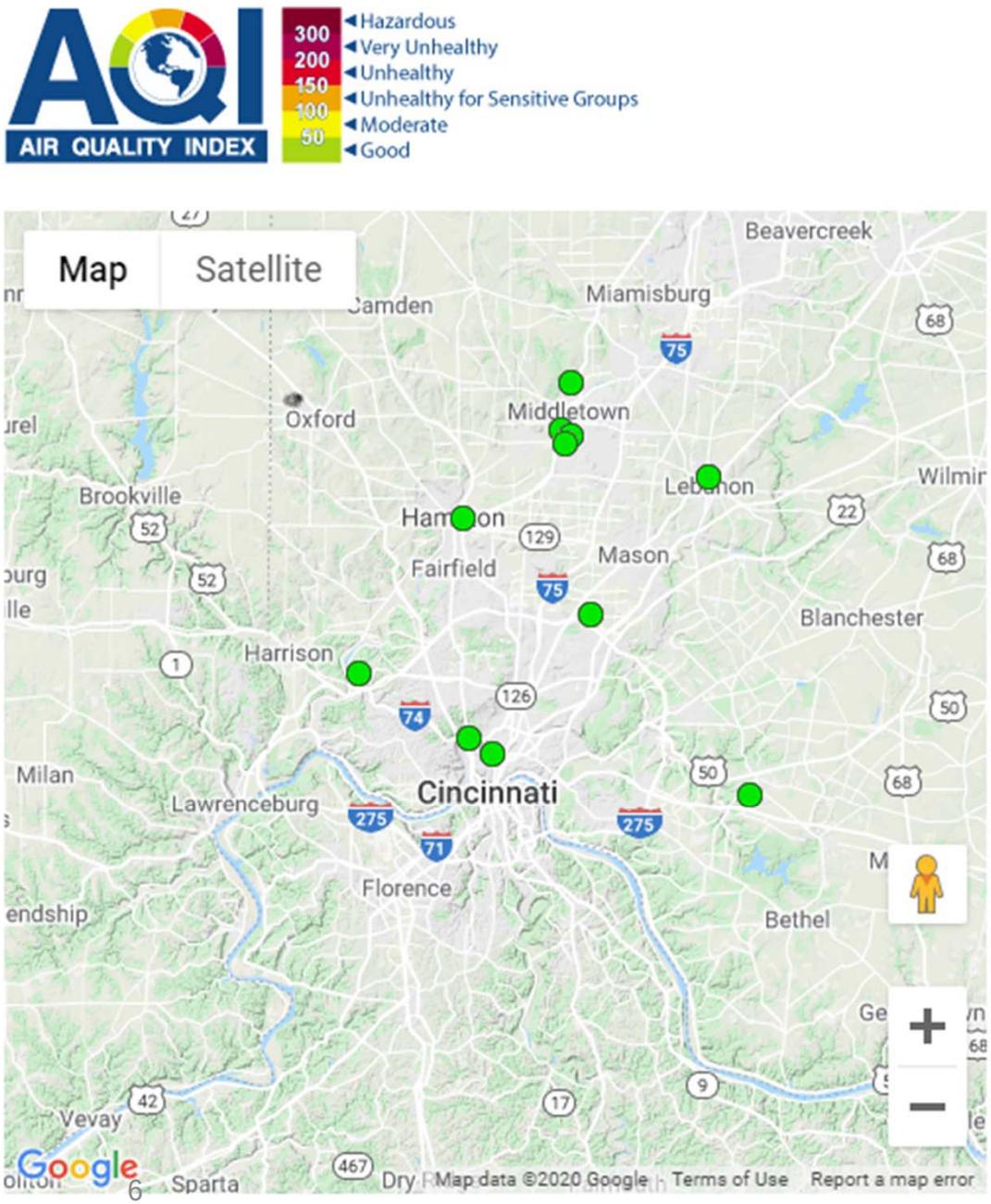
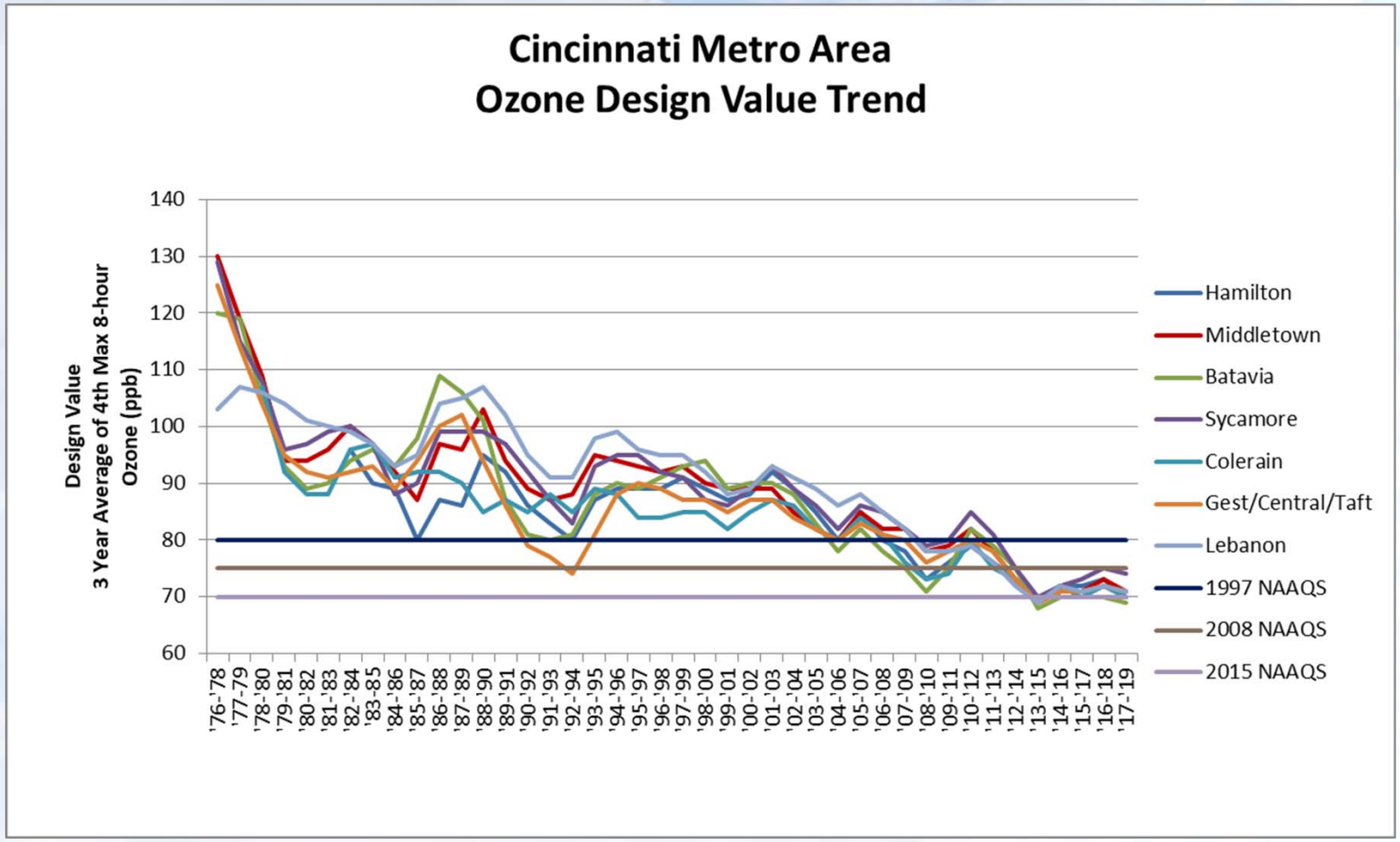
Ozone Sites in Southwest Ohio



Current Status: Attainment or Not?

