



“The Air We Breathe”

Investigating local pollution and environmental exposures and the cost to our community.

Wednesday, March 6th
Nature at the Confluence

Dr. Brittany Keyes, PT, DPT, ATC
Dr. Pablo Toral, PhD

Objectives

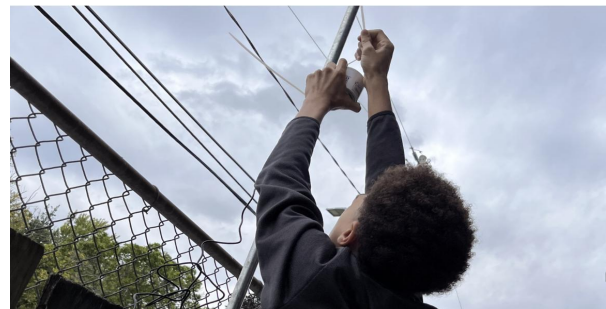
- Climate Status
 - Global
 - Local
- Climate and Health
- Air Pollution
 - Local Contributors
 - Health Impacts
- Community Science and Action
 - Inspire Active Hope
 - Initiate Community Collaboration

ENVIRONMENT

What's in the air? Climate activists in Beloit decide to look for themselves

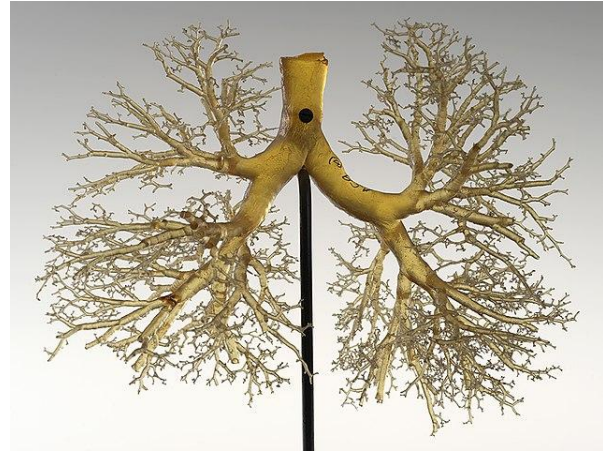
Air monitoring project underway aims to shed light on local asthma levels

BY: **ERIK GUNN** - JANUARY 30, 2023 6:45 AM

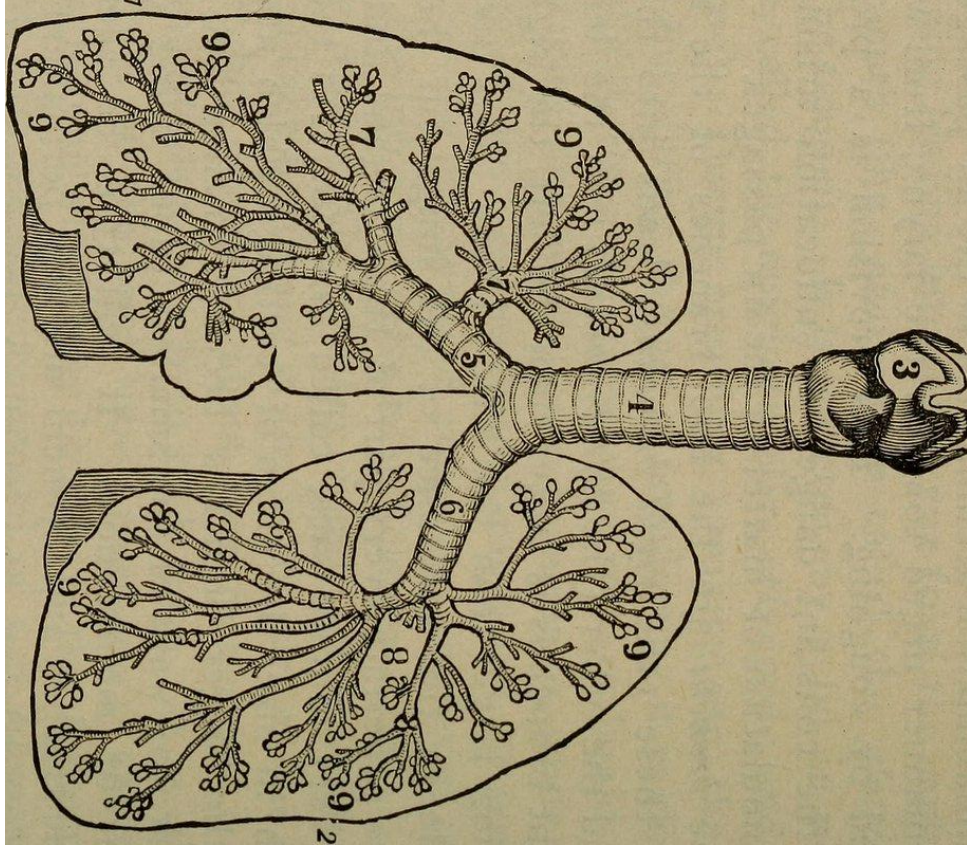


📷 A Beloit Memorial High School student installs an air monitor, part of a community project organized by climate change activists to measure contaminants in the local air. (Photo courtesy of Wisconsin Health Professionals for Climate Action)

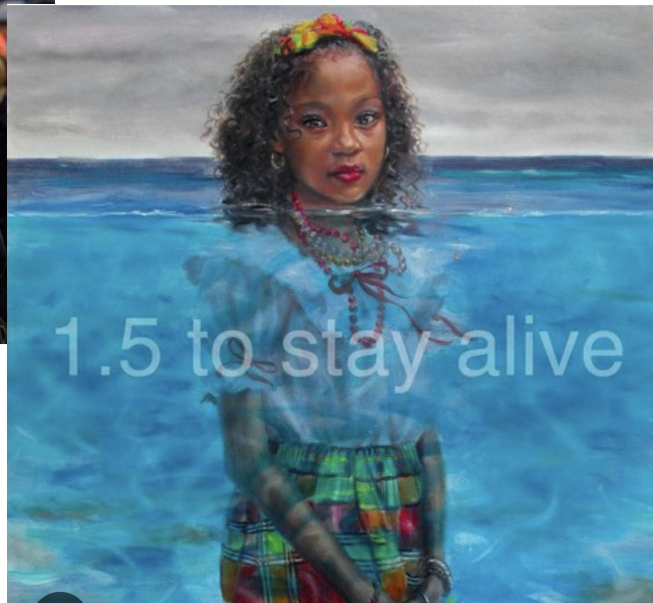
Part of Nature



The Air We Breathe...



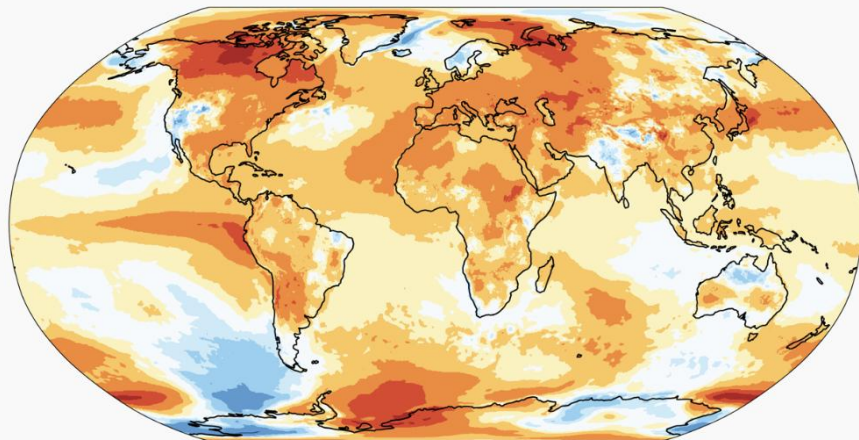
1.5 C



2023: Global

SURFACE AIR TEMPERATURE ANOMALY • 2023

Reference period: 1991–2020 • Data: ERA5 • Credit: C3S/ECMWF



Temperature anomaly (°C)



PROGRAMME OF
THE EUROPEAN UNION

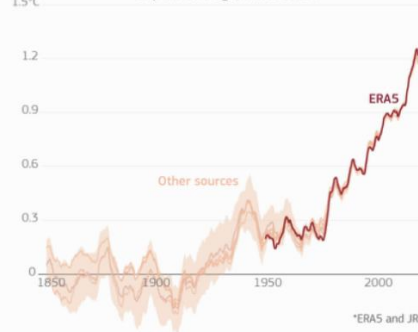


Surface air temperature anomaly for 2023 relative to the average for the 1991-2020 reference period. Data source: ERA5. Credit: C3S/ECMWF.

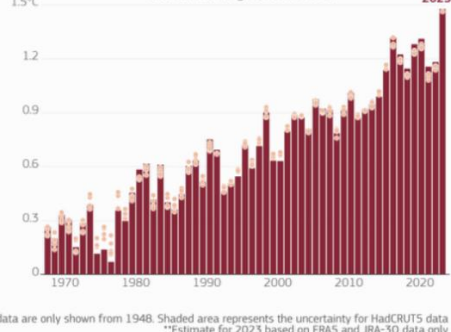
GLOBAL SURFACE TEMPERATURE: INCREASE ABOVE PRE-INDUSTRIAL LEVEL (1850–1900)

■ ERA5 data ■ Other sources* (including JRA-3Q, GISTEMPv4, NOAA GlobalTempv5, Berkeley Earth, HadCRUT5)

5-year average, since 1850



Annual averages, since 1967



*ERA5 and JRA-3Q data are only shown from 1948. Shaded area represents the uncertainty for HadCRUT5 data
**Estimate for 2023 based on ERA5 and JRA-3Q data only
Credit: C3S/ECMWF




PROGRAMME OF
THE EUROPEAN UNION



Global surface air temperature increase relative to the average for 1850-1900, the designated pre-industrial reference period, based on several global temperature datasets shown as 5-year averages since 1850 (left) and as annual averages since 1967 (right). Credit: C3S/ECMWF.

