

Seeing the Invisible:
Sensing Wonder, Health and Danger
in the Air of Uncertainty

Imhotep STEM Week
Afrofuturism:
Honoring Our Past, Present, and Future in STEM
March 6, 2023

Introducing Myself

Craig Johnson

AIR

Air is a gas.
We can't see Air, that's true,
But, often we feel Air,
In the things that we do.

Air keeps up a kite,
Air fills up a bubble,
And, without Air to breathe,
We would be in big trouble.

BREATH

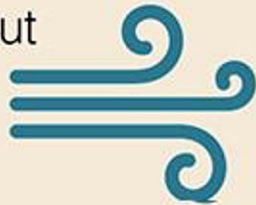
Survival and the Rule of 3

« YOU CAN »
SURVIVE

3 MINUTES

without

AIR



3 DAYS

without

WATER



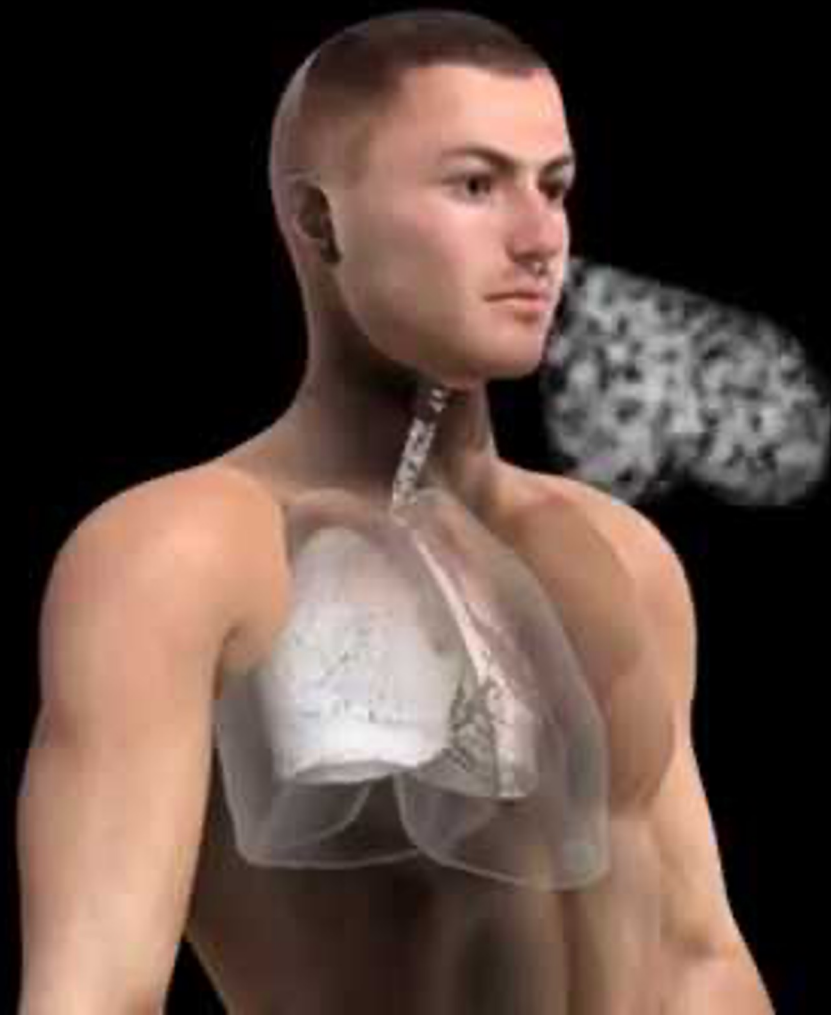
30 DAYS

without

FOOD



5:00



Question

How many times on average do we breathe each day?

Question

How many times on average do we breathe each day?

- A. 5,000 times a day
- B. 10,000 times a day
- C. 20,000 times a day
- D. 60,000 times a day
- E. 90,000 times a day

Answer

On average we breathe 15 times a minute, and about 60,000 times a day.

Question

How many gallons of air do we breathe each day?

Question

How many gallons of air do we breathe each day?

- A. 200 gallons of air a day
- B. 500 gallons of air a day
- C. 1,000 gallons of air a day
- D. 2,000 gallons of air a day
- E. 8,000 gallons of air a day