- *Design Values* at the monitors determine attainment of the NAAQS
  - For ozone: annual 4th highest daily maximum 8-hour concentration, averaged over three years
  - Applicable to every ozone site in the Greater Cincinnati Metropolitan Statistical Area – most are partial year and one is full year

Greater Cincinnati Ozone: Current Status



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8-hour ozone values – 4th high

	2013	2014	2015	2016	2017	2018	2019
Hamilton	68	70	70	76	72	73	67
Middletown	68	69	70	74	70	76	67
Oxford	69	69	68	72	69	70	65
Batavia	66	68	70	73	68	69	71
Sycamore	69	70	72	75	72	80	72
Colerain	64	73	70	73	68	75	67
Taft	69	69	71	73	71	72	71
Lebanon	67	71	71	74	68	75	72

Design Values for Ozone

	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
Butler	69	72	72	74	71
Clermont	68	70	70	70	69
Hamilton	70	72	73	75	74
Warren	69	72	71	72	71

Background Ozone

- Why needed?
- Year long monitoring of ozone required
- Nationwide: approximately 80 sites
- 3 sites in Ohio: 2 urban, 1 rural
  - Max 8-hour values

	November 2018	December 2018	January 2019	February 2018
Cincinnati	32	37	37	44
Cleveland	33	32	37	44
Dayton	34	34	40	46

For the future

- Photochemical Assessment Sites
  - Required at NCore sites in populations of 1 million and greater
  - Required in 2015 ozone rule
    - Implementation June 1, 2021
  - From June to August
    - Hourly VOCs
    - Mixing Height
    - 8 hour carbonyl sampling every 3rd day
    - Direct measure NO_2
    - Additional meteorological parameters: ultraviolet radiation, precipitation, solar radiation

George Schewe – History and Background of Achievement of the Ozone NAAQS in Cincinnati

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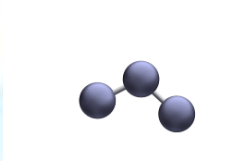
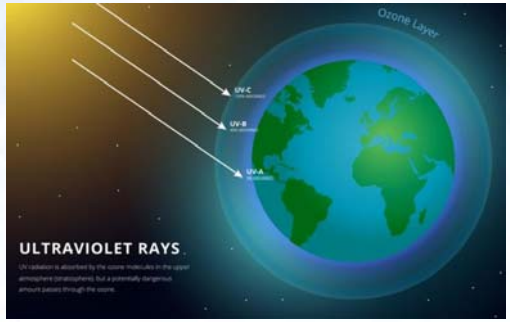
Ozone in the Atmosphere



- O_3 = Ozone
  - Naturally occurring – lightning, stratospheric intrusion
  - Anthropogenic generated ozone
  - "bad ozone" in lower atmosphere is related to health effects, plant and materials damage
  - "good ozone" is in upper atmosphere & screens sun's UV



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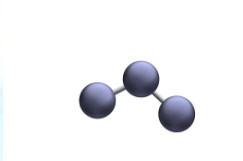
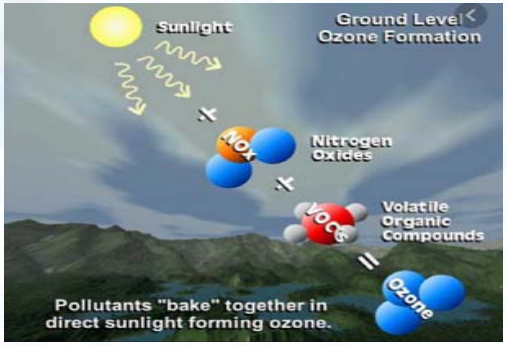
Ozone in the Atmosphere



- O_3 = Ozone
  - Concentrations vary throughout lower atmosphere, by time of day and by season
  - By-product of human activities are emissions of NO_X and VOC emissions that react in the atmosphere
  - atmospheric reactivity occurs during sunny, warm afternoon summer months



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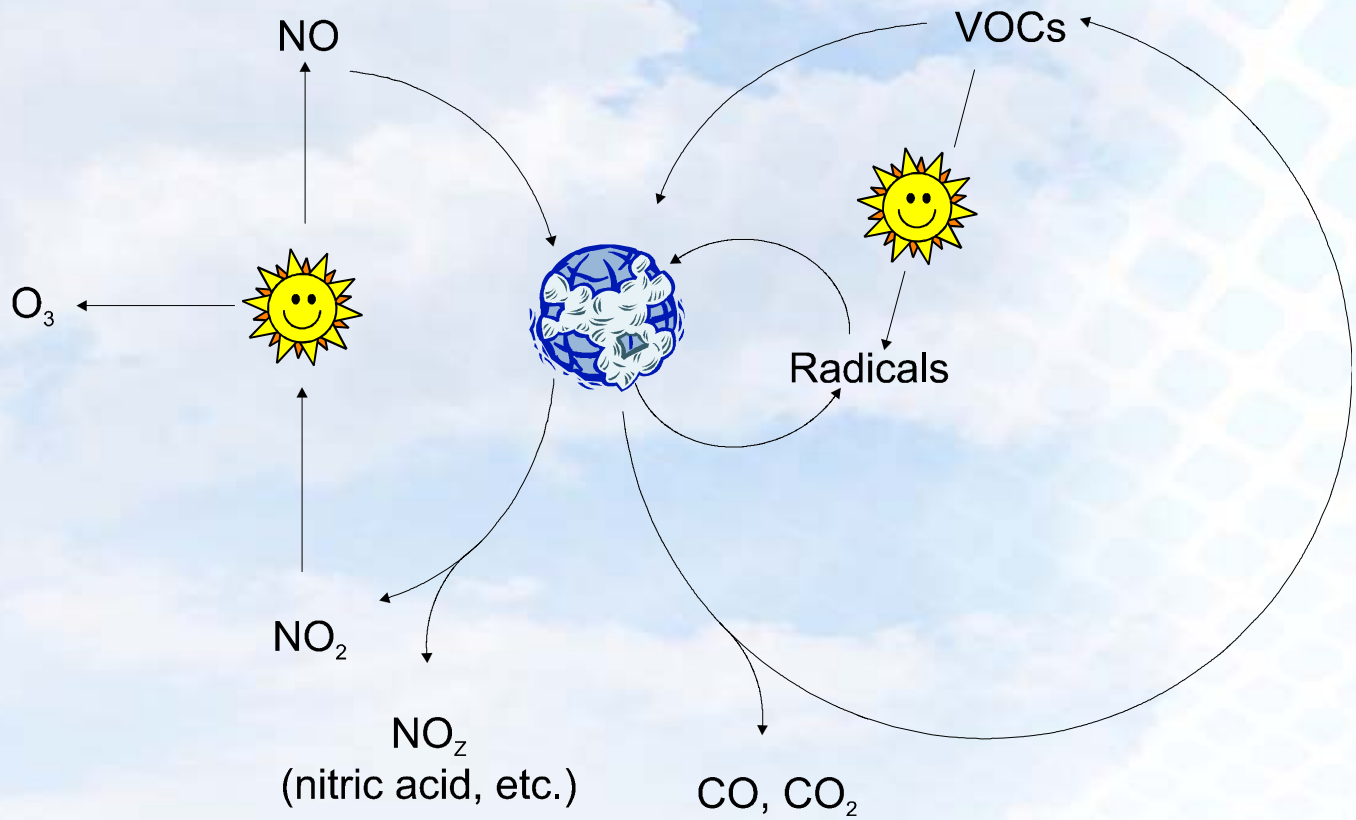
Ozone Formation from VOC and NOx in the Atmosphere



No sunlight ⇨ no ozone production
No NOx ⇨ no ozone production
No VOC ⇨ no ozone production

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Ozone Sources

- No direct ozone sources
- Ozone formation from VOC and NOx from industrial and naturally occurring sources
- Control strategy implications
  - Sensitivity to VOC and/or NOx
  - VOC reactivity
  - NOx suppression (inhibition or disbenefits)