“Vital Signs”



F	C	 C
98.6	37	-
100.4	38	+1
101.5	38.5	+1.5
102.2	39	+2
104	40	+3
105.8	41	+4

 **GLOBAL CLIMATE CHANGE**
Vital Signs of the Planet





Vital Signs

 **Facts** › Vital Signs

[Carbon Dioxide](#) [Global Temperature](#) [Methane](#)

Global Temperature

LATEST ANNUAL AVERAGE ANOMALY:
2022 

0.89 °C | 1.6 °F

2023 Recap

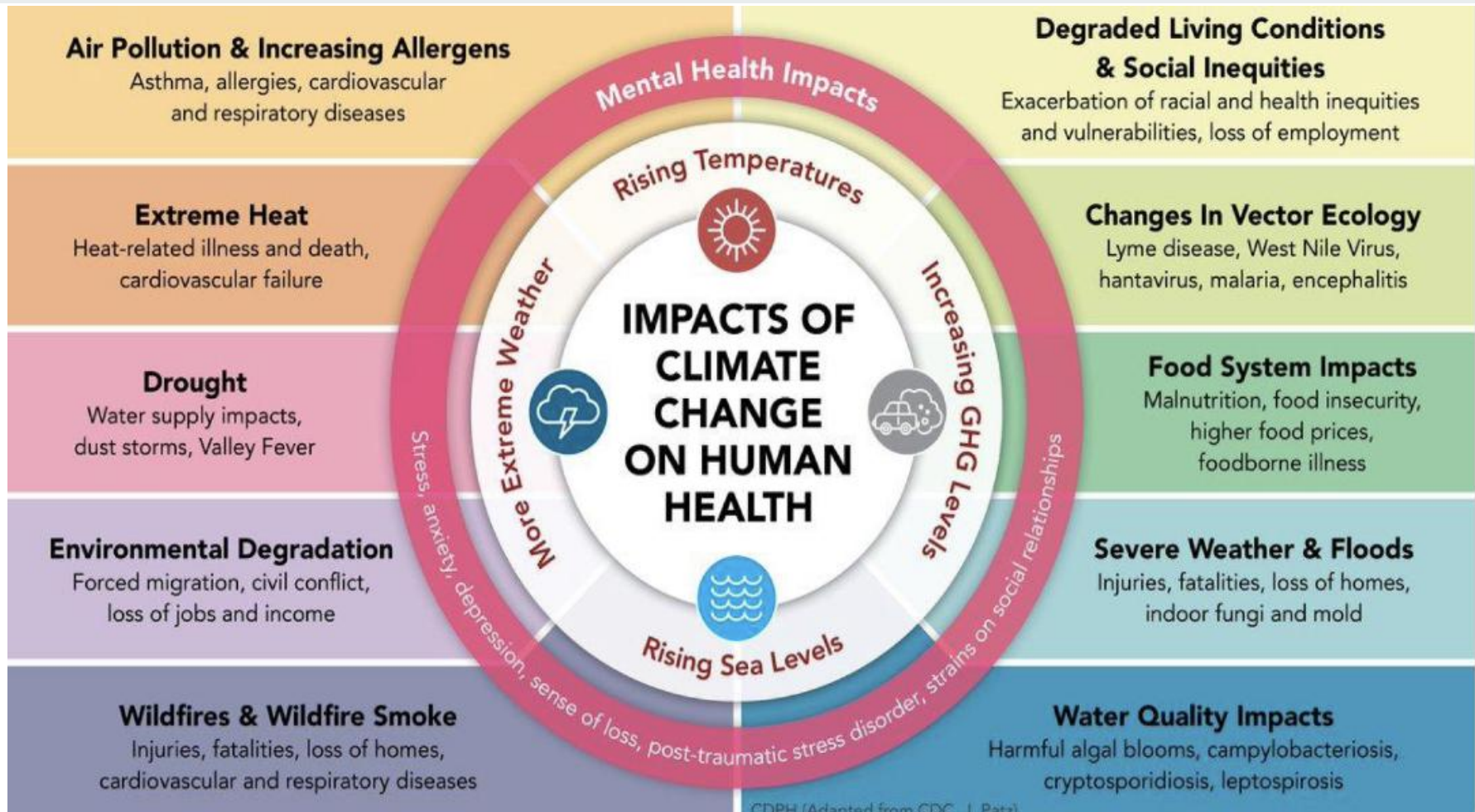


<https://climate.copernicus.eu/copernicus-2023-hottest-year-record>

Global surface air temperature highlights:

- 2023 is confirmed as the warmest calendar year in global temperature data records going back to 1850
- 2023 had a global average temperature of 14.98°C , 0.17°C higher than the previous highest annual value in 2016
- 2023 was 0.60°C warmer than the 1991-2020 average and 1.48°C warmer than the 1850-1900 pre-industrial level
- It is likely that a 12-month period ending in January or February 2024 will exceed 1.5°C above the pre-industrial level
- 2023 marks the first time on record that every day within a year has exceeded 1°C above the 1850-1900 pre-industrial level. Close to 50% of days were more than 1.5°C warmer than the 1850-1900 level,

Climate & Health



“Think Global, At Local.”

NOW, THEREFORE, BE IT PROCLAIMED by the City Council of the City of Beloit that we will support State, Federal, and International efforts to reduce GHG emissions with the goal of achieving carbon neutrality by 2040. Approved this 15th day of March, 2021.



Official Proclamation

WHEREAS, the City of Beloit maintains the goal of being an eco-municipality which aspires to develop an ecologically, economically and socially healthy community for the long term. A sustainable municipality meets basic economic, social, and security needs without undermining the natural resource base and the environmental quality; and

WHEREAS, the goal of a sustainable organization is to have biological systems remain diverse and productive over time. Beloit increasingly supports initiatives to carry out sustainable development projects such as green building programs, open space preservation, public space beautification, recycling, and smart growth planning; and

WHEREAS, the concept of Sustainability remains embedded in the City of Beloit's Strategic Plan. Every individual goal is defined to "create and sustain ..." incorporating the idea that sustainability is not a project – it is a way of life and governance; and

WHEREAS, a strong community sustainability commitment manifested in energy-efficient operations, green spaces, clean streets and waterways, and clean air are indicative of a city that is investing in its future and very desirable for individuals and employers seeking to relocate to the area; and

WHEREAS, reducing GHG emissions will reduce local air pollution and improve public health; and

WHEREAS, climate change is known to lead to longer and more intense heat waves, increased intensity of storms, flooding, droughts, loss of sea ice, extinctions, sea level rise, threats to human health, and loss of agricultural output; and

WHEREAS, the United States is a world leader in clean energy technology, and renewable energy is the fastest growing energy source in this country; and

WHEREAS, in 2011, the City of Beloit installed photovoltaic solar panels on the roof of the Police Department. The energy produced by these panels ties into the electrical system at City Hall and reduces the amount of energy that the City purchases. Beloit has produced 315.6 MWh of solar energy to date, which is the equivalent of 5,710 trees saved; and

WHEREAS, Alliant Energy, the utility for the City of Beloit, has committed to accelerate their sustainability goals to eliminate all coal from their generation fleet by 2040 and aspires to achieve net zero carbon emissions from the electricity they generate by 2050; and

WHEREAS, our current generation has a moral obligation to leave a habitable planet to the next and future generations; and

Beloit's contributions to climate change

Pablo Toral (toralp@beloit.edu)

Professor of Environmental Studies and
International Relations at Beloit College

Preliminary report prepared for the members
of the Beloit City Council.

August 10, 2021

Click City of Beloit to read report





Is Beloit a pollution haven?