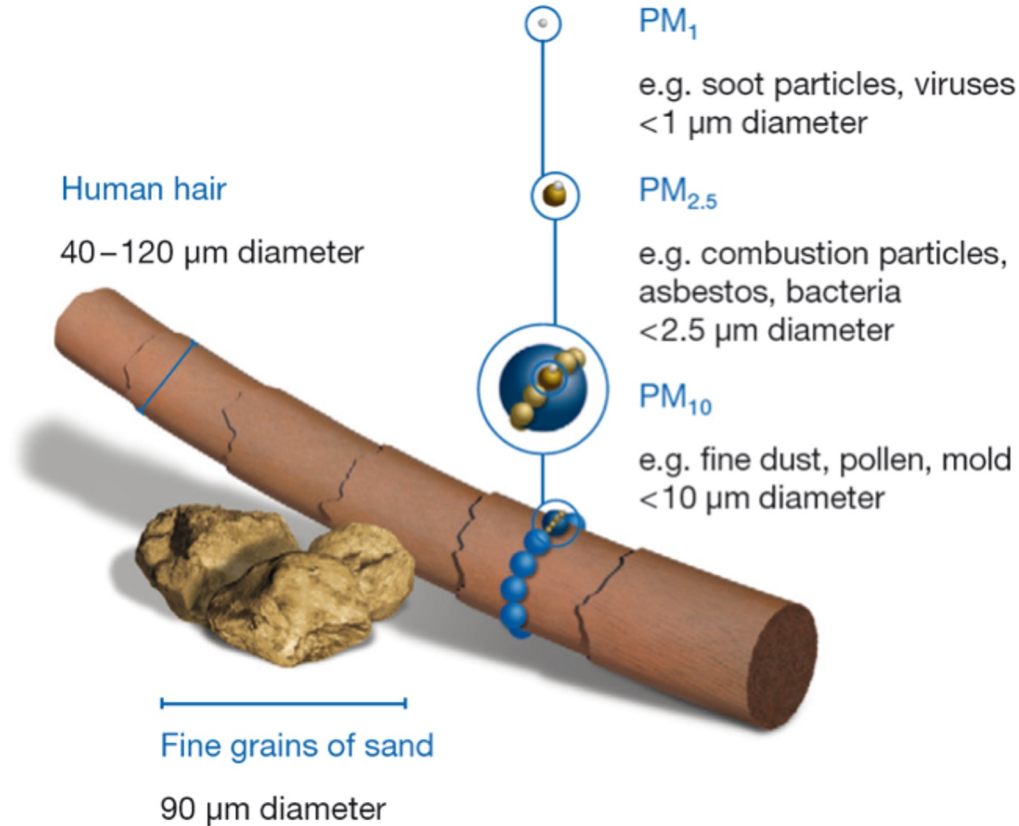
Answer

(D) ... Every day, most of us breathe in over 2,000 gallons of air—

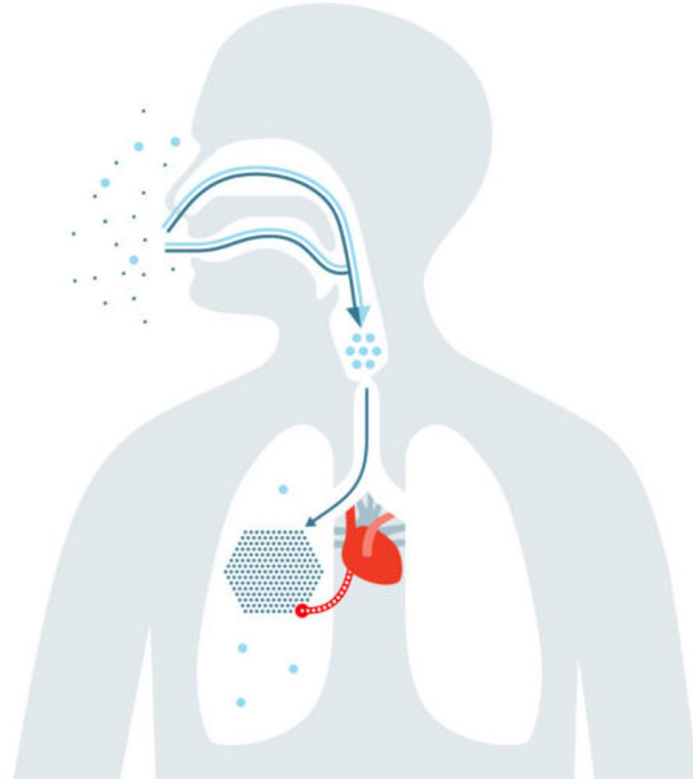
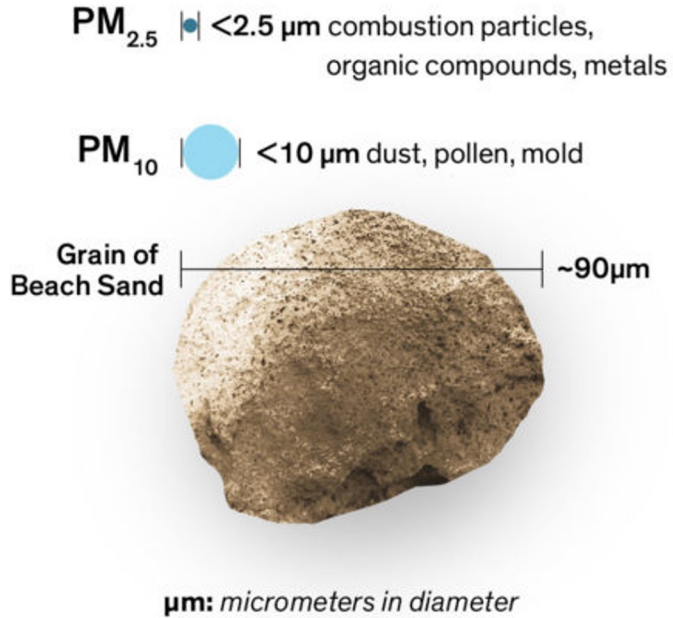


TOXINS

Air Particulates



Air Particulates



PM10

COARSE PARTICLES

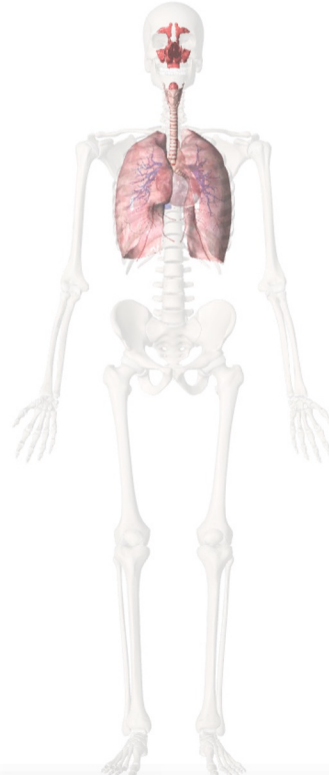
Pollen
Wood burning
Dust
Construction
Fireworks
Road traffic



PM2.5 & PM1

FINE PARTICLES

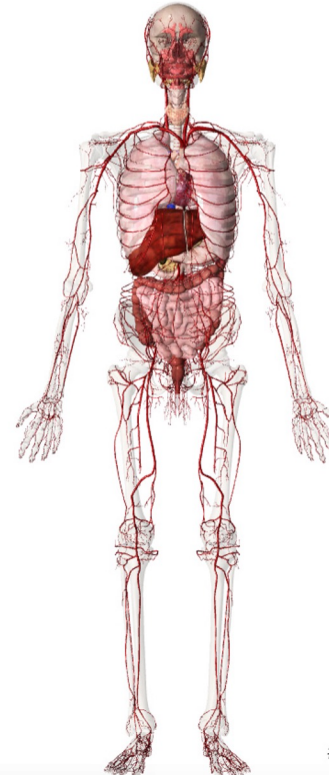
Wood burning
Car exhaust
Biomass
Agricultural burning
Fireworks
Cooking
Bacteria & Fungi



PM0.1

ULTRAFINE PARTICLES

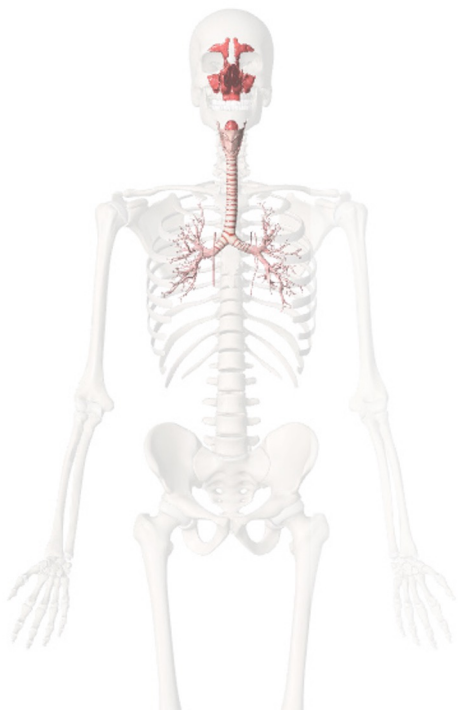
Wood burning
Car exhaust
Biomass
Agricultural burning
Viruses



PM10

COARSE PARTICLES

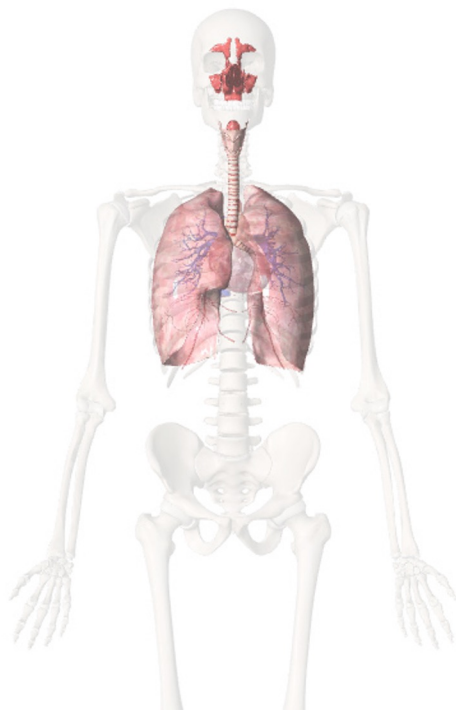
Pollen
Wood burning
Dust
Construction
Fireworks
Road traffic



PM2.5 & PM1

FINE PARTICLES

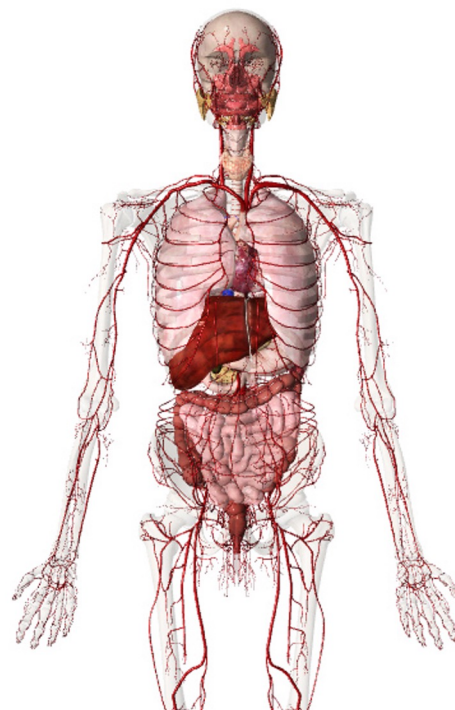
Wood burning
Car exhaust
Biomass
Agricultural burning
Fireworks
Cooking
Bacteria & Fungi