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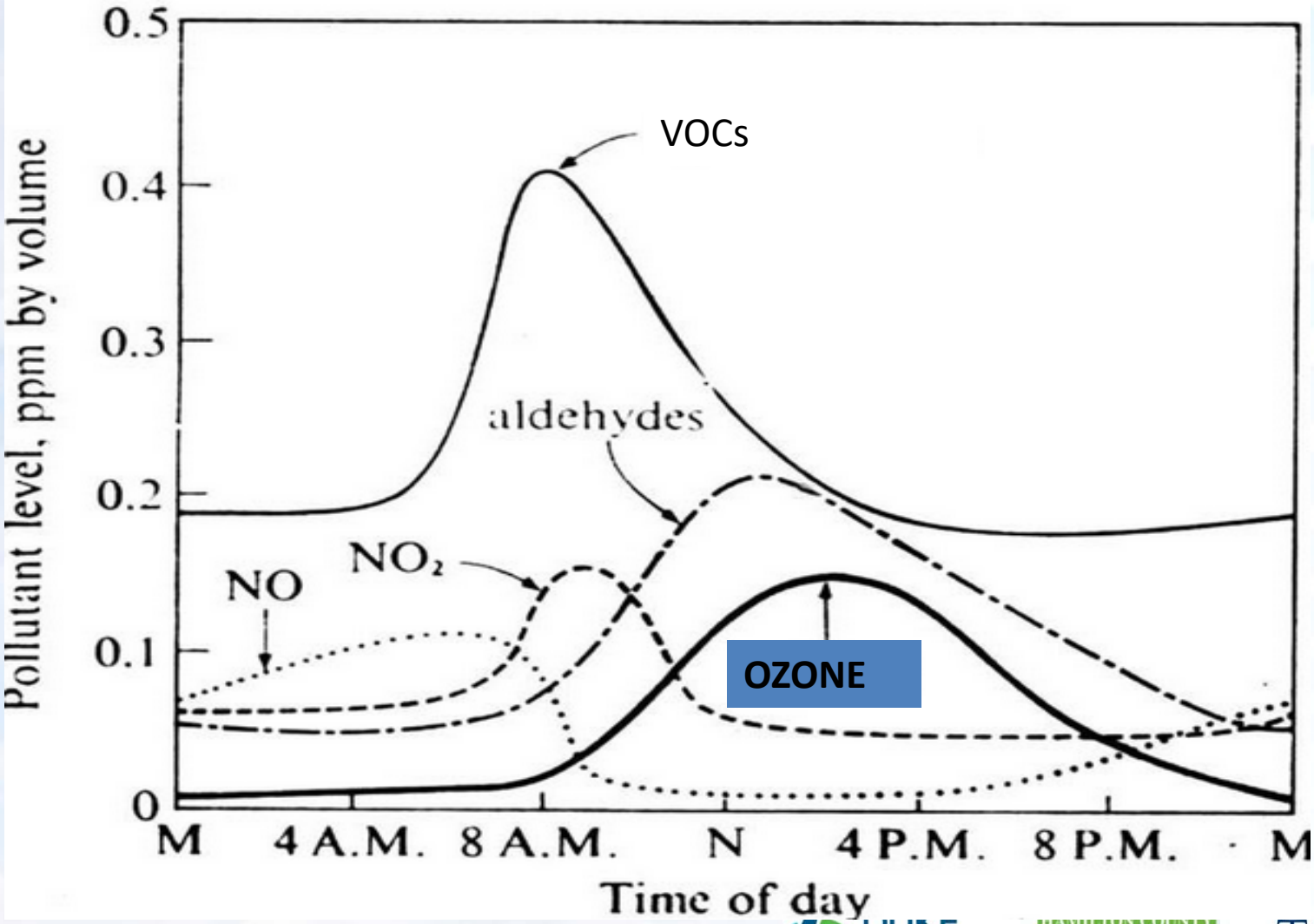
Ozone Formation by Time of Day



http://www.intechopen.com/books/indoor-and-outdoor-air-pollution/air-pollution-a-case-study-of-ilorin-and-lagos-outdoor-air

Overview and History of Ozone

Final Rule/Decision	Primary/Secondary	Indicator	Averaging Time	Level	Form of NAAQS
1971 36 FR 8186 4/30/1971	Primary and Secondary	Total photochemical oxidants	1 hour	0.08 ppm	Not to be exceeded more than one hour per year
1979 - 44 FR 8202 - 2/8/1979	Primary and Secondary	O_3	1 hour	0.12 ppm	Attainment is defined when the expected number of days per calendar year, with maximum hourly average concentration greater than 0.12 ppm, is equal to or less than 1
1993 58 FR 13008 3/9/1993	EPA decided that revisions to the standards were not warranted at the time				
1997 62 FR 38856 7/18/1997	Primary and Secondary	O_3	8 hours	0.08 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
2008 73 FR 16483 3/27/2008	Primary and Secondary	O_3	8 hours	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
2015 80 FR 65292 10/26/2015	Primary and Secondary	O_3	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8 hour average concentration, averaged over 3 years

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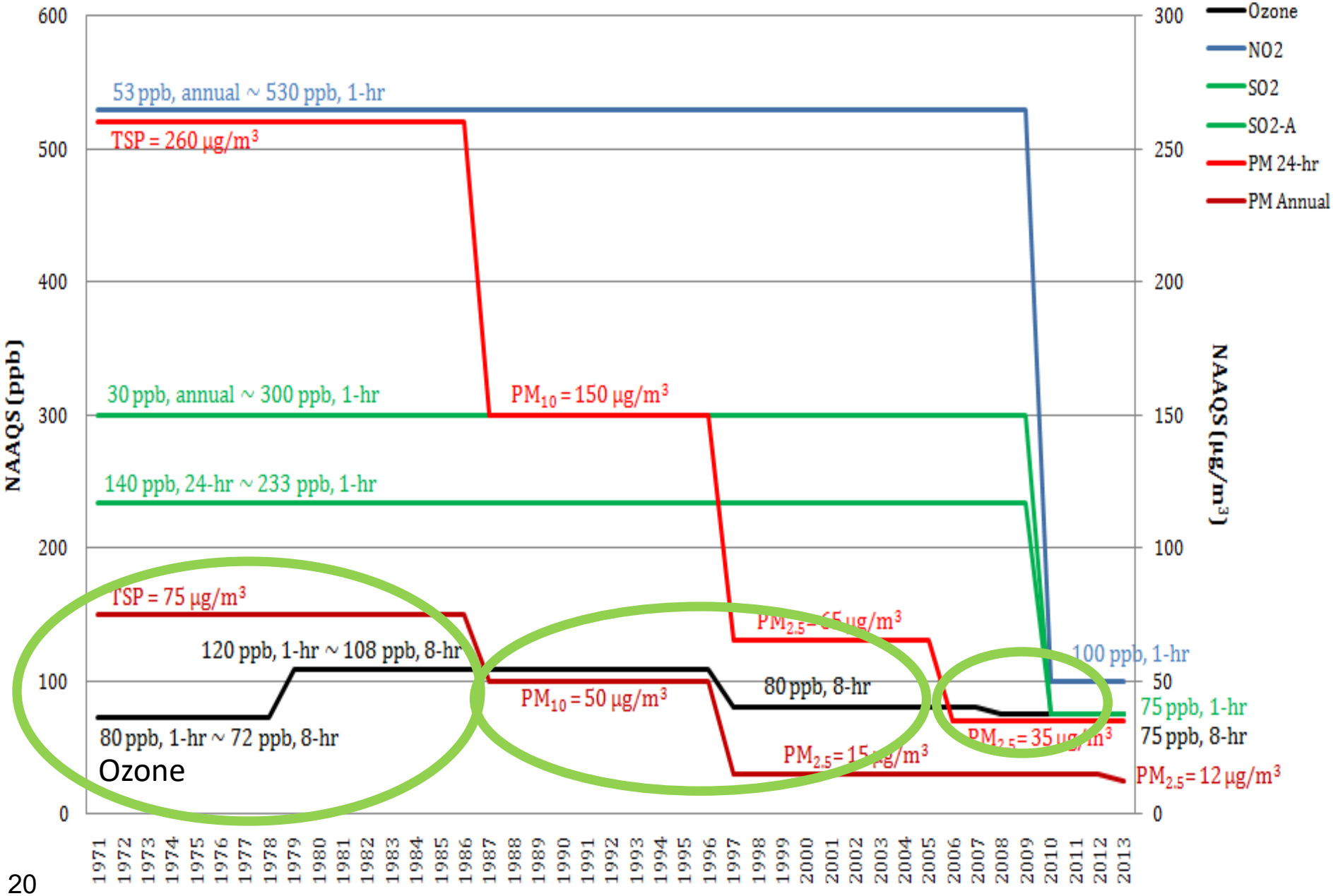
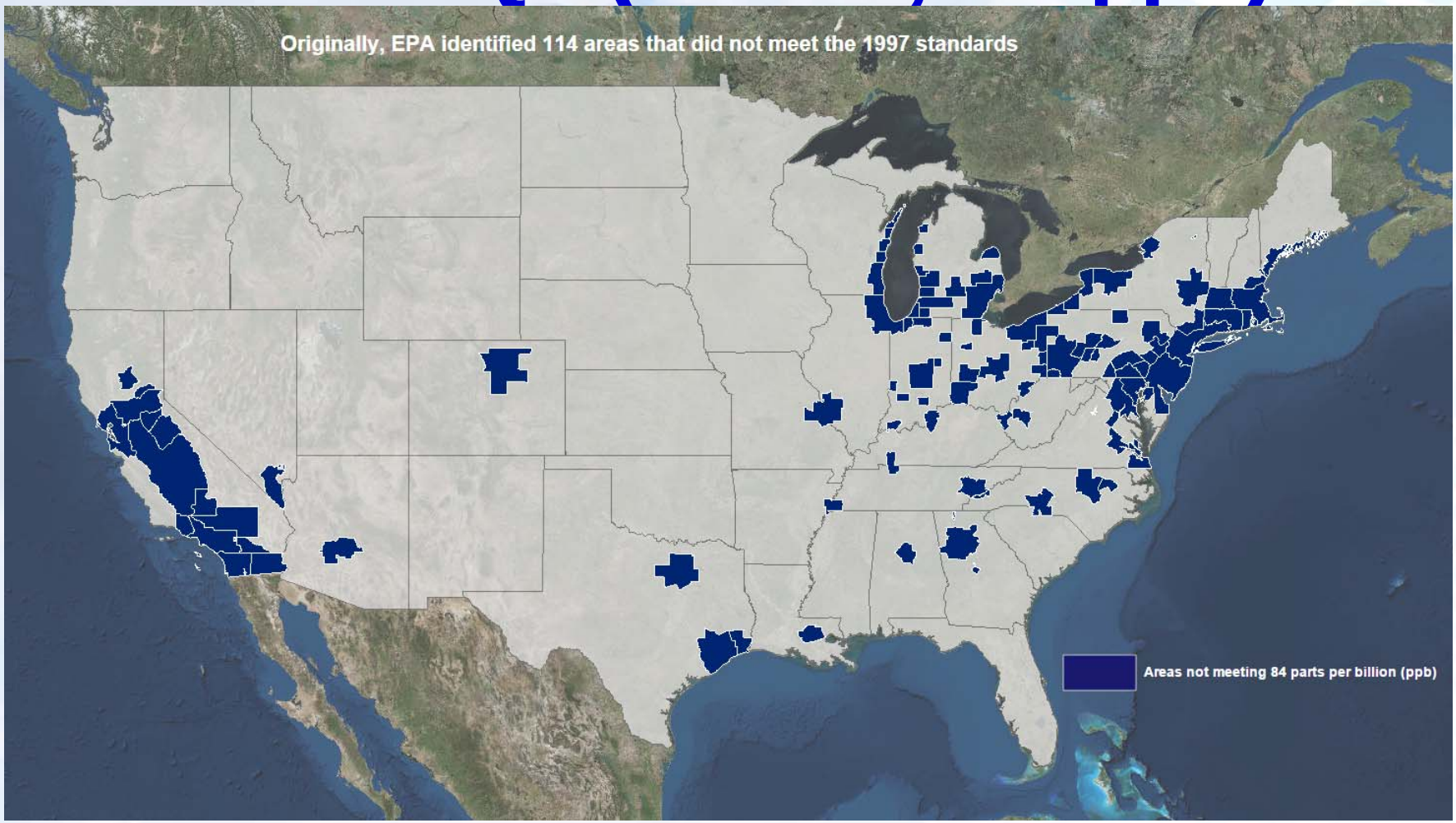
Primary NAAQS, 1971-2014