Pablo Toral

Nature at the Confluence

March 5, 2024

The pollution haven hypothesis

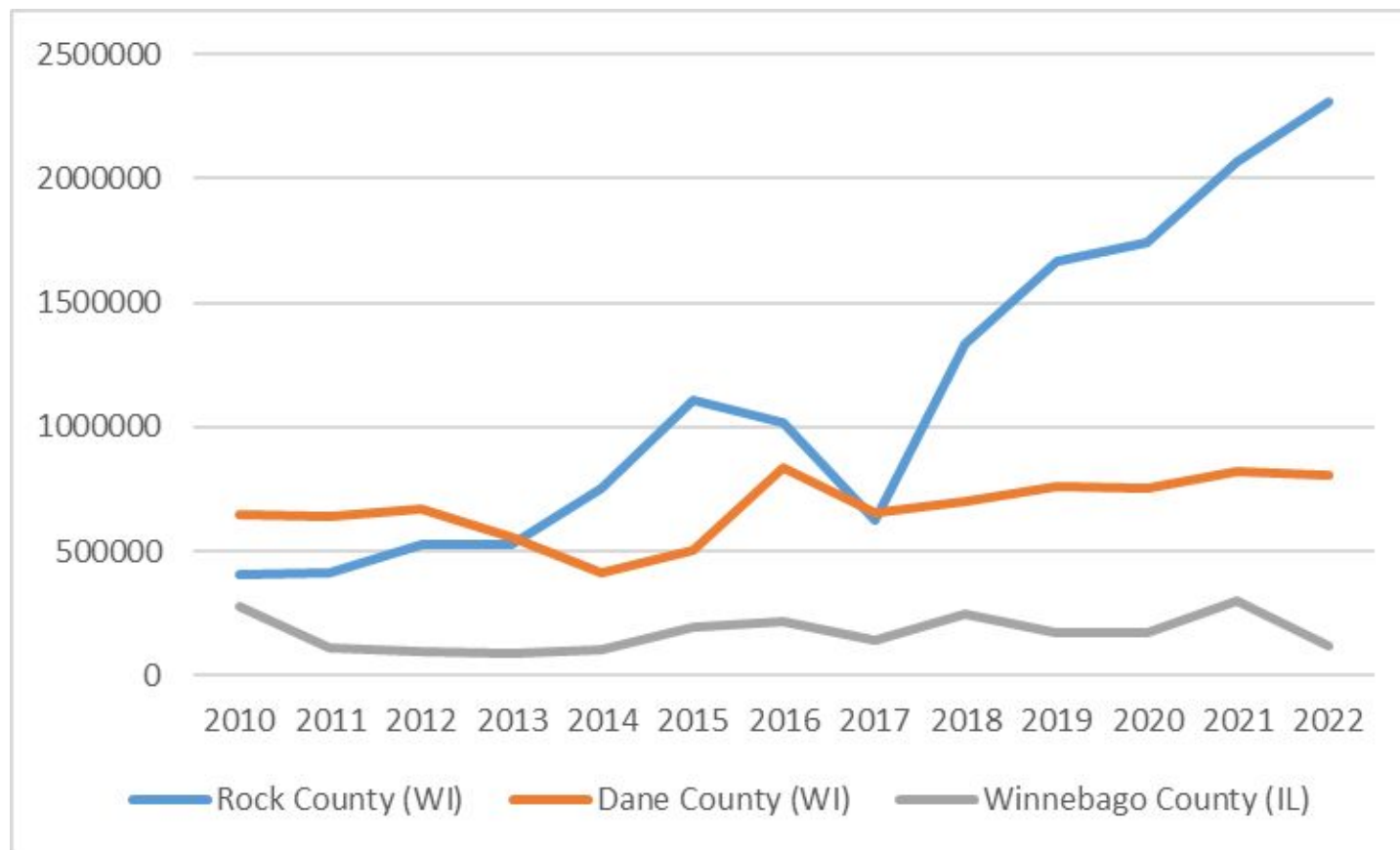
- Rationale:
- As corporations make investment decisions...
- ...they will seek to cut costs
- The most polluting industries will seek investment in communities with higher tolerance for pollution
- The result is a growing imbalance between
 - cleaner communities (that tend to be wealthier, healthier)
 - and polluted communities (poorer, less healthy)

Cost to health, welfare, farming, nature

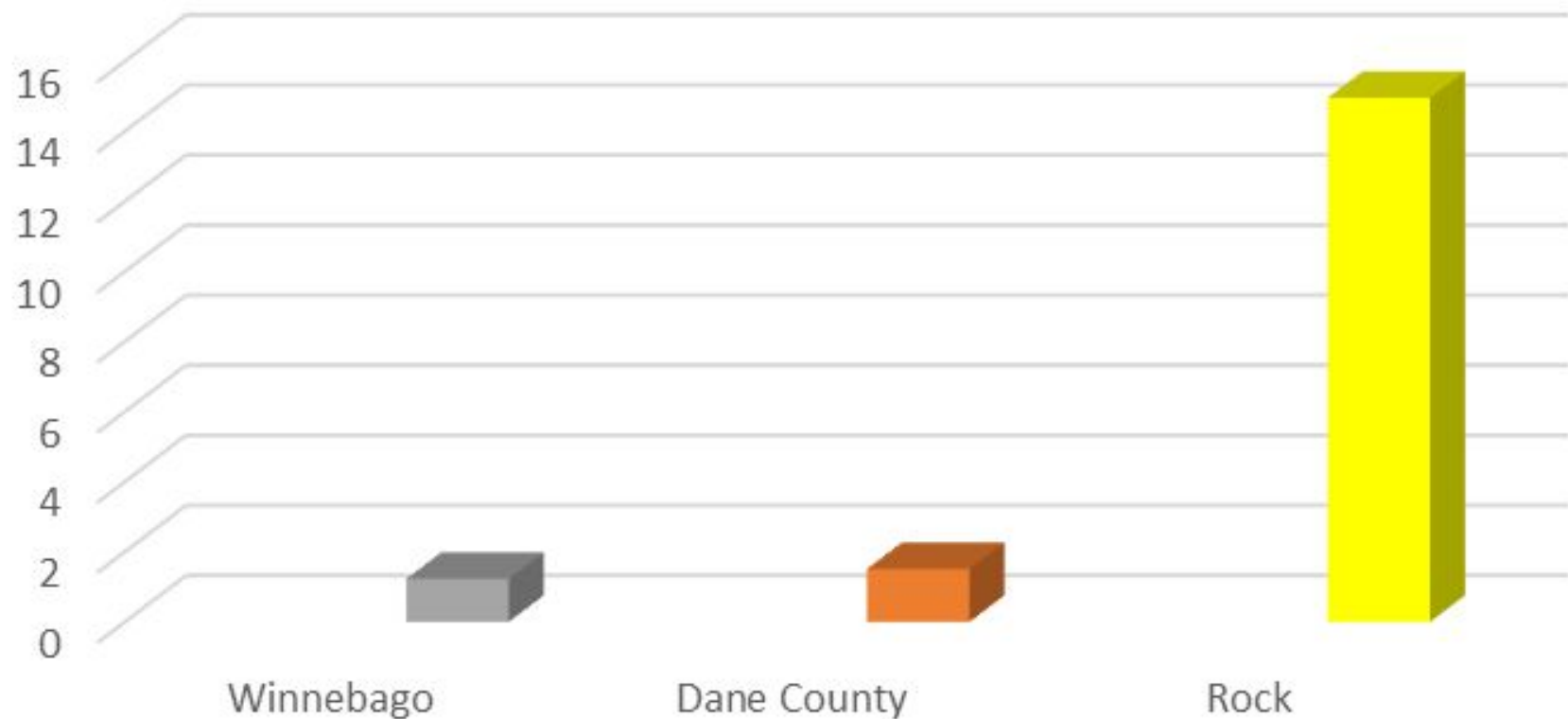
- California Québec Carbon cap and trade
- 2024 auction price: \$24.04/ton
- 2022 reported emissions (Beloit and Town of Beloit):
 - 2,211,861 tons
- Cost of current emissions to Beloit (WI):
- \$53,173,138
- Source of data for following graphs: U.S. EPA and U.S. Census