PM0.1

ULTRAFINE PARTICLES

Wood burning
Car exhaust
Biomass
Agricultural burning
Viruses



SENSING

COVID-19 Design Aid: Outdoor Classrooms

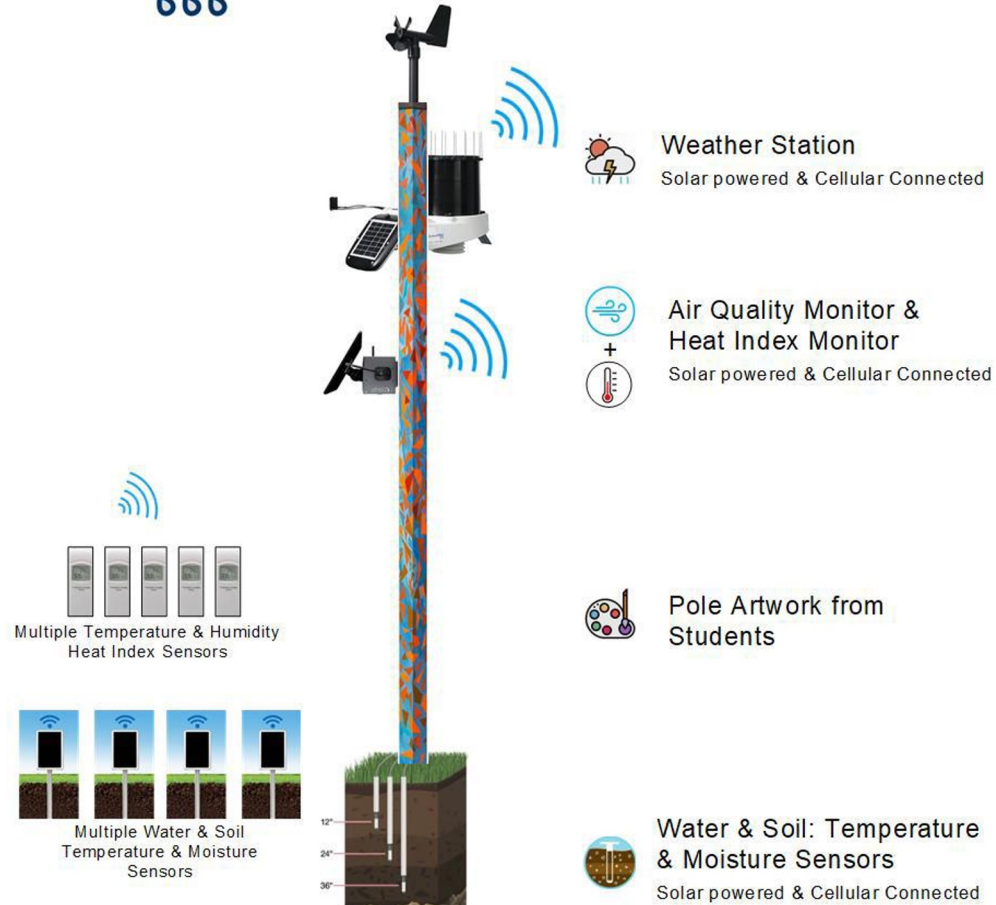


COVID-19 Environmental Sensing Outdoor Classrooms





Sensing Station for Schools



Air Quality Monitor



Advanced Station



Basic Station



Mobile Station

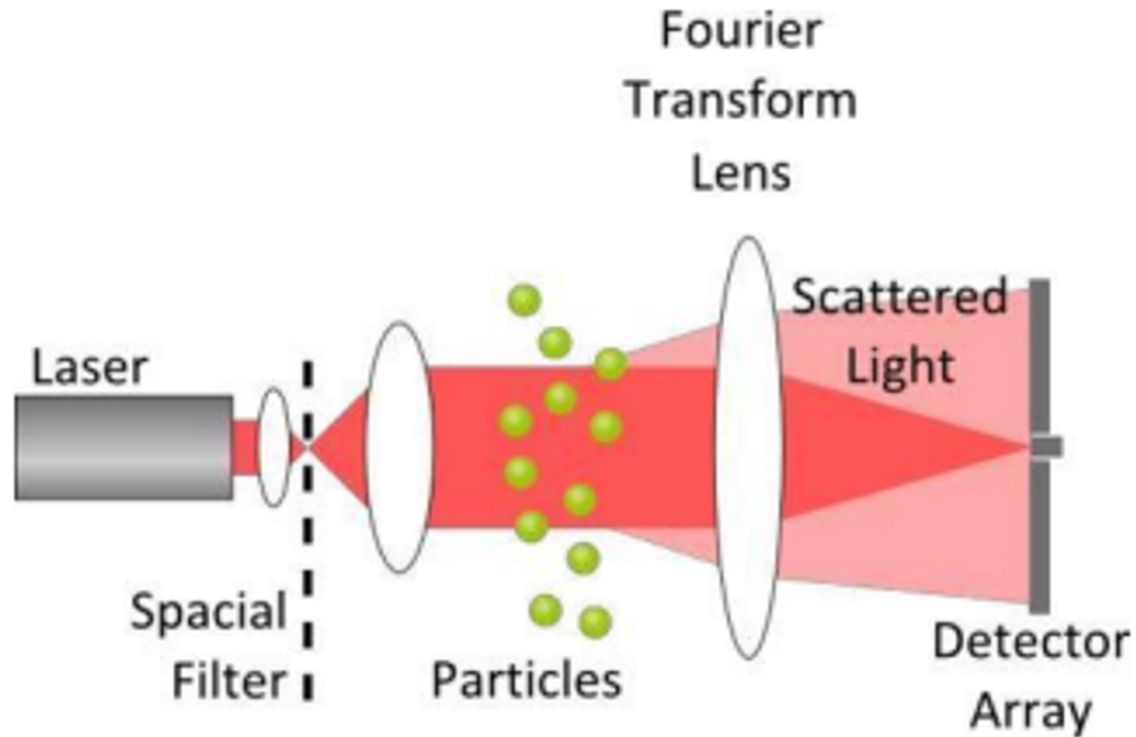


MEASURING

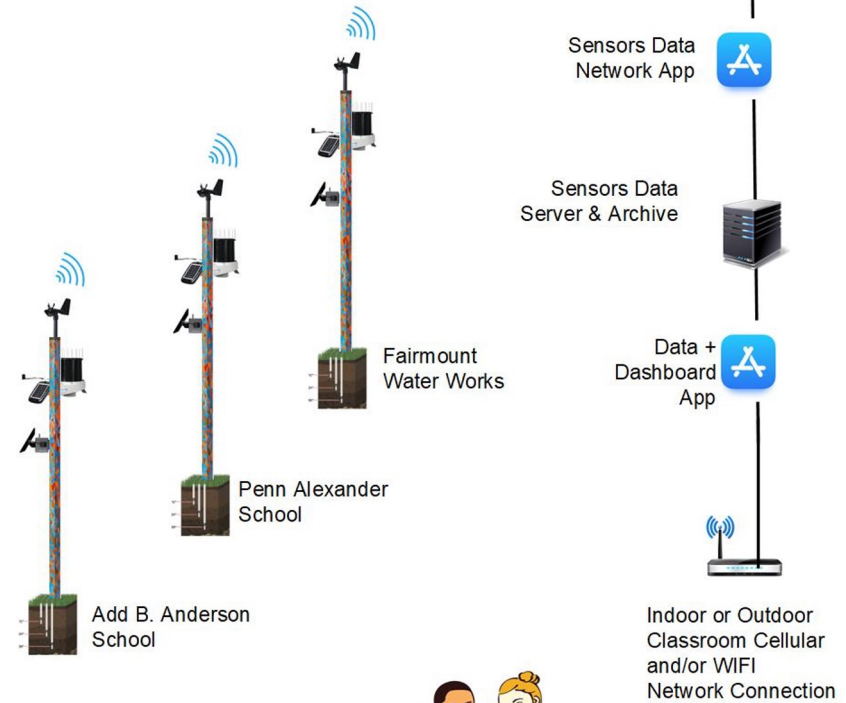
AirNote Air Quality Monitor



Measuring Air Particulates

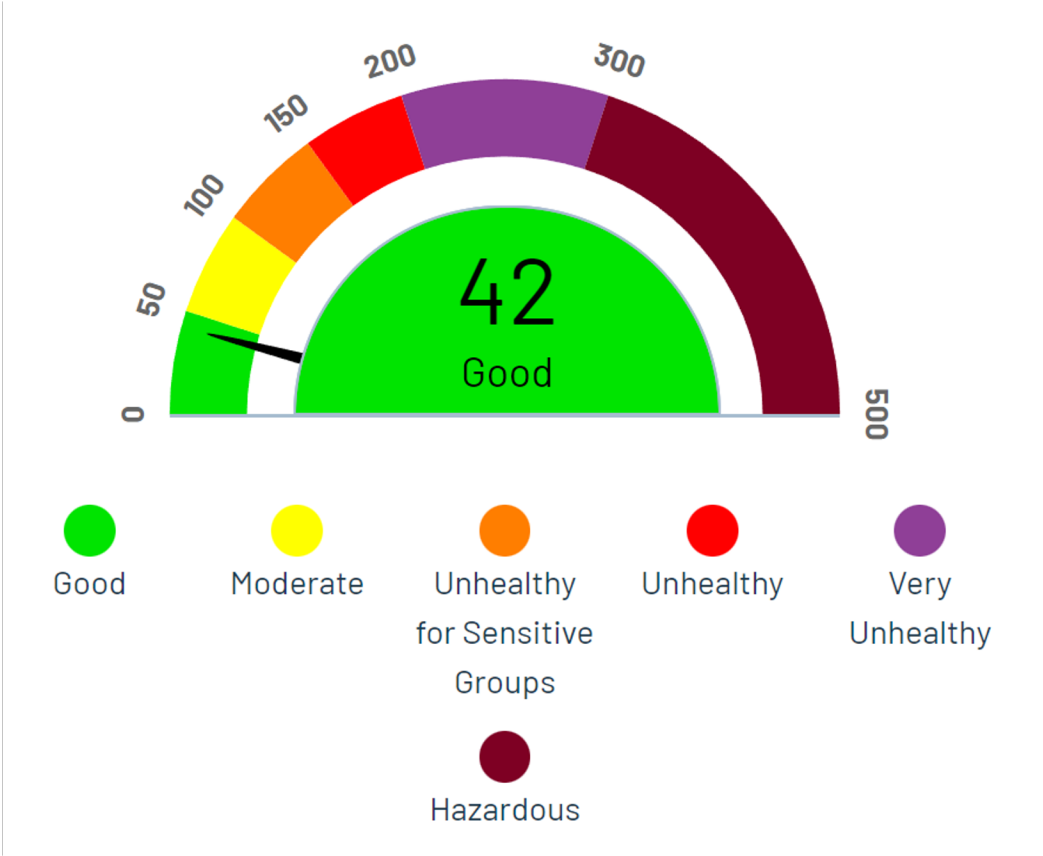


Sensing Station for Schools

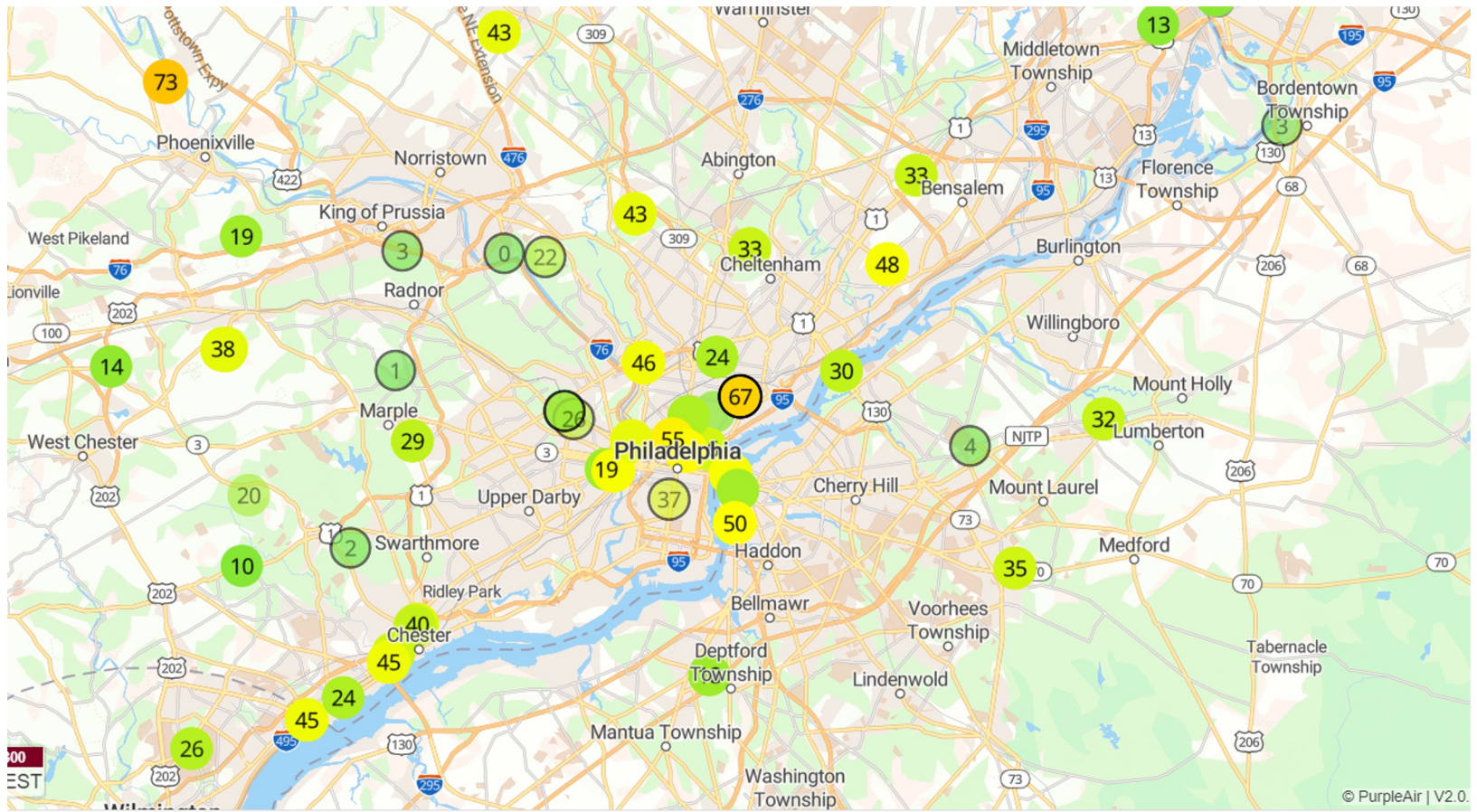


aqi	csecs	c00_30	c00_50	c01_00	c02_50	c05_00	c10_00	pm01_0	pm02_5	pm10_0	sensor	voltage	csamples	humidity	pressure	aqi_level
181	60	29530	6363	47	14	11	2	110.8421	113.192986	125.14035	pms7003	4.1445312	57	49.401104	100867.625	unhealthy
132	60	10385	2281	10	6	1		45.212765	48.12766	50.638298	pms7003	4.1484375	47	47.461178	100860.805	unhealthy-if-sensitive
809	60	20619	4565	93	12	10		807.9434	808.84906	814.9434	pms7003	4.1445312	53	48.338963	100886.96	very-hazardous
96	60	7593	1587	17	10	2		29.14035	33.57895	36.31579	pms7003	4.1484375	57	49.27998	100902.39	moderate
187	60	29295	6814	109	8	2	1	120.37037	125.35185	132.11111	pms7003	4.1445312	54	45.89994	100930.19	unhealthy
85	60	6567	1096	13	13	2		22.906977		32.395328	pms7003	4.1445312	43	44.619507	100941.586	moderate
2981	60	20277	4712	95	8	3		2980.3333	2981.3555	2982.3555	pms7003	4.1445312	45	42.957798	100988.52	very-hazardous
1650	60	15018	3192	62	12	5	2	1648.8572	1649.7858	1651.1666	pms7003	4.1445312	42	43.246815	101024.61	very-hazardous
178	60	25491	5843	40	7	5		103.73684	107.192986	116.38596	pms7003	4.1484375	57	44.7944	101030.85	unhealthy
167	60	19089	4498	42	7	2		81.76363	86.34545	90.818184	pms7003	4.1445312	55	47.158367	101033.51	unhealthy