Nonattainment areas with 1997 Ozone NAAQS (8-hour, 80 ppb)



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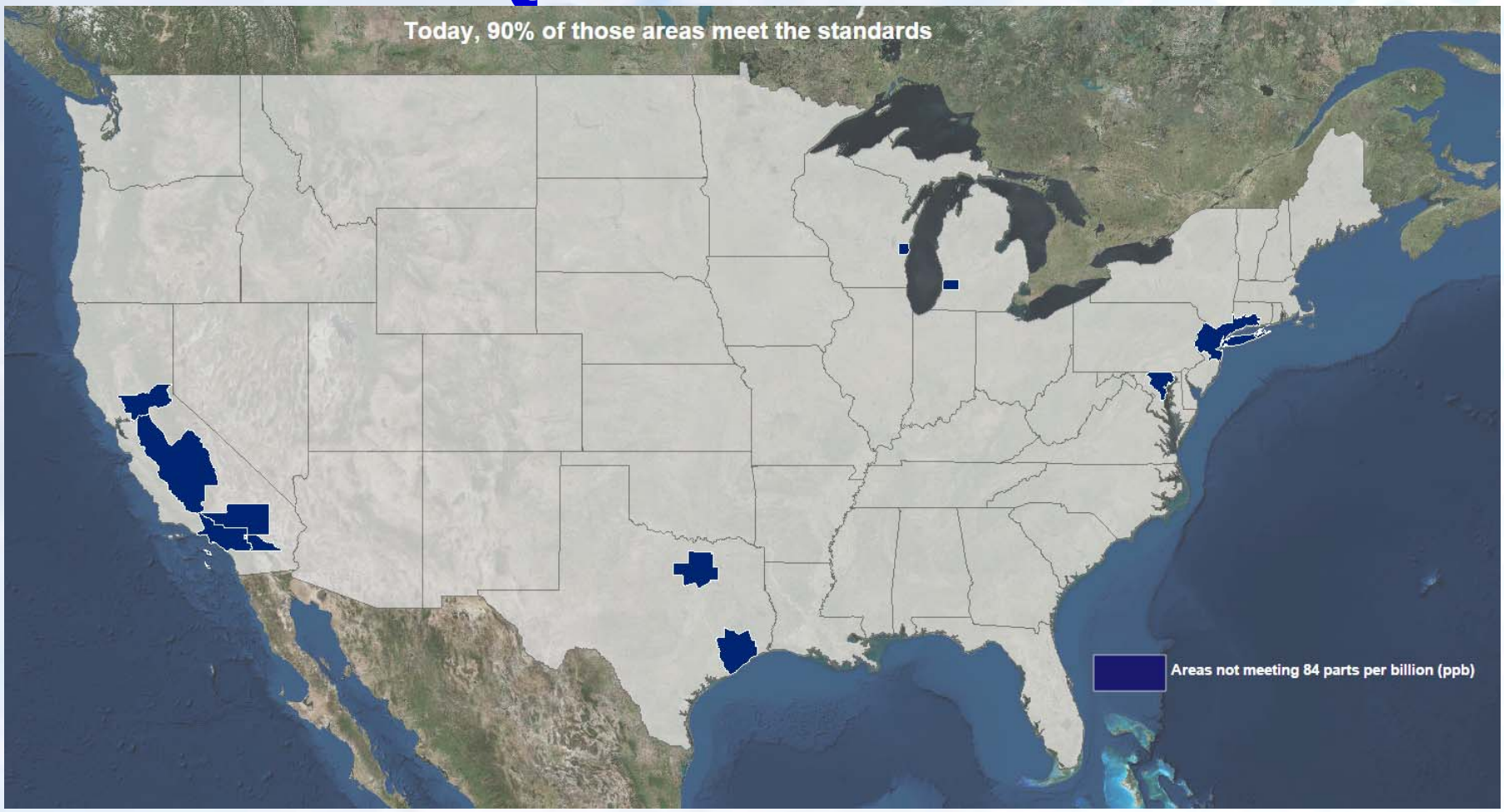
Nonattainment areas with 1997 Ozone NAAQS in 2007



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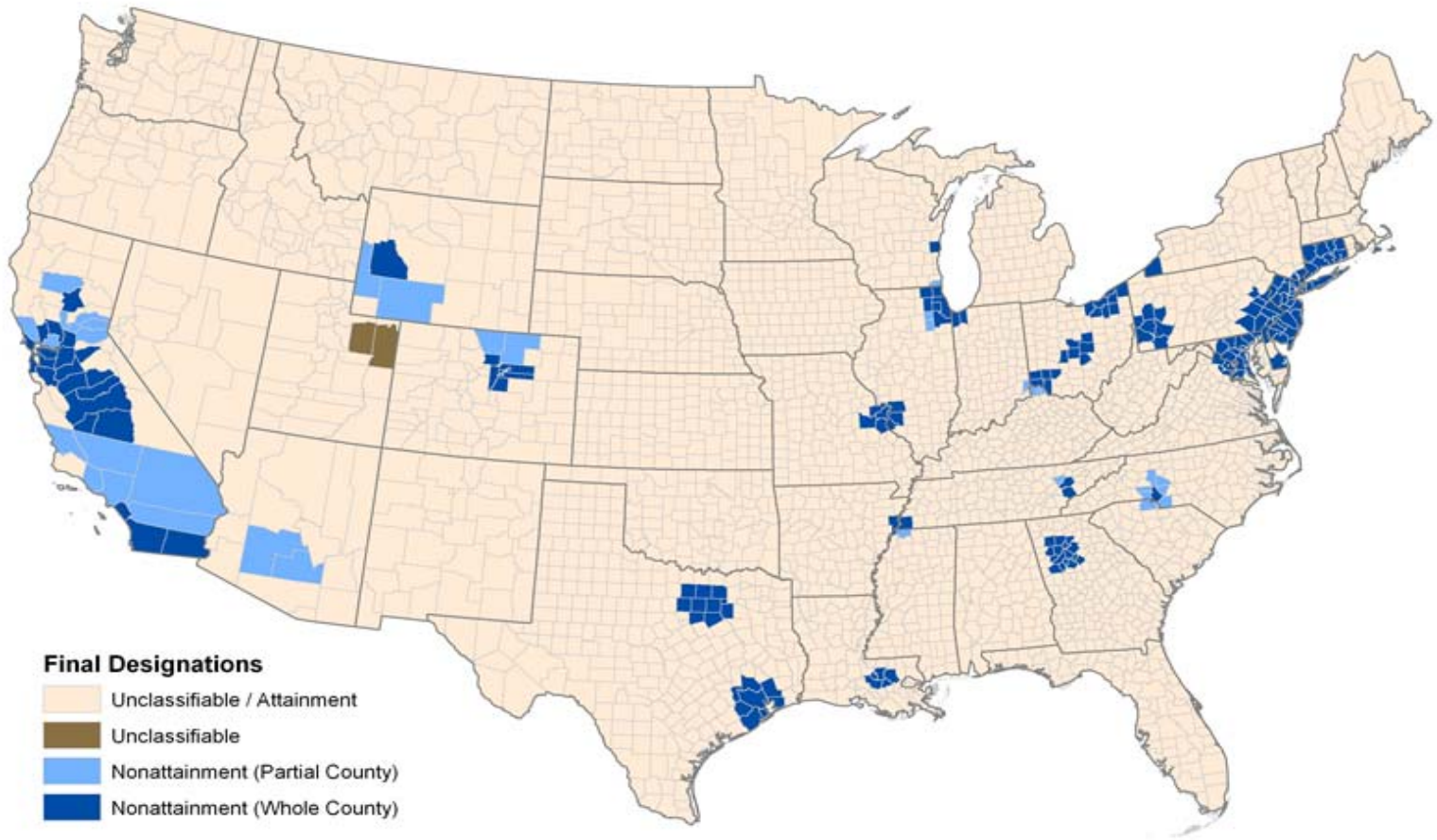
Nonattainment aeas for 2008 Ozone NAAQS (8-hour, 75 ppb)