Reported GHG emissions per capita, 2010-2022

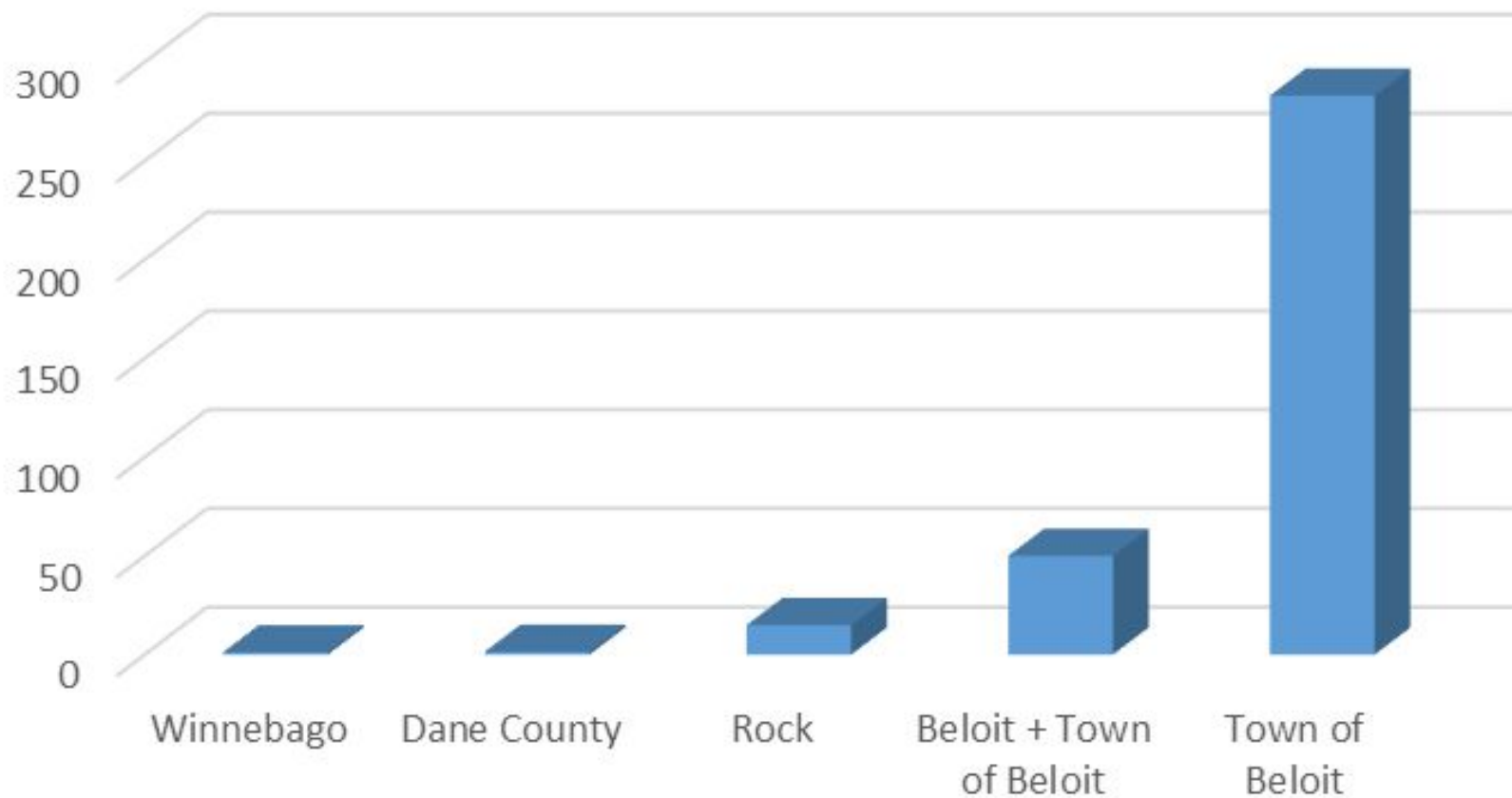
Source: EPA, US Census



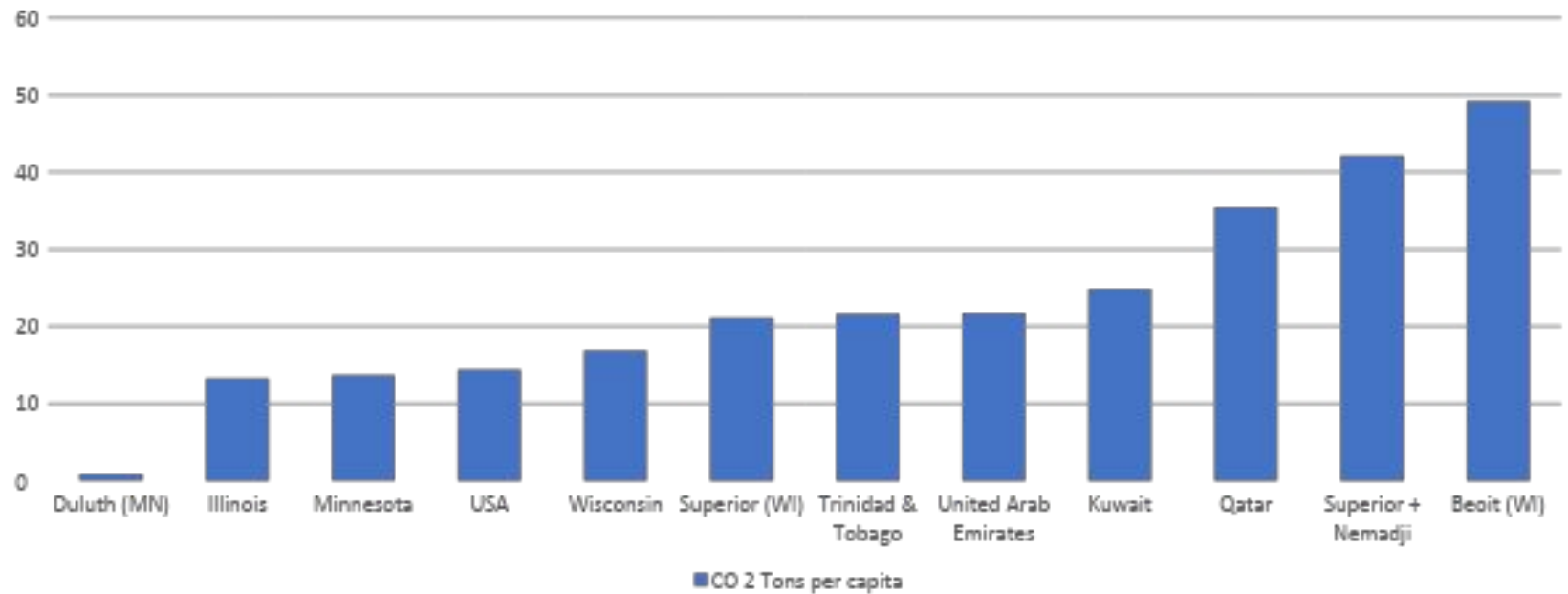
GHG emissions per capita in 2022, Rock, Dane, Winnebago



Reported GHG emissions per capita in 2022



Greenhouse gas emissions in 2022



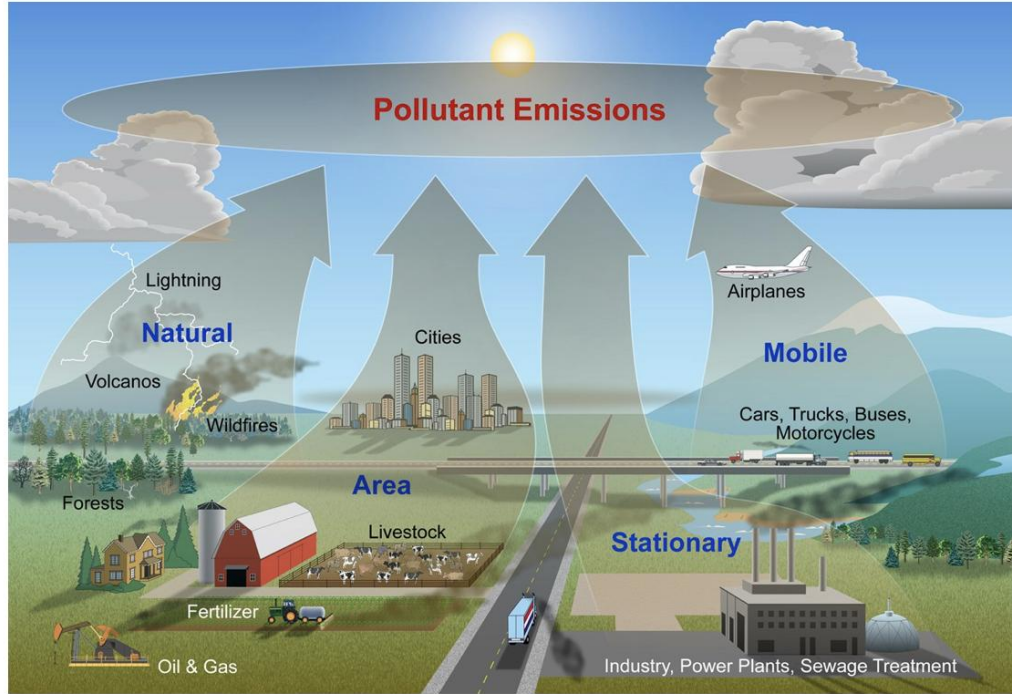
Concluding thoughts

- Emissions leakage:
 - the community that benefits from power does not bear all of the cost of producing it
- Pollution havens: Environmental justice
- Principle of U.S. Env. Law:
- Polluter pays:
- If pollution costs \$53,173,138...
- Who pays?
 - The utility, by internalizing this cost?
 - The utility's customers?
 - Beloit? Town of Beloit? Rock County?
 - The citizens of Beloit and vicinity? Illinois

Concluding thoughts

- The Clean Air Act (1972) mandates reductions of air pollution
- “Good neighbor” provision
 - Sought to address trans-boundary pollution: drifting across state boundaries
- The Supreme Court is currently hearing arguments and will be asked to rule on whether being a “good neighbor” requires states to keep pollution from drifting downstream
- If so, how will Wisconsin keep its emissions from drifting into Illinois?
 - Will Illinois sue Wisconsin? Seek compensation?
- EPA announced in Feb. 29, 2024 that it will soon announce new emissions standards for coal-fired and gas-fired power plants

Air Pollution



Beloit: West Riverside Power Plant



Traditional Energy

Natural Gas & LNG

Power Generation

📅 Sep 22, 2016

Alliant Energy Breaks Ground on Riverside Energy Center Expansion

A celebration today signaled the start of one of Wisconsin's largest economic and job growth projects. Alliant Energy's Riverside Energy Center expansion, near Beloit, Wis., is a 700-megawatt, natural gas-fueled generating facility with an integrated, two-megawatt solar field. The approximately \$700 million project will create more than 1,000 construction jobs and result in an estimated \$250 million economic impact during construction.



Alliant Energy began building the West Riverside Energy Center in spring 2017 after receiving approval from the Public Service Commission. The \$660 million plant can produce enough power for more than half a million homes. *Photo courtesy of Alliant Energy*

Produces power for 550,000 homes and residences

Population of Rock County: 163,500

West Riverside Energy Center

POWER

Coal

Alliant Closing Coal Unit, Brings Gas Plant Online

Wisconsin-based Alliant Energy on May 22 said it would retire the coal-fired Edgewater Generating Station in Sheboygan by year-end 2022, an announcement coming just one week after the utility said it had placed the new 730-MW West Riverside Energy Center, a natural gas-fired combined cycle plant in Beloit, into commercial operation.