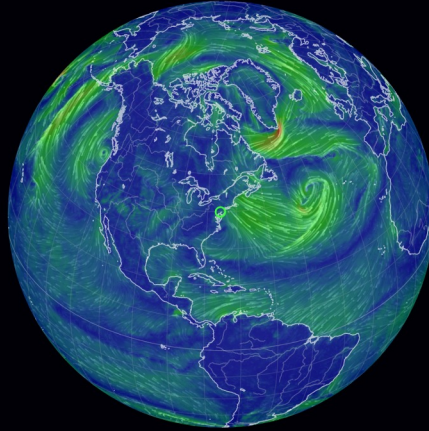
VISUALIZING



<https://airnote.live/dev:864475044227832/dashboard>



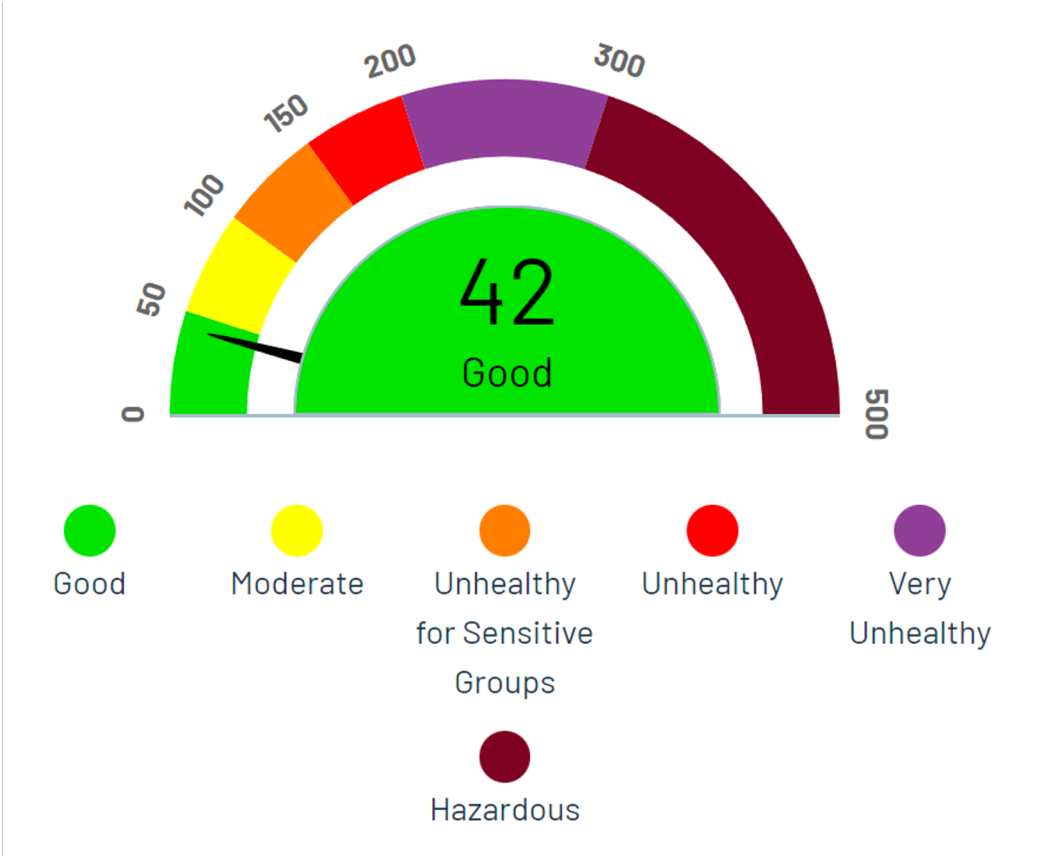
<https://map.purpleair.com/1/mAQI/a10/p604800/cC0#8.31/39.976/-75.229>



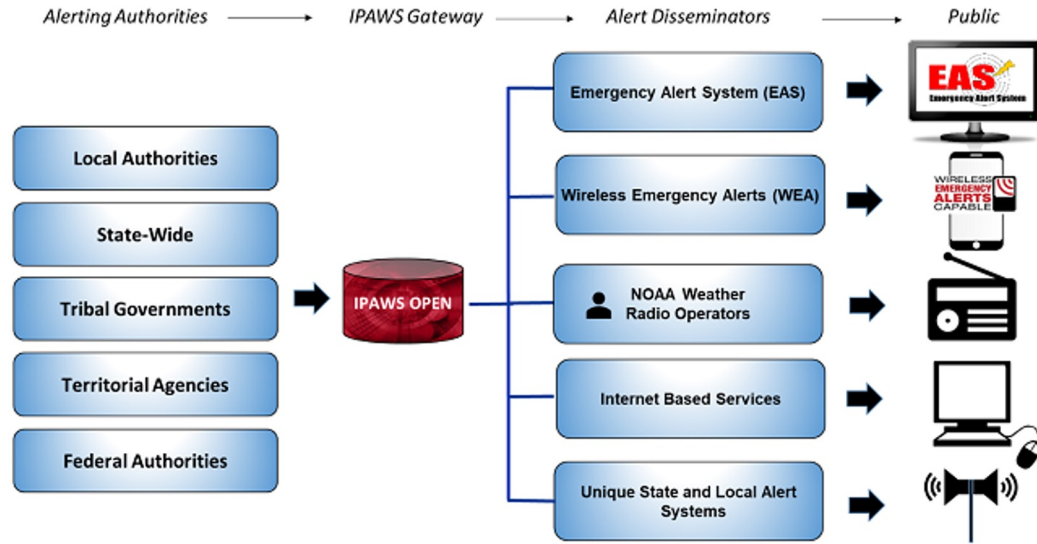
39.93° N, 75.57° W ×
345° @ 26 km/h
earth =

[Earth Nullschool](#)

ALERTS



<https://airnote.live/dev:864475044227832/dashboard>



The Integrated Public Alert and Warning System Open Platform for Emergency Networks (IPAWS-OPEN) receives and authenticates messages transmitted by alerting authorities. IPAWS-OPEN then routes the messages to IPAWS communications pathways. Software and hardware developers are creating IPAWS-OPEN-compatible alert origination and dissemination tools that allow messages to travel to the public via radio, television, cellular phone, National Oceanic and Atmospheric Administration Weather Radio, internet-based and other dissemination systems.