Notes:
EPA has not designated as nonattainment any areas outside the Continental US.

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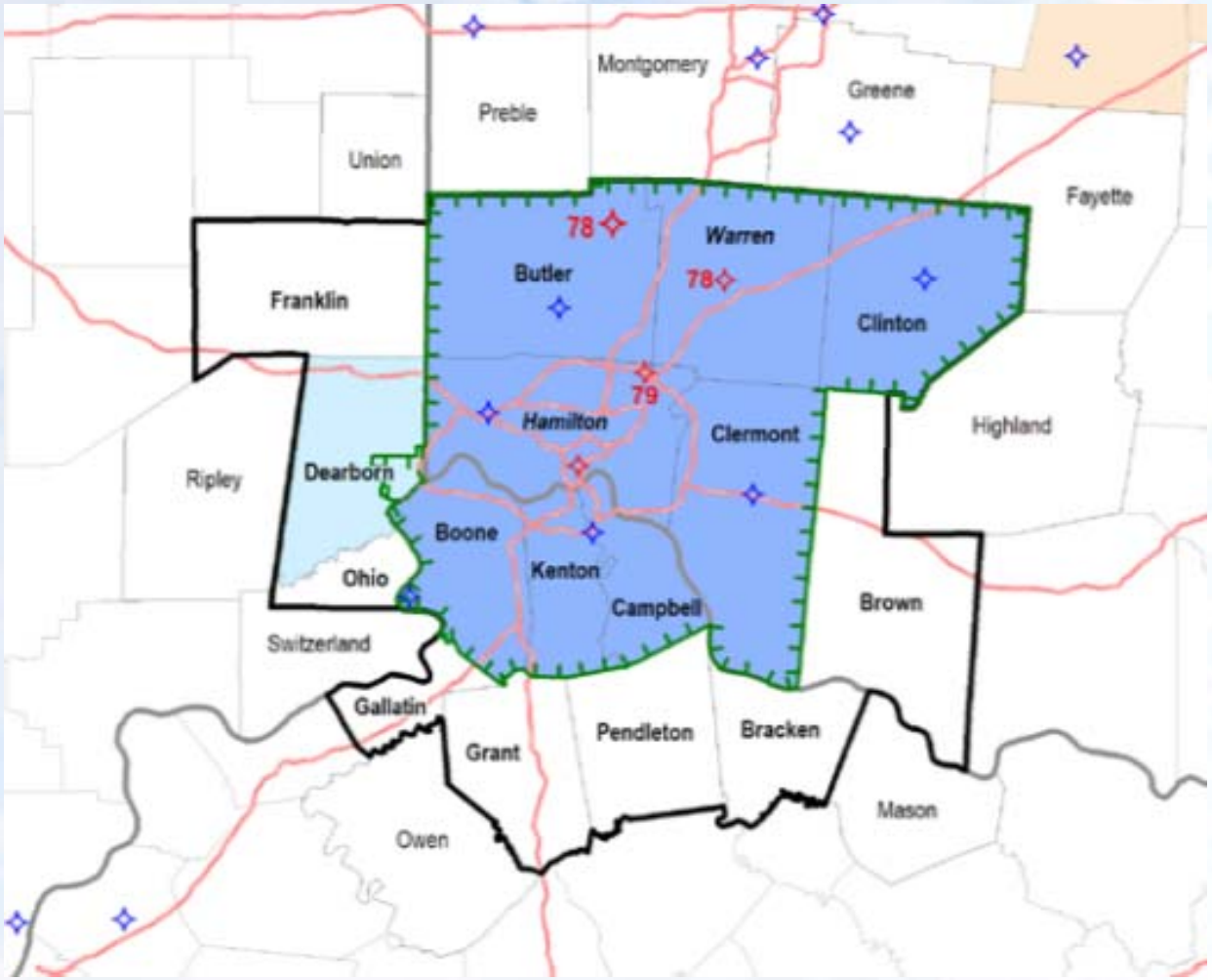
2008 Ozone in Greater Cincinnati Area



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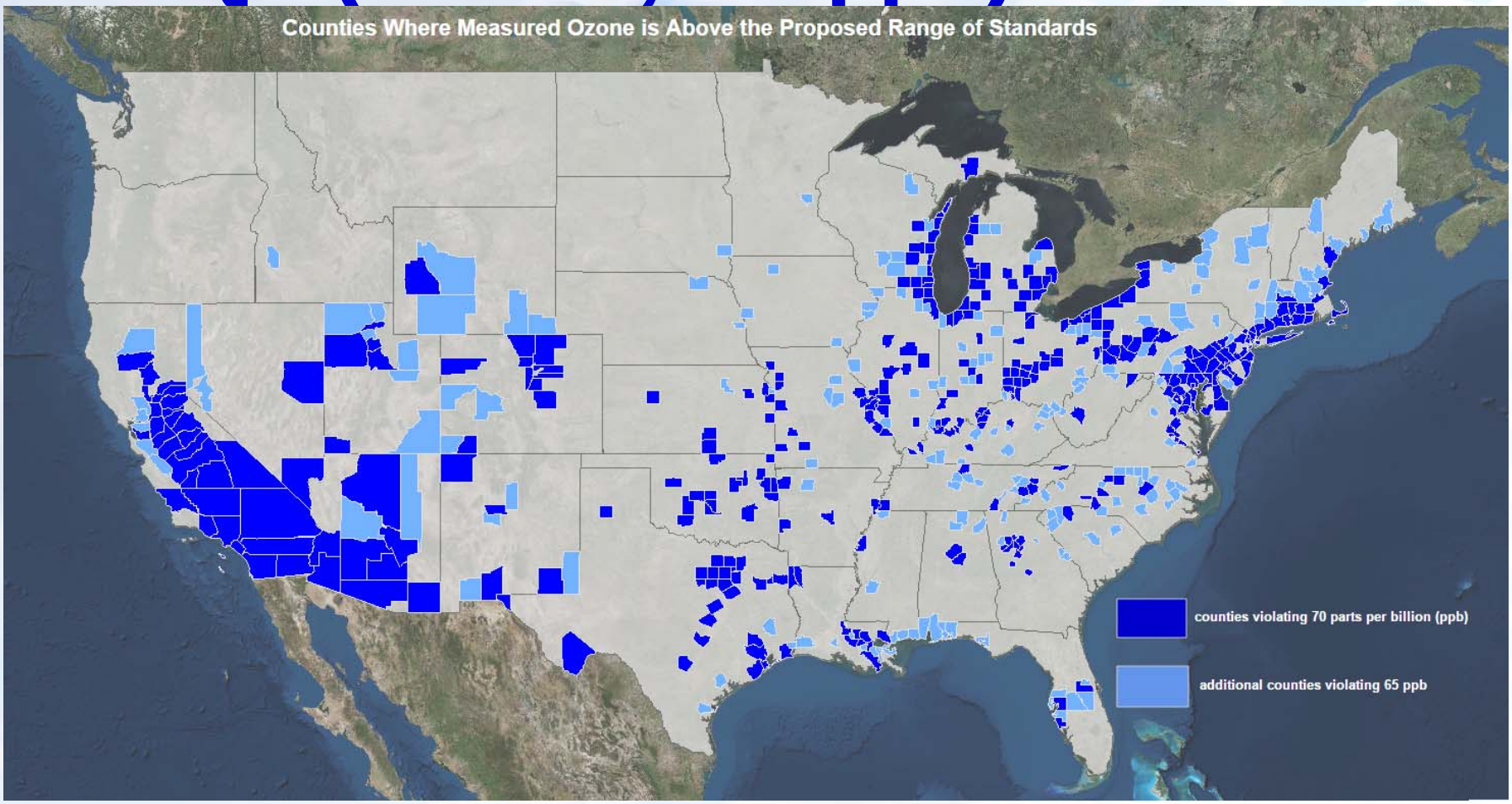
EPA's 2015 NAAQS