WISCONSIN STATE JOURNAL

Subscribe

TOPICAL FEATURED

Alliant swapping coal for gas to cut costs, carbon; environmental advocates push for faster transition to renewable energy

Chris Hubbuch | Wisconsin State Journal Oct 1, 2018

0



Workers move a section of pipe Thursday at Alliant Energy's West Riverside Energy Center in Beloit. The 30-inch diameter alloy pipe will carry 1,050-degree steam produced at the 730-megawatt natural gas generation plant, which is scheduled to begin operation



Menu

Facility Retirement

In May 2020, we announced plans to retire the coal-fired Edgewater Generating Station in Sheboygan, Wisconsin to advance our goal of delivering cleaner, more cost-effective energy to customers. In June 2022, we provided an updated target retirement date for the Edgewater Generation Station of June 2025. ✨

As we transition from coal to cleaner energy, we will remain focused on caring for our customers and employees by creating new jobs and bringing new economic development opportunities to the community.

Human Health & Gas-Fueled Power Plants

Research from the National Institutes of Health and Harvard Shows:

- **Living in a zip code with a gas-fueled power plant:**
 - a. **Rates of asthma hospitalization 11% higher**
 - b. **Respiratory infection hospitalization rates 15% higher**
 - c. **COPD hospitalization rates 17% higher**
- **Air and water pollution associated with fossil gas extraction and combustion contributes to:**
 - a. **Pre-term birth and low birthweight**
 - b. **Respiratory issues**
 - c. **Cardiovascular harm**
 - d. **Developmental changes, and learning issues.**
- **Pollutants from gas plants have already surpassed deaths from coal plants in 19 states(1).**



Air Pollution



- Identified as one of the greatest environmental threats to human health (WHO).
- Causes over 7 million premature deaths annually
- Damages lung growth and function in children
- Leads to ischemic heart disease and stroke; contributes to diabetes and neurodegenerative conditions (2).



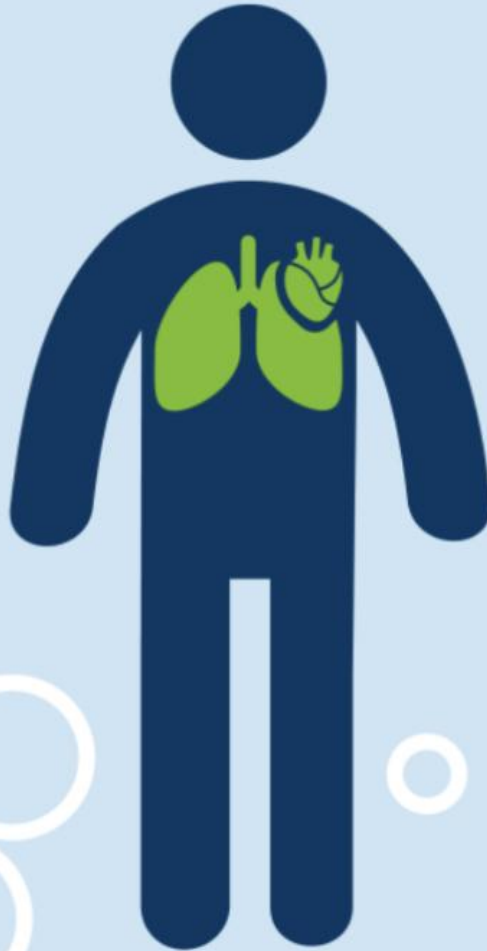
Fine particles

pollution can cause:

- Shortness of breath
- Wheezing, coughing
- Chest pain
- Fatigue

Fine particles can make these conditions **worse**:

- Cardiovascular and heart disease
- Asthma and COPD



Ground-level ozone

pollution can cause:

- Difficulty breathing deeply
- Shortness of breath
- Sore throat
- Wheezing, coughing
- Fatigue

Ozone can make these conditions **worse**:

- Asthma and COPD
- Emphysema



Air Pollution Exposure Linked to Poor Academics in Childhood

July 13, 2021



Photo courtesy of David Kaplan



We are on a journey to discover the extent to which the > 80,000 human-created chemicals in our air, water, food, and homes may be causing inadvertent harm to our bodies during development. As an environmental

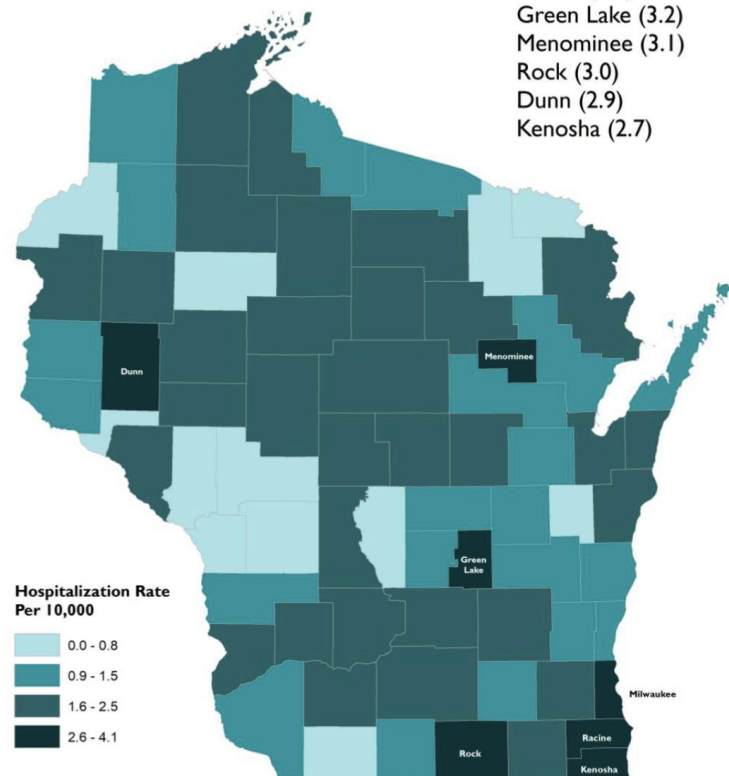
<https://sites.uwm.edu/kalkbrennerlabs/publications/>

Air Pollution & Health

Average number of asthma hospitalizations per 10,000 people by county (2019-2021).

The counties with the highest rates in Wisconsin are: Milwaukee (4.2)
Racine (3.5)
Green Lake (3.2)
Menominee (3.1)
Rock (3.0)
Dunn (2.9)
Kenosha (2.7)

- Rock County ranked fifth highest for asthma hospitalizations (3).



% of Disabled less than 40% in reg ed (1).pdf



Done

% of Disabled Students less than 40% of the time in Regular Education Classes by Whole District

Year	State %	Neenah (6,702)	Oak Creek (6,472)	La Cross (6,449)	BELOIT (6,309)	Westbend (6,309)	Howard - Suamico (6, 017)	DC Everest (6,017)		JANESVILLE (9,899) <i>Neighbor School District</i>
		Larger	Larger	Larger		Same Size	Smaller	Smaller		Larger by 3,590 students
2016	8.84	8.46	4.36	7.11	11.01	10.69	3.91	11.92		6.03
2017	8.48	8.77	4.09	7.75	13.93	9.30	4.53	12.37		6.78
2018	8.47	10.00	3.42	8.50	13.58	8.66	6.21	12.09		5.91
2019	8.15	11.00	5.31	5.71	14.27	8.73	7.15	12.16		5.82
2020	NA	NA	NA	NA	NA	NA	NA	NA		NA
2021	6.90	7.36	6.73	6.65	17.1	7.71	5.89	11.13		4.59
2022										

World Health Organization: Air Quality Guidelines

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
PM_{2.5}, µg/m³	Annual	35	25	15	10	5
	24-hour ^a	75	50	37.5	25	15
PM₁₀, µg/m³	Annual	70	50	30	20	15
	24-hour ^a	150	100	75	50	45
O₃, µg/m³	Peak season ^b	100	70	–	–	60
	8-hour ^a	160	120	–	–	100
NO₂, µg/m³	Annual	40	30	20	–	10
	24-hour ^a	120	50	–	–	25
SO₂, µg/m³	24-hour ^a	125	50	–	–	40
CO, mg/m³	24-hour ^a	7	–	–	–	4

^a 99th percentile (i.e. 3–4 exceedance days per year).

^b Average of daily maximum 8-hour mean O₃ concentration in the six consecutive months with the highest six-month running-average O₃ concentration.

The image is a vertical rectangular cover for the WHO global air quality guidelines. It features a bright sun with rays shining through a blue sky with wispy white clouds. Below the sky, there are silhouettes of mountains. The text 'WHO global air quality guidelines' is written in large, white, sans-serif font. Below this, in smaller white text, is a list of pollutants: 'Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide'. At the bottom right is the WHO logo and the text 'World Health Organization'.

WHO global air quality guidelines

Particulate matter (PM_{2.5} and PM₁₀),
ozone, nitrogen dioxide, sulfur dioxide
and carbon monoxide

EPA: PM_{2.5} Standards

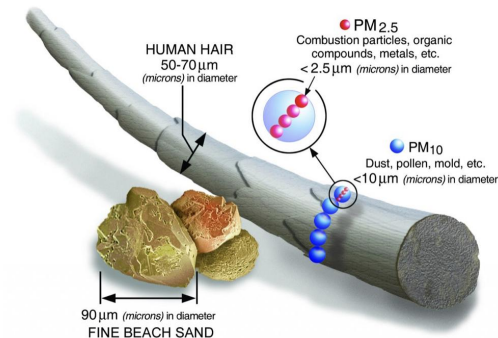
What is PM, and how does it get into the air?