EXAMPLE



LIVE

**BREAKING
NEWS**

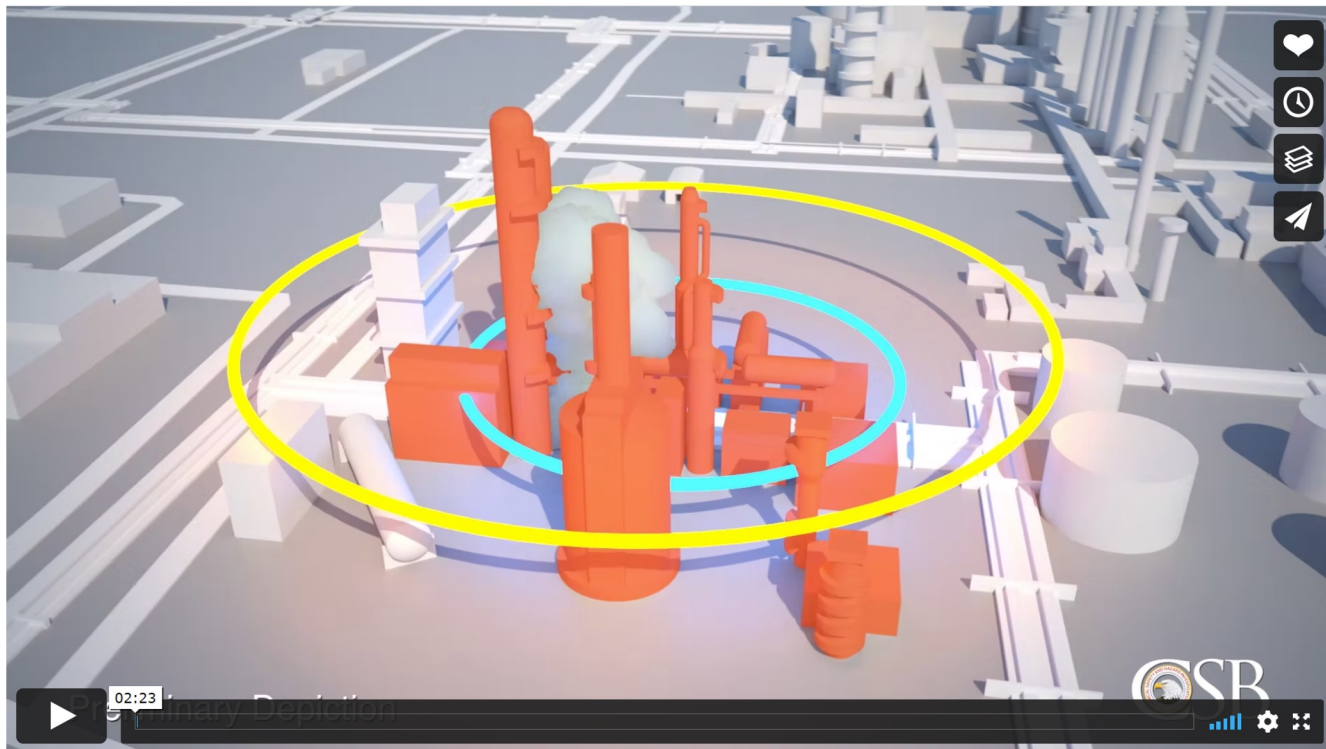
**MASSIVE REFINERY FIRE
NEAR PHILADELPHIA**

CNBC

South Philadelphia: June 21, 2019

DRAFT

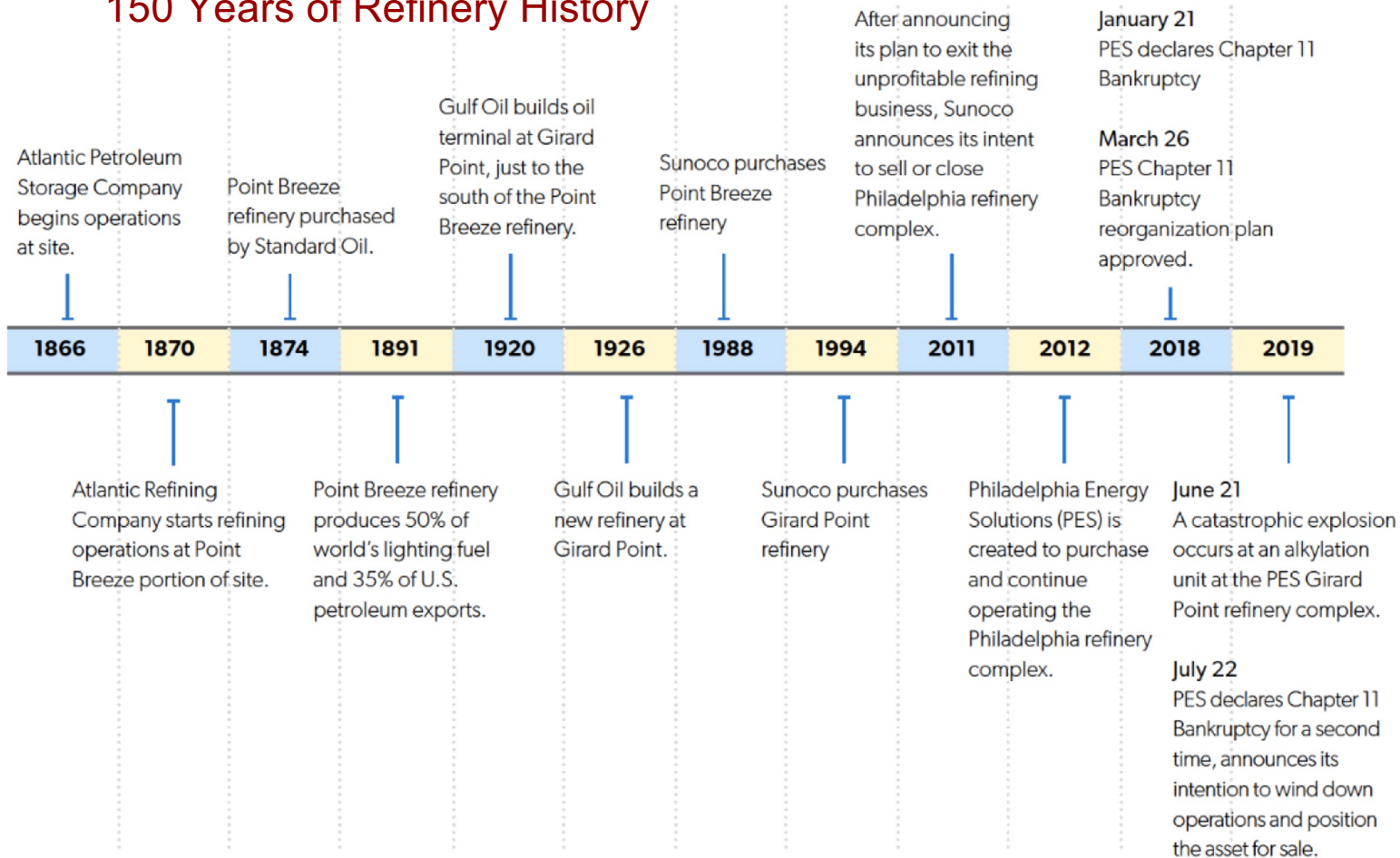
Animation of PES Explosion: June 21, 2019



https://vimeo.com/366764121?embedded=true&source=vimeo_logo&owner=69774189

Chemical Safety Board animation of the Philadelphia Energy Solutions refinery explosion and fire on June 21, 2019.