- 2014 - Proposed to lower the primary and secondary NAAQS to within the range of 65 to 70 ppb
- Added Appendix U to 40 CFR Part 50 detailing data selection, handling, and reporting requirements for ozone NAAQS
- Revised ambient monitoring requirements for ozone monitoring; included roadside monitors
- Final 2015 NAAQS = 70 ppb

Compliance with 2015 Ozone NAAQS (8-hour, 70 ppb)



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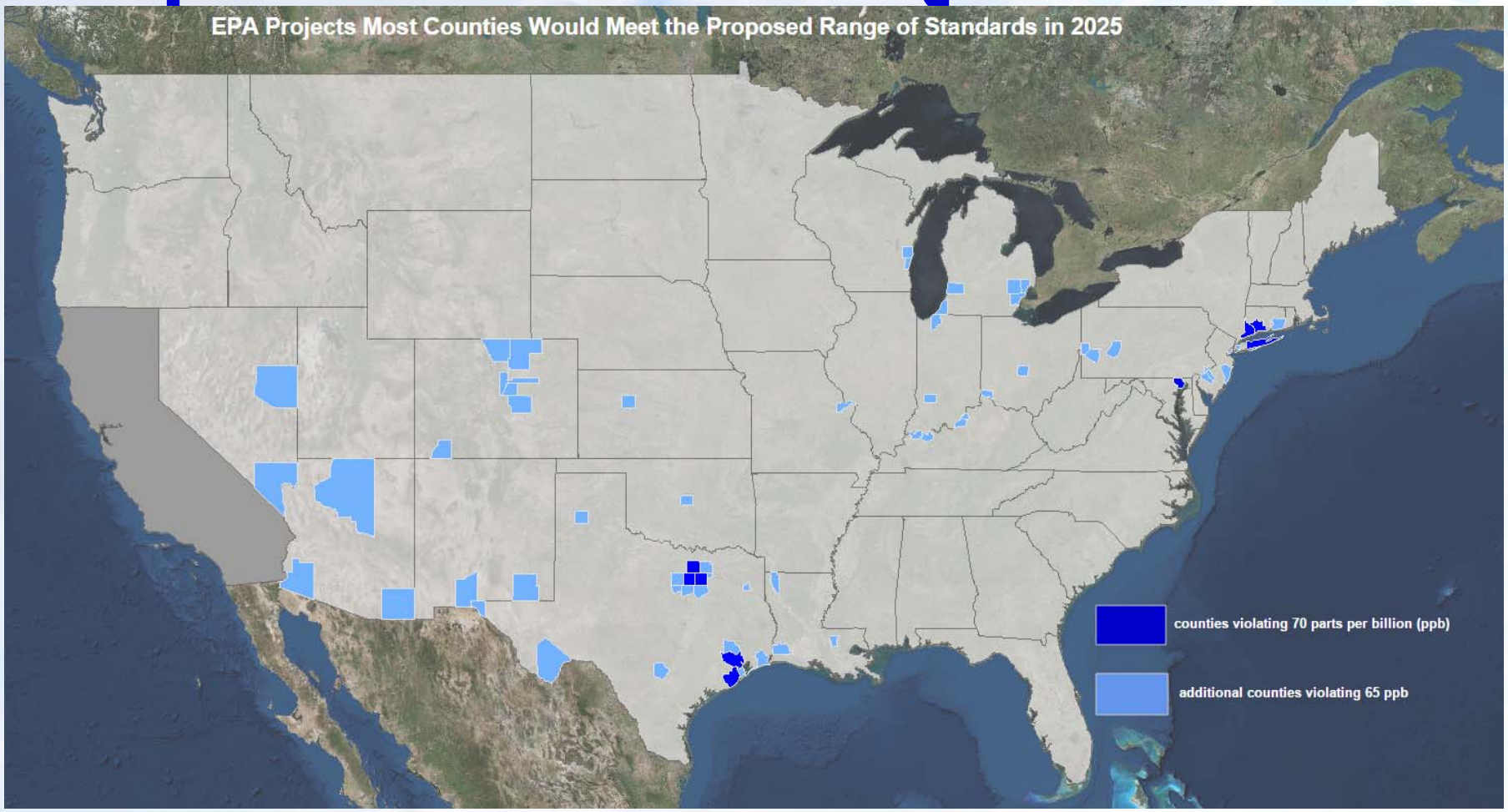
EPA Projected Compliance with Proposed Ozone NAAQS



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Revisions to Ozone NAAQS

- Ambient Monitoring
  - Lengthened the monitoring season for 33 states whose ozone > 60 ppb on days outside of existing monitoring season
  - Increased season length was 1 to 7 months depending on state

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Revisions to Ozone NAAQS

- Revisions to Photochemical Assessment Monitoring Stations (PAMS)
  - Network design
  - VOC sampling
  - NO sampling
  - Increased carbonyl sampling
  - Upper air measurements
- Modified reporting requirements
  - Combine monitors across a state
  - No more overlapping 8-hr periods rather three block data sets – 7am to 3pm, 3pm to 11pm, 11pm to 7am

Implications of 2015 Ozone NAAQS

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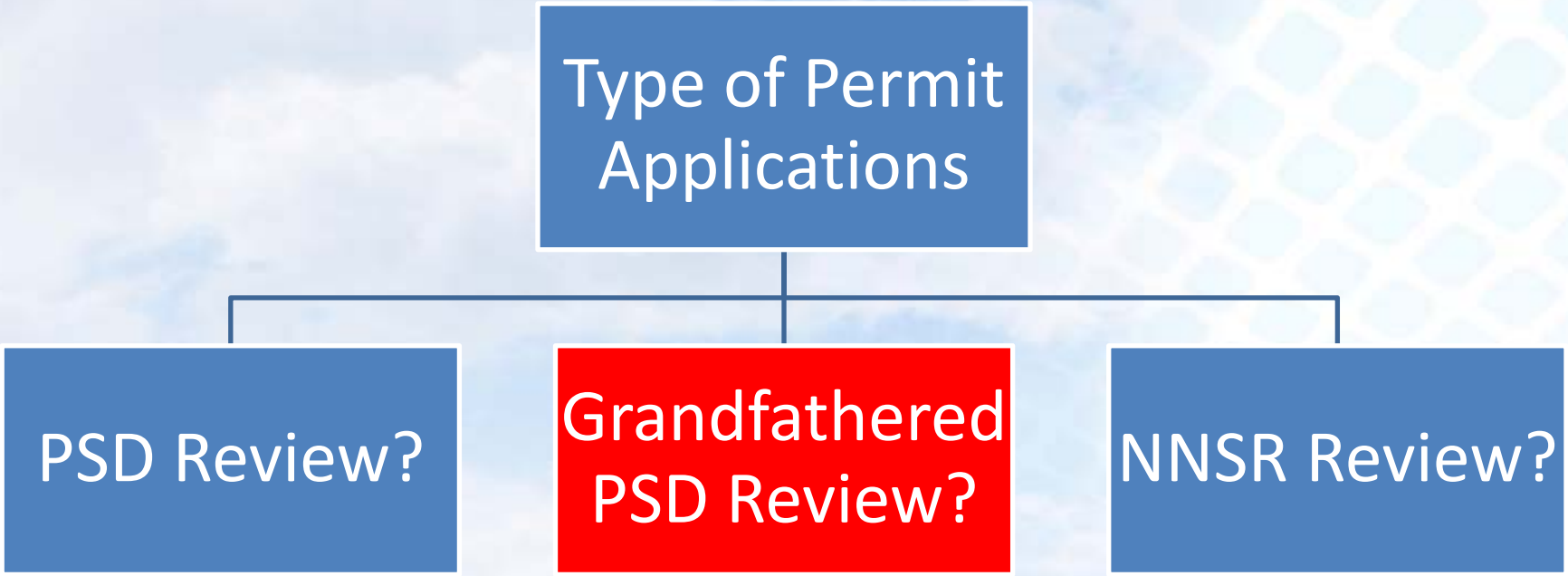
Permitting Strategy