On February 7, 2024, EPA strengthened the National Ambient Air Quality Standards for Particulate Matter (PM NAAQS) to protect millions of Americans from harmful and costly health impacts, such as heart attacks and premature death.

*Primary (health-based) annual PM_{2.5} standard **12.0 $\mu\text{g}/\text{m}^3$** revised to **9.0 $\mu\text{g}/\text{m}^3$** .*

Particle or soot pollution is one of the most dangerous forms of air pollution, and an extensive body of science links it to a range of serious and sometimes deadly illnesses.

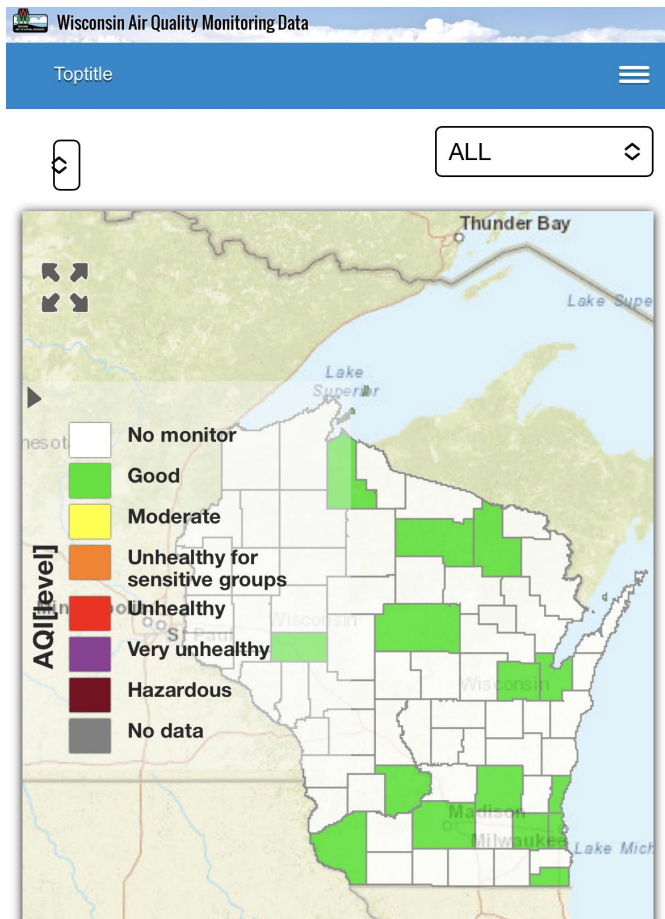
EPA is retaining the primary 24-hour PM_{2.5} standard at the level of 35 $\mu\text{g}/\text{m}^3$.



Size comparisons for PM particles



WI DNR Air Quality Monitoring Data

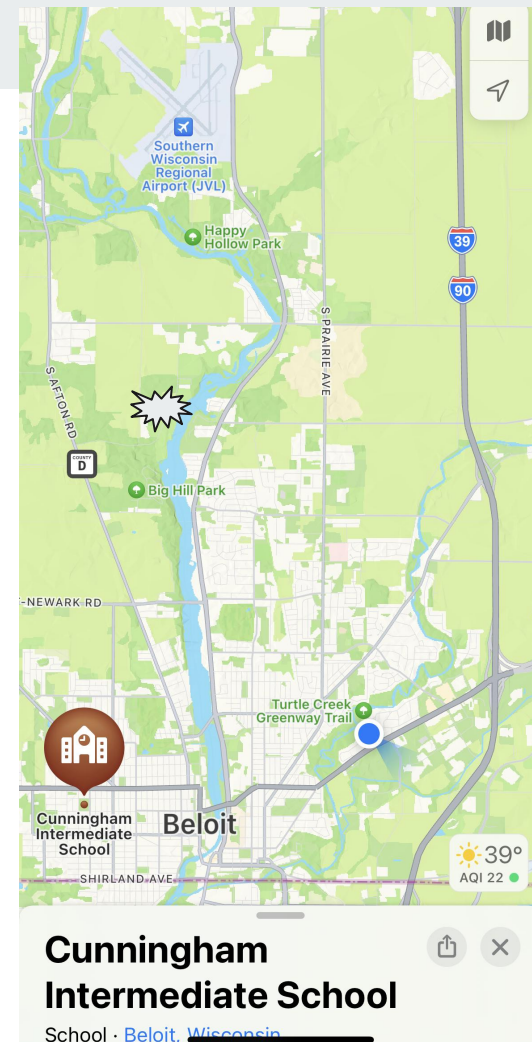


Rock County

One Monitor

Ozone: Seasonal

Airquality.wi.gov



“Think Global, Act Local.”

-Dr. Jane Goodall

Bridging Hope and Action:
The Jane Goodall Institute
Tapestry of Hope Map



MAPPING HOPE AND ACTION



<https://janegoodall.org/>

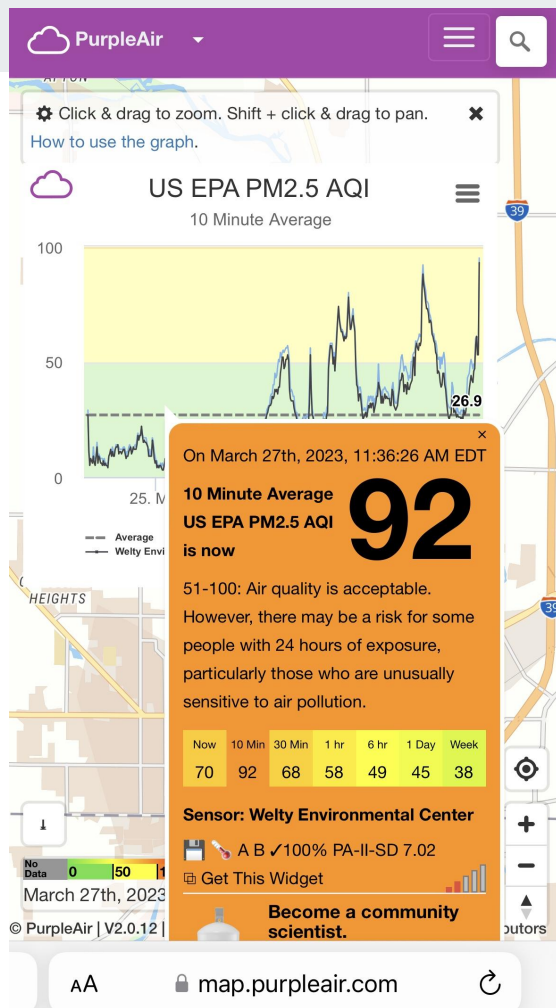


**PARTICULATE
MATTER**
IS A HEALTH ISSUE

Thriving Earth Exchange

Thriving Earth Exchange supports community science by helping communities find resources, project managers, and experts to address their pressing concerns.

Together they work to help communities be more empowered, resilient, and responsive.