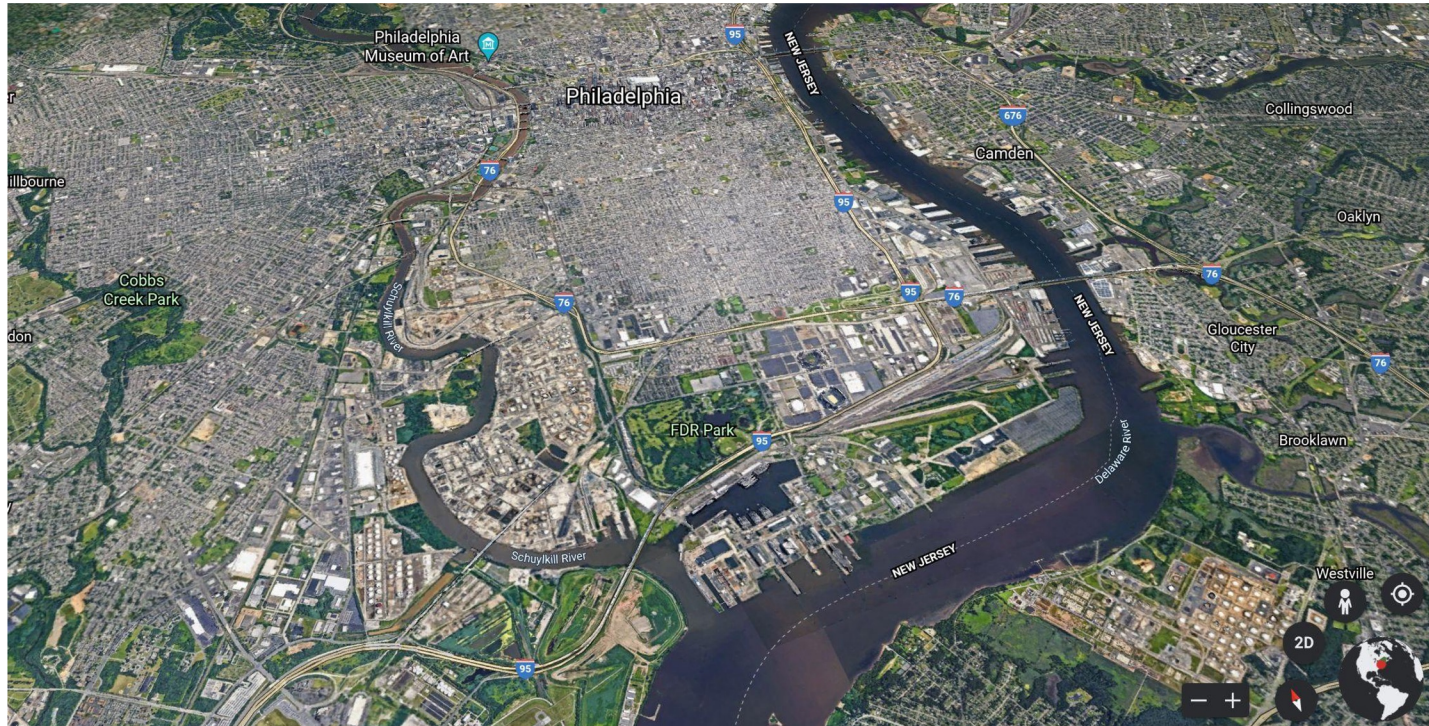
150 Years of Refinery History



Catastrophic Fire and Explosions at Refinery: June 21, 2019



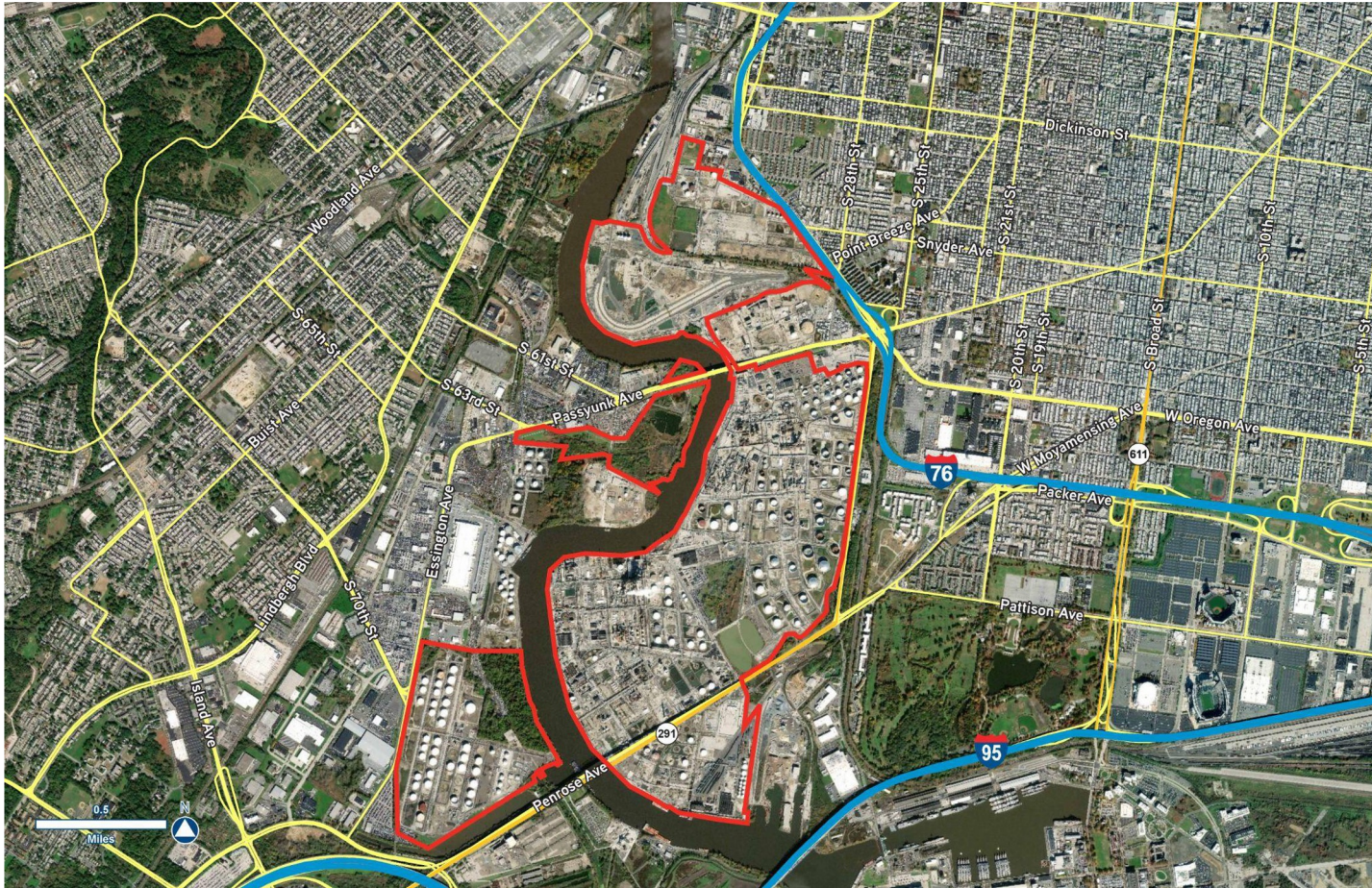
Lower Schuylkill Watershed and Landscape