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PSD Review before October 2015

- Required for ozone when:
  - Project VOC or NO_X emissions > 40 tpy
- Air quality impact required when:
  - Project VOC and\or NO_X emissions > 100 tpy
- Quantitative Demonstrations
  - Screening Approach using AERMOD
  - Photochemical Modeling
- Qualitative Demonstrations Accepted

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PSD Review after October 2015

- Main Purpose of the AQ Analysis
  - To demonstrate single source impacts
  - To demonstrate net improvement in the overall air quality in the area
  - Analysis of project's potential impact on the overall air quality in the area

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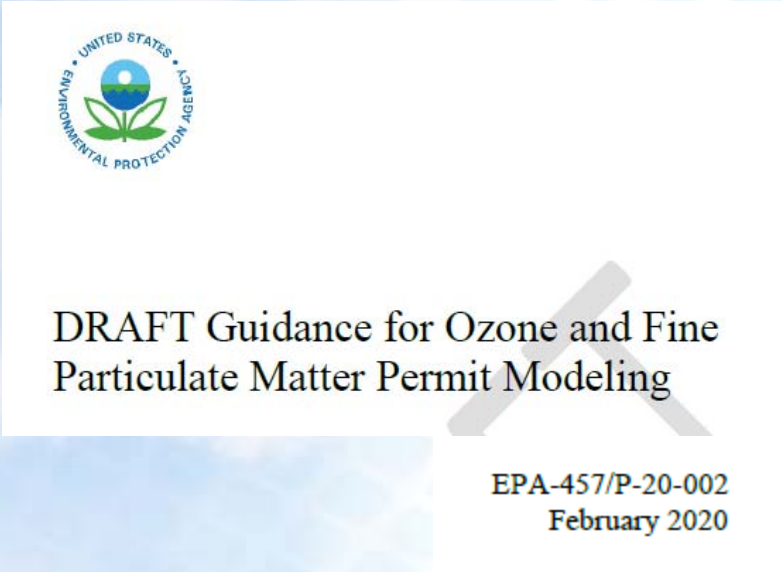
New Ozone Guidance from EPA

- Issued by EPA February 10, 2020
- Intent is to allow demonstration that a stationary source will not cause or contribute to a NAAQS violation
- Comments due 4/17/20 (original - 3/27/20
- Available at

https://www3.epa.gov/ttn/scram/guidance/guide/Draft_Guidance_for_O3_PM25_Permit_Modeling.pdf


DRAFT Guidance for Ozone and Fine Particulate Matter Permit Modeling

EPA-457/P-20-002
February 2020

New Ozone Guidance from EPA

> SILs, NAAQS and SERs for Ozone

Table III-1. EPA Recommended Approaches for Assessing O_3 Impacts by Assessment Case

Assessment Case	Description of Assessment Case	Secondary Impacts Approach*
Case 1: No Air Quality Analysis	NO_X emissions and VOC emissions < 40 tpy SER	N/A
Case 2*: Secondary Air Quality Impacts	NO_X emissions and/or VOC emissions ≥ 40 tpy SER	Include each precursor of O_3 emitted in a significant amount, see Section II.2. • **Tier 1 Approach** (*e.g.*, MERPs) • **Tier 2 Approach** (*e.g.*, Chemical Transport Modeling)

* In unique situations (*e.g.*, in parts of Alaska where photochemistry is not possible for portions of the year), it may be acceptable for the applicant to rely upon a qualitative approach to assess the secondary impacts. Any qualitative assessments should be justified on a case-by-case basis in consultation with the appropriate permitting authority and the appropriate EPA Regional Office.

J. Michael Geers – 2020 Ozone Season – Utility Perspective

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Air Quality • Solid Waste

Trinity Consultants

2020 Ozone Season Utility Perspective

J. Michael Geers

Duke Energy

Duke Energy's Environmental & Sustainability Progress

- Information taken from Duke Energy's 4th Quarter Earnings Call
- In 2019, increased 2030 CO_2 reduction goal from 40% to 50%
- Added a 2050 "Net Zero" CO_2 emissions goal

Duke Energy's industry-leading climate plan

DUKE ENERGY.

Companywide CO_2 Emissions Reduction Goals[1]

- ❑ Cut CO_2 emissions by at least 50% by 2030
- ❑ Attain net-zero CO_2 emissions by 2050

CO_2 Reductions Already Achieved[2]

- ✓ Exceeded 2025 reduction benchmarks agreed to by the U.S. for the Paris climate accord
- ✓ Met the 2030 CO_2 emission-reduction requirements of EPA's former Clean Power Plan almost 11 years early

PATH TO A LOW-CARBON FUTURE

- Collaborate and align with our states and stakeholders as we transform
- Accelerate transition to cleaner energy solutions
- Modernize our electric grid
- Continue to operate existing carbon-free technologies, including nuclear and renewables
- Advocate for sound public policy that advances technology and innovation

(1) From 2005 levels
(2) Achieved 39% reduction as of 2019

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Market forces between 2018 and 2019

Between 2018 and 2019

- CO2 emissions decreased by 12%
- SO2 emissions decreased by 31%
- NOx emissions decreased by 22%

Environmental and climate accomplishments

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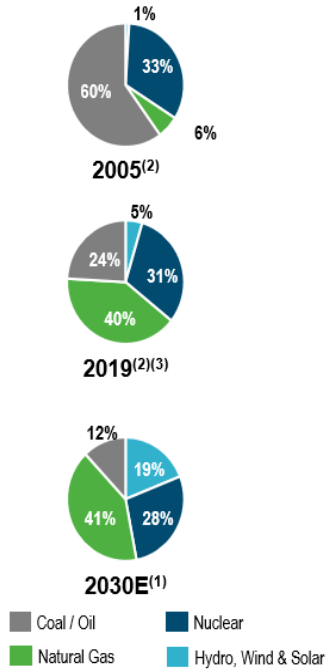
SIGNIFICANT CARBON REDUCTIONS AND RENEWABLE POWER EXPANSION

- Since 2005, decreased CO_2 emissions by 39%, sulfur dioxide emissions by 97% and nitrogen oxides emissions by 79%[1]
- 51 coal units retired (~6.5 GW) since 2010
  - Plans to retire an additional ~0.9 GW of coal by 2024
  - Proposals in NC and IN for accelerated depreciation of ~7 GW of coal units
- Completed excavation of 12 ash basins, ~28 million tons of ash to fully lined facilities or recycled
- As of year-end 2019, owned or contracted 8,100 MW of renewables
- Targeting 1 trillion gallon reduction in water withdrawals by our generation fleet by 2030 (from 5.34 trillion gallons in 2016)
- Clear leader in energy efficiency savings in the Southeast

FUEL DIVERSITY (MWh OUTPUT)



(1) *From 2005 levels. 2030 estimate and year to year reductions will be influenced by customer demand for electricity, weather, fuel and purchased power prices, and other factors*
(2) *2005 and 2019 data based on Duke's ownership share of U.S. generation assets as of Dec. 31, 2019*
(3) *2019 data excludes 9,400 GWh of purchased renewables, equivalent to ~4% of Duke's output*

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OEPA's Cincinnati Ozone Update Meeting

- OEPA conducted an outreach meeting on February 11th, 2020 with government, industry and other stakeholders.
- Recapped recent ozone season performance.
- Gave a preview of the 2020 season.