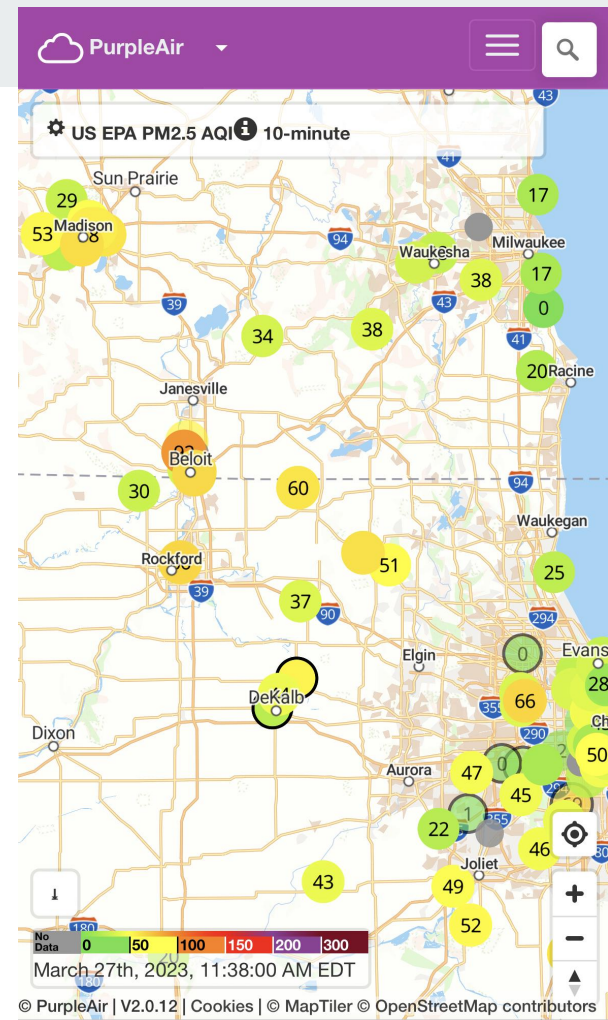
Results

Purpleair.com

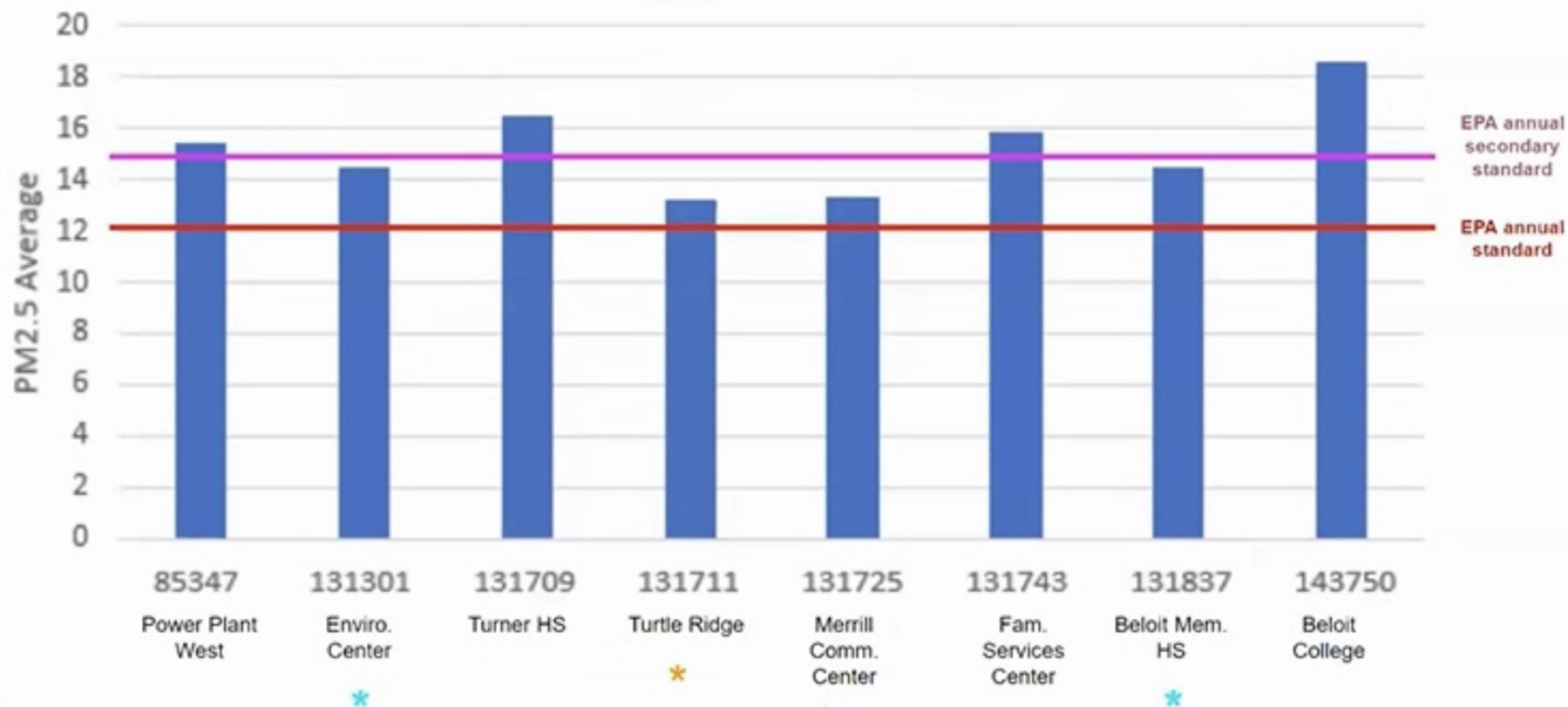
Directionality

Conclusions

<https://map.purpleair.com/1/mAQI/a10/p604/800/cC0#8.26/42.808/-89.223/0/0>



PM2.5 Averages

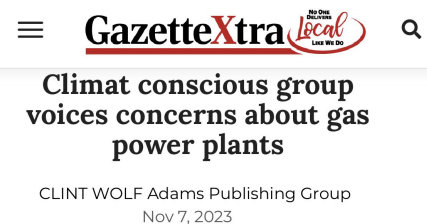


Community Outreach & Education

- Newspaper write up
- Health Conferences & Press Conferences
- Rotary & Community Presentations
- College & HS School Students
- Beloit City Council
- State & US Representatives



Pollution monitors in Beloit may give warning to those with respiratory conditions
beloitdailynews.com



Pablo Toral, chair of Environmental Studies at Beloit College, speaks during a news conference near the West Riverside Energy Center on Tuesday. Toral and others called for stricter regulations



**Healthy Climate
Wisconsin: Beloit health
experts and leaders
sound the alarm on the
dangerous health
impacts of gas plants
saying there's nothing
natural about gas**

Climate Vulnerability

<https://climatevulnerabilityindex.org/>



Overall score combines environmental, social, economic, and infrastructure effects on neighborhood level stability.

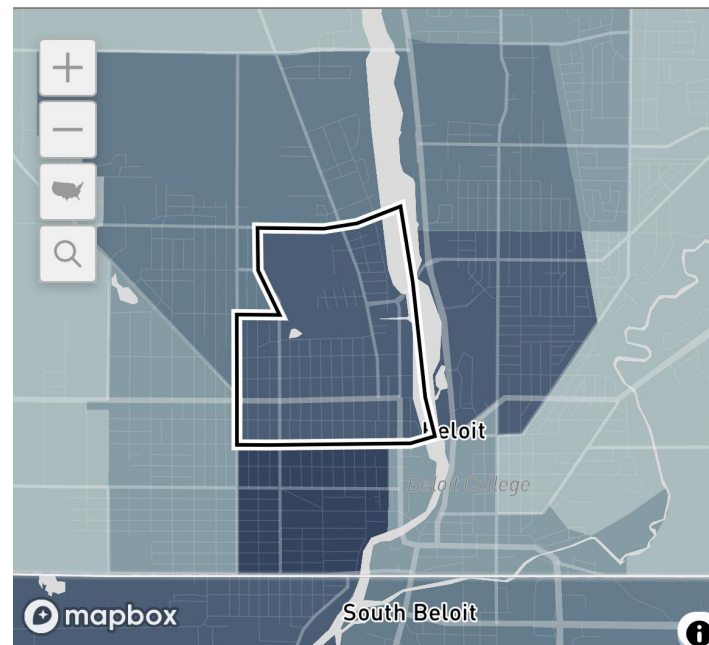
Beloit:
Ranks 2 out of 1,409 Tracts in Wisconsin

Highest Vulnerability
81st National Vulnerability Percentile

☰ The U.S. Climate Vulnerability Index



Overall Climate Vulnerability



Overall Climate Vulnerability

Score combining environmental, social, economic,

Cancer rates by county (2014-2018 annual averages)

Choose a cancer type >

All invasive cancers

Lowest
rates

Lower than
state median

Similar to
state median

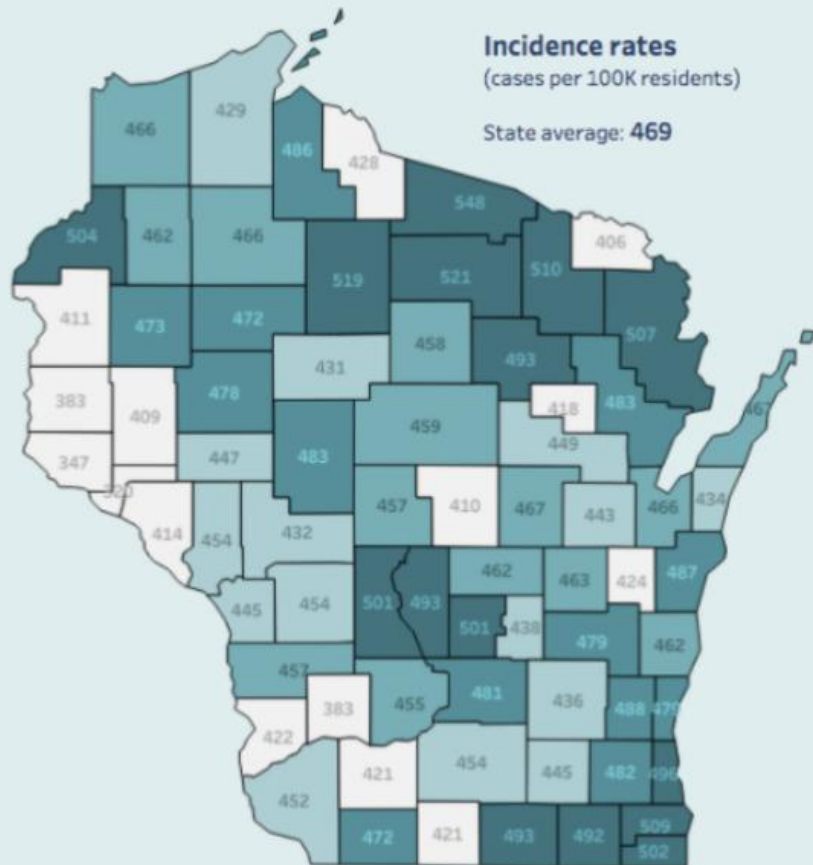
Higher than
state median

Highest
rates

Incidence rates

(cases per 100K residents)