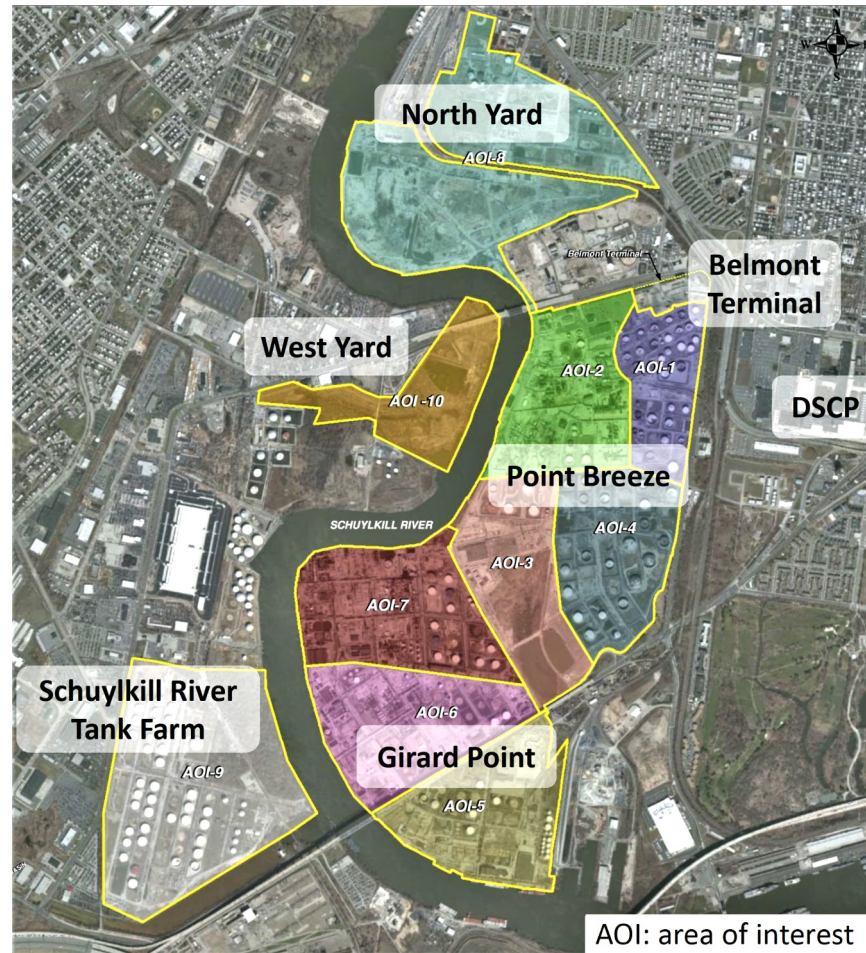
Click Below for GOOGLE EARTH VIEW

<https://earth.google.com/web/search/bartrums+garden+philadelphia/@39.91015462,-75.18769499,6.92587148a,12354.11362718d,35y,23.86715371h,43.68762703t,-0r/data=CigiJgokCYjFt9tk9TNAEYjFt9tk9TPAGS43zihoQTpAIVM1i9SMxFLA>

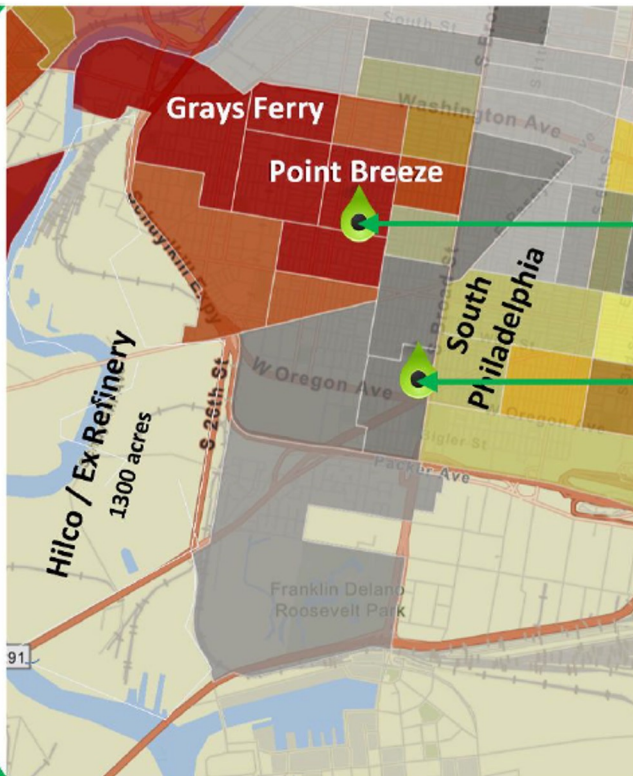
HRP: 1,300 Acres



HRP: 1,300 Acres



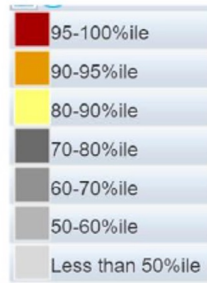
Community Air Monitoring Project



Philly Thrive
Community Engagement
HQ location

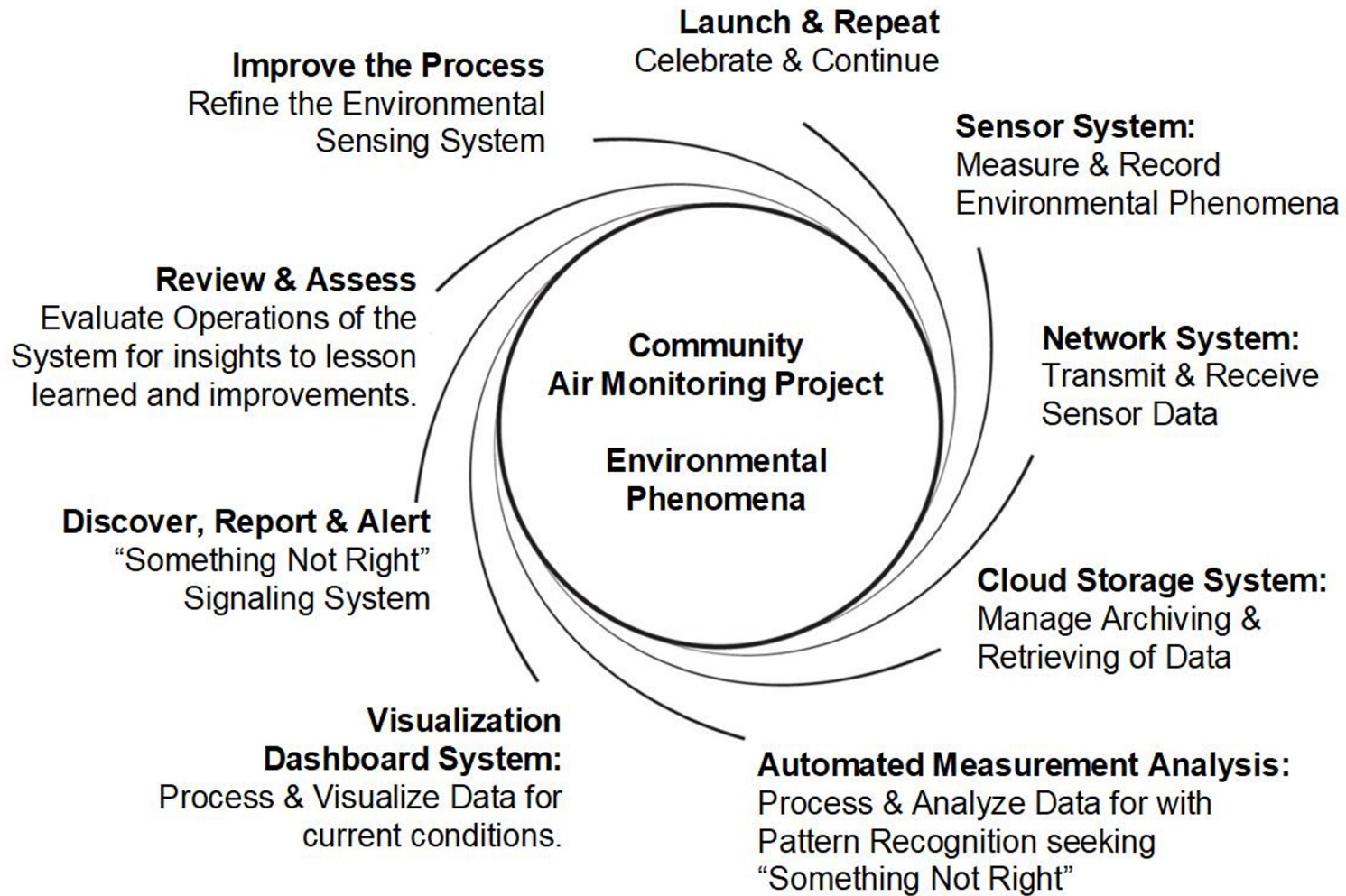


AQM AMS
City of Philadelphia
Monitoring location



LEGEND:
Sum of the percentile
Of the highest asthma
rates and lowest
life expectancy rates
compared to
national averages.

SOLUTIONS



ACTION

Seeing the Invisible:
Sensing Health, Wonder and Danger
In an Age of Transformation

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