Note – the next several slides are from OEPA's presentation

Background

On 8/3/18, U.S. EPA designated 3 areas as "marginal nonattainment": Cincinnati, Cleveland and Columbus

- Columbus was redesignated to attainment on 8/21/19
- Cincinnati and Cleveland continue to exceed the standard
- Cincinnati nonattainment area also includes 3 partial counties in KY

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Cincinnati Outlook

- **Cincinnati is highly unlikely to meet standard by end of 2020**
- Required to meet standard ("attain") by August 3, 2021
  - 2020 is last ozone season before attainment date
- Critical monitor (Sycamore) would need a 2020 4th high below 61 ppb
  - Lowest 4th high since 2000 was 69 ppb in 2013
  - Exceeded this value 19 times in 2017, 31 times in 2018, 22 times in 2019
- Unlikely to qualify for 1-year extension
  - All monitors in area would need 2020 4th high meeting standard (70 ppb or below)

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Consequences of Not Meeting Standard

"Bump-up" from marginal to moderate nonattainment triggers additional requirements under Clean Air Act (CAA):

- NOx Reasonably Available Control Technology (RACT)
  - affects many industrial sources
- VOC Control Technique Guidelines (CTGs)
- Additional challenges permitting new and modified sources
  - NSR offset ratio 1.15:1
  - Baseline year reset
- Emissions inspection and maintenance (I/M) Program (i.e. E-check)
  - But not the E-check you may remember!
    - On-board diagnostics only; no longer tail-pipe tests

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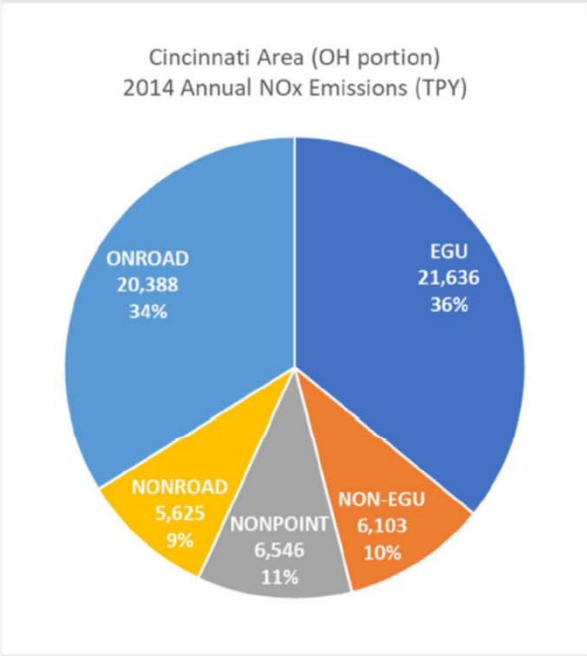
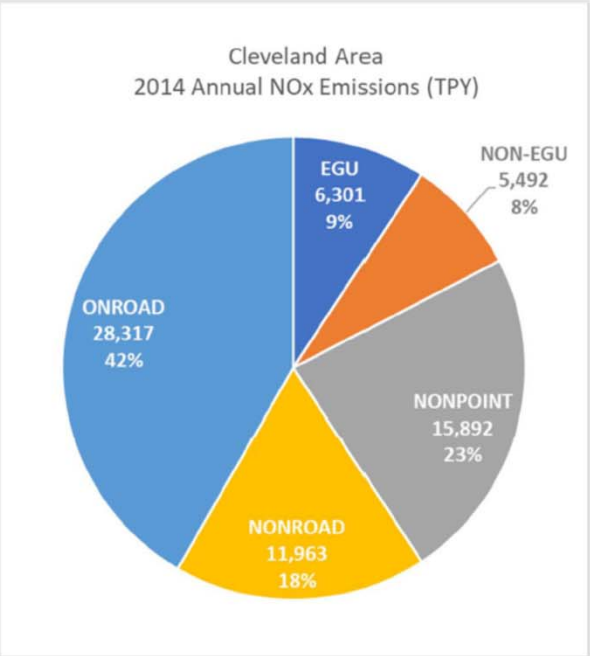
Comparing Cincinnati's & Cleveland's NOx Emissions Inventory

- Point sources are significant in Cincinnati
  - Electric generating units (EGUs) and non-EGUs (industrial sources) emitted 27,739 tons in 2014 (46%)
- Mobile sources significant, but are a larger portion of Cleveland's inventory

NOx Inventory
Comparison to Cleveland





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Point Source NOx Emissions Continue to Decline

EGU NOx emissions continue to reflect market forces

- Continued unit retirements which are seen outside the immediate Cincinnati area
- Reduced dispatch of the surviving units
- Due to market forces, Duke Energy's Indiana coal fired generation fell by about 27% and NOx emissions by 35% from 2018 to 2019
- Duke Energy's only area coal fired EGU is SCR equipped and operates at ~0.10-0.11 lb/mmBtu. It emits about 1,000 tons of NOx per ozone season

NOx Point Source Inventory

2018 Update and Comparison to Cleveland

- 2014 is the most recent available inventory that includes all types of emission sources (including mobile, nonpoint, etc.)
  - However, we do have more recent for point sources (2018)
- Compare to Cleveland for perspective

NAA	Source Type	2014 NOx (tons)	2018 NOx (tons)
Cincinnati	EGU	21,636 (36%)	15,097 (↓30%)
	Non-EGU	6,103 (10%)	4,728 (↓23%)
	Total Point	27,739 (46%)	19,825 (↓29%)
Cleveland	EGU	6,301 (9%)	1,990 (↓68%)
	Non-EGU	5,492 (8%)	3,529 (↓36%)
	Total Point	11,793 (17%)	5,529 (↓53%)

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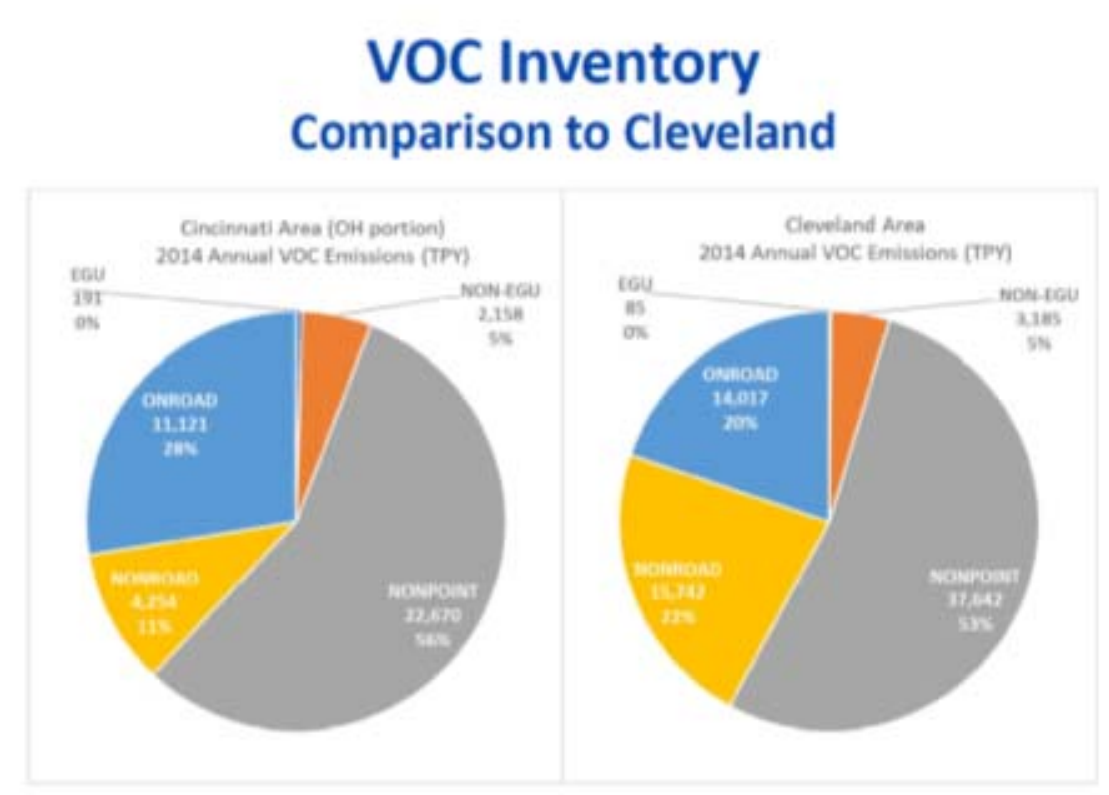
Comparing Cincinnati's & Cleveland's VOC Emissions Inventory

- Non-point source emissions are significant in both regions
- On road vehicles are a larger fraction
- Available studies show reduction in NOx emissions would have bigger impact on ozone in Cincinnati.



What Will the 2020 Ozone Season Bring?

- 2020 Ozone Season NOx & VOC Emissions could potentially fall
  - Downturn in economic activity
    - Reduced point source emissions
    - Reduced mobile source emissions
- Market forces in the long term will continue to drive cleaner electric generation, but there may still be short term variations
- Potential supply chain disruptions for chemical reagents, fuels and other materials
- Weather – always the uncontrollable variable

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Summary

- Ozone still a NAAQS concern in Greater Cincinnati area
- Ozone concentrations improving
- Major VOC and NOx reductions in area have contributed to lower ozone
- NAAQS has tightened up making compliance harder
- Area can come into compliance

Questions

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