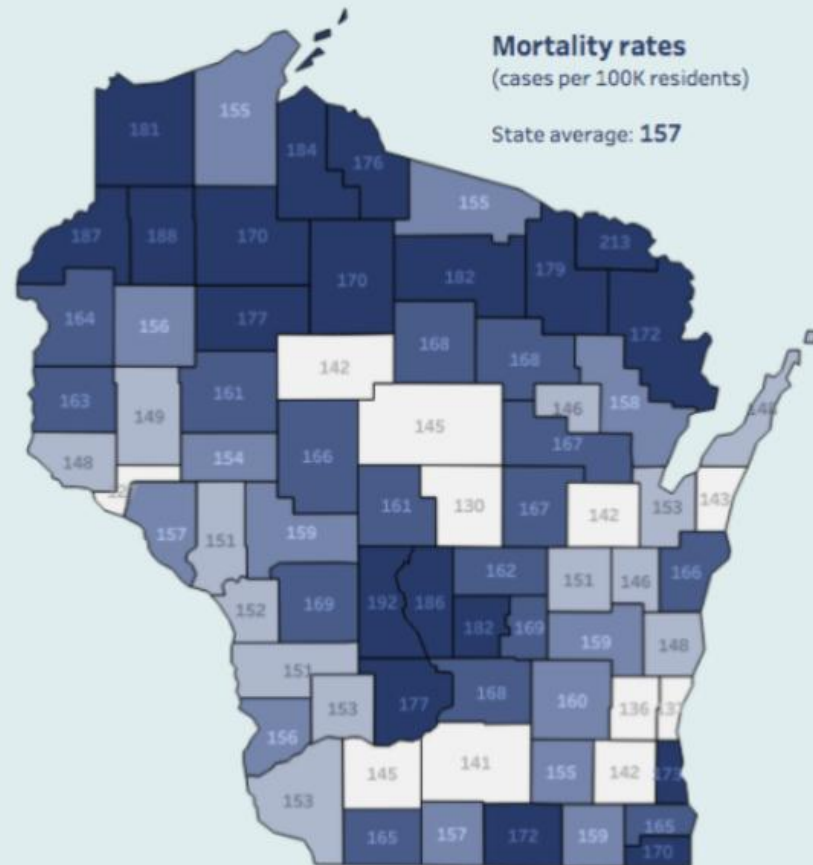
State average: 469



Mortality rates

(cases per 100K residents)

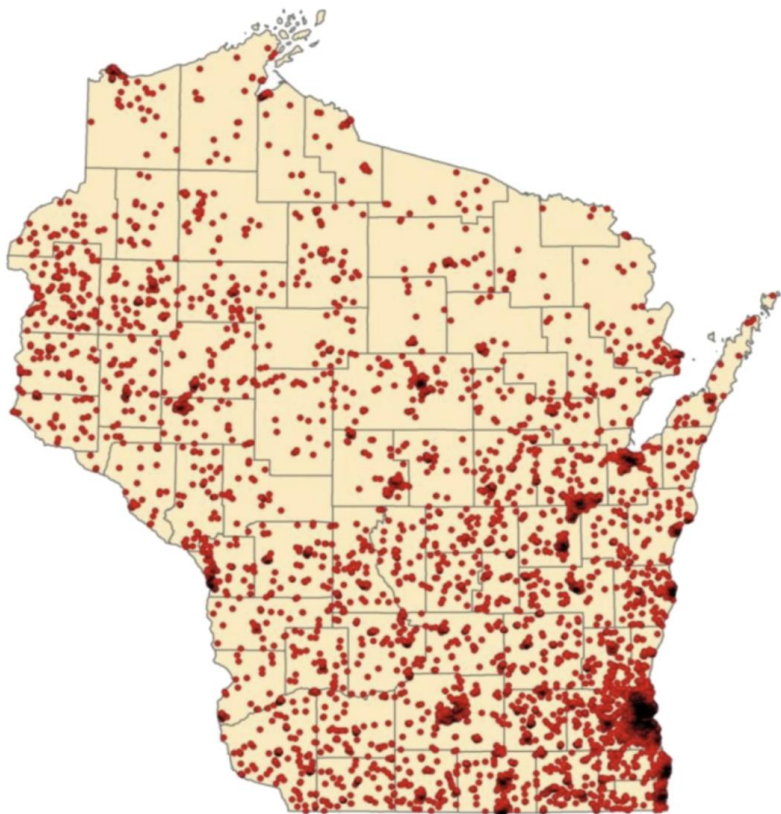
State average: 157



Lead poisoning in Wisconsin

From 1996-2016 more than 200,000 children have been diagnosed as lead-poisoned.

Each red dot represents an address associated with a lead-poisoned child.



Source: Wisconsin Department of Health Services, Wisconsin Blood Lead Testing Data



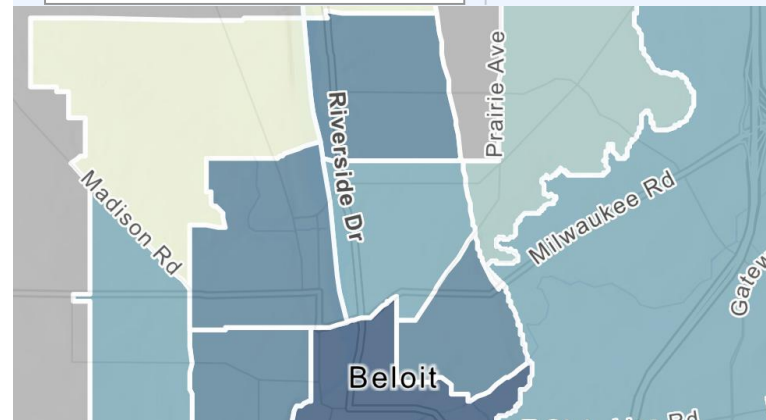
Select a Map

Percent Poisoned



Compare Map

Off ☐ On



Percent Poisoned | 2018-2021



Percent of children under 6 years old that were tested for lead and had a confirmed blood lead level of $\geq 5\mu\text{g/dL}$:

Census tract 15: 17.57% (total 13)

Rock County: 3.88% (total 236)

Wisconsin: 3.64% (total 11,139)

*Percentage calculations are based on total children <6 years of age that were tested for blood lead levels.

Overlapping Burdens



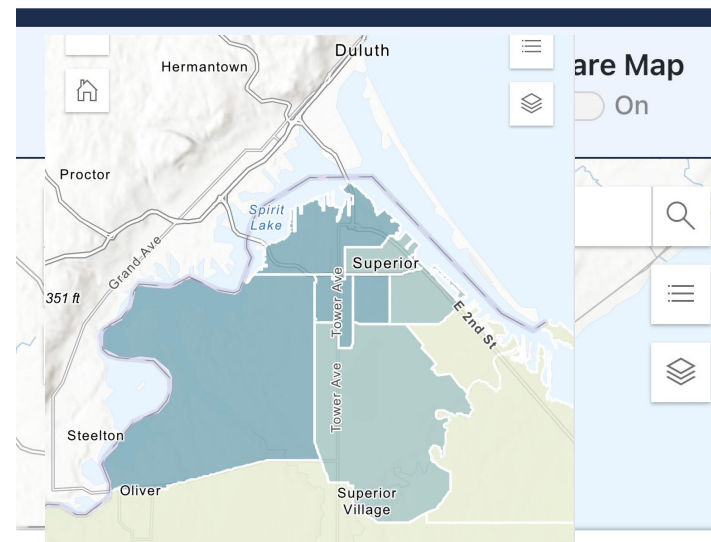
Air Pollution

Water Pollution

Brown Fields

Industrial Disasters

Communities coping with cumulative health risks have less resilience
to absorb additional industrial and environmental exposures



Percent Poisoned | 2018-2021

Percent of children under 6 years old that were tested for lead and had a confirmed blood lead level of $\geq 5\mu\text{g/dL}$:

Census tract 206: 4.63% (total 13)

Douglas County: 1.61% (total 41)

Wisconsin: 3.64% (total 11,139)

*Percentage calculations are based on total children <6 years of age that were tested for blood lead levels.

Next Steps

- Expand monitoring
- Education and Public Awareness
- Build Community Coalitions
- Build Public Health Support
- Pursue Funding Opportunities
- Regulatory Action
- Advocacy and Prevention

COMMUNITY HEALTH FORUMS



Learn about the health impacts of the Nemadji Trail Energy Center

A one-hour panel of Wisconsin health professionals and tribal leaders, followed by an optional Q&A session.

Forum Dates and Times

Tuesday, February 20
4:30 PM

Wednesday, February 21
12 PM (Noon)

Attend In-Person or Online

Superior Public Library
1530 Tower Ave, Superior, WI

Zoom link provided after registering

LWV LEAGUE OF WOMEN VOTERS **HEALTHY CLIMATE MOVEMENT**



Summary


- Climate Change/Global Warming is breaching +1.5C
 - Local air pollution levels in Beloit and Rock County are amongst the highest, regionally and nationally
 - Gateway to Wisconsin or Pollution Haven?
-
- No safe level of PM2.5 when it comes to human health
 - Air pollution is harmful across the lifespan
 - Air pollution leads to poor educational outcomes
 - Communities with higher Environmental Vulnerability have less bandwidth to absorb additional environmental pollutants

There are steps we can take!!

Together - we can make a difference.



Resources

- 
1. “Investigating the potential air quality impacts of natural gas plant emissions on community health in Beloit, Wisconsin.” Thriving Earth Exchange, AGU. <https://thrivingearthexchange.org/project/beloit-wi/>
 2. “New WHO Global Air Quality Guidelines aim to save millions of lives from air pollution.” WHO. <https://www.who.int/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution>
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Thank you



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