TULSA URBAN DATA PIONEERS

Report of the

Air Quality Sensor Placement Project Team


MISSION

The Tulsa Urban Data Pioneers
Air Quality Sensor Placement Project Mission

Determine for each of Tulsa's nine (9) Council Districts (CDs)

The optimum areas for placing two (2) $PM_{2.5}$ Air Quality Sensors, with

★ ***one area being in close proximity to at least one significant source of $PM_{2.5}$ pollution***

★ ***and the other being remote from significant $PM_{2.5}$ pollution sources.***


PURPOSE

The Tulsa Urban Data Pioneers
Air Quality Sensor Placement Project Purpose

Determine whether there are significant differences

in residential exposure to $PM_{2.5}$ pollution

★ ***Among Tulsa's nine (9) City Council Districts (CD), and***

★ ***within each CD, between locations***

- **In close proximity to at least one significant source of PM2.5 pollution, and**
- **Those remote from PM2.5 pollution sources**

Rationale

EXPOSURE to $PM_{2.5}$ POLLUTION IS HAZARDOUS

★ **People exposed to $PM_{2.5}$ pollution are at significant risk of suffering health problems and <u>premature death</u>**

★ **Recent studies have revealed that**

- ***Health risks associated with exposure to PM2.5 pollution are significant***
- ***Even at concentration levels below current regulatory standards.***

TULSA SHOULD BE CONCERNED

- ★ Tulsa's PM2.5 pollution levels are above the levels recent studies have associated with significant health risks.
- ★ Tulsa's annual average PM2.5 pollution level is above the annual average PM2.5 pollution level across 500 U.S. Cities.
- ★ In 2018, Tulsa was among 26 large and small urban areas with more than 100 days of elevated PM2.5 pollution levels.

SOME COMMUNITIES ARE DISPROPORTIONATELY AFFECTED BY $PM_{2.5}$ POLLUTION

★ **Children, older adults, and people suffering from heart or lung disease**

★ **People of color and socioeconomically disadvantaged communities**

- ***are more likely than others***
- ***to be closer to significant sources of PM2.5 pollution***

CURRENTLY, IT'S DIFFICULT TO DETECT DIFFERENCES IN RESIDENTIAL EXPOSURE TO $PM_{2.5}$ POLLUTION

- ★ **Only two (2) air quality monitors capable of measuring $PM_{2.5}$ pollution levels are located in or near Tulsa**
  - ○ ***One in far North Tulsa***
  - ○ ***One South of Tulsa near Glenpool***
- ★ **So it's not presently possible to get granular $PM_{2.5}$ pollution measurements in various areas of Tulsa**


Methodology

CENSUS TRACTS (CTS) USED AS POTENTIAL $PM_{2.5}$ AIR QUALITY SENSOR PLACEMENT AREAS

- ★ **CT locations can be mapped in relation to locations of $PM_{2.5}$ pollution sources**
- ★ **Various databases provide useful information about people and things located within them**
- ★ **CTs with low population densities were eliminated**
  - ○ ***So the Project Team could focus on CTs where***
  - ○ ***Presence or absence of high PM2.5 pollution levels would have the greatest impact.***

POWER PLANTS, INDUSTRIAL SITES, TRUCKS, AND CARS ARE MAIN SOURCES OF PM2.5 POLLUTION

★ **The Project Team decided to focus on significant point sources PM2.5 pollution, which are those**

- ***With Operational Air Permits issued by the OK-DEQ***
- ***That emit at least 5 Tons of PM2.5 pollution annually***

★ **It discovered from the OK-DEQ's website that seven (7) such point sources were located in Tulsa**

CD	$PM_{2.5}$ Pollution Emitters	T/yr	Address
2	Holly Frontier Tulsa Refining	67.10	3333 Southwest Blvd.
2	Hollyfrontier Tulsa Refining	44.74	1700 S. Yukon
1	Universal Sandblasting & Coating	44.00	1800 S. 49th W. Ave
2	PSO-AEP Power Plant	14.21	3600 S. Elwood Ave.
3	Waste Management of Oklahoma	9.56	13720 E. 46th St. N.
3	Valmont Newmark	7.54	801 N. Xanthus Ave.
2	Covanta Tulsa Renewable Energy	5.00	2122 S. Yukon Ave.

Major Routes	Crosstown Expressway	Skelly Drive	Creek Turnpike	BA Expressway
Interstate Highways	I244	I44	Hidden I444	
US Highways	US64	US75	US169	US412
Expressway / Parkway	Gilcrease	LL Tisdale		
Tulsa Streets	Riverside Drive	Memorial Drive	71st St	

CRITERIA FOR EVALUATING CTs "CLOSE" TO $PM_{2.5}$ POLLUTION SOURCES

★ Distance from sources

★ # of PM2.5 sources nearby

★ Tons of PM2.5 Pollution emitted by sources

★ Whether CT is in northerly direction from source

(2019 Wind Data showed that Wind Blew most often from a southerly direction)

PROJECT TEAM USED INTUITIVE JUDGMENT TO SELECT SEMI-FINALIST CTs

★ **The Intuition: CTs closer to $PM_{2.5}$ point sources will be more affected than CTs more remote from those point sources.**

★ **Intuition was used because accurate information about emissions pathways was unavailable**

- ***Pathway Emissions are determined through expensive modeling or from Air Quality Regulators***
- ***Air Quality Regulators get pathway information from point sources, but only if their $PM_{2.5}$ emissions are $\geq$ 100 T/yr***
- ***None of the Tulsa $PM_{2.5}$ Point Sources emit 100 T/yr***

SEMI-FINALISTS WERE THEN EVALUATED ON HEALTH & SOCIO-ECONOMIC FACTORS

- ★ % of CT Residents with high blood pressure
- ★ Life expectancy of CT residents
- ★ % of children living poverty
- ★ Income inequality [(Top 20% HH - Bottom 20% HH) / Total HH] / 100]
- ★ Racial/Ethnic Diversity [0 means all residents are in 1 racial/ethnicity group, 100 means all racial/ethnicity groups are equally represented--The higher the score, the > the diversity]
- ★ Excessive Housing Cost [% of HH with housing costs ≥ 30% of HH income]

‘WINNING’ CTs CLOSE TO POLLUTION SOURCES

CD	CT	N	S	W	E
1	5.00	Apache	Pine	Peoria	US75
2	46.00	US75/ArkR	W 25th/W 23rd	US75	Jackson Ave/ArkR
3	16.00	Pine	Admiral Blvd	Yale Avenue	Sheridan Road
4	45.00	21st St	31st St	Riverside Dr	Peoria Ave
5	85.01	21st St	31st St	Memorial Dr	Mingo Road
6	90.04	31st St	41st St	US169	Garnett Road
7	76.17	61st St	71st St	Memorial Dr	Mingo Road
8	76.29	91st St	101st St	Sheridan Road	Memorial Dr
9	50.01	41st St	I44	Arkansas River	Peoria

HEALTH SOCIO-ECONOMIC FACTORS OF‘WINNING’ CTs

CD	CT	Hi Blood Pressure	Life Expectancy	Child Poverty	Income Inequality
1	5.00	50.80%	67.5	71.5%	-61.2
2	46.00	35.60%	74.1	74.2%	-53.6
3	16.00	39.70%	70.4	50.7%	-39.0
4	45.00	34.40%	81.2	18.8%	30.1
5	85.01	39.20%	72.5	42.4%	-21.1
6	90.04	33.00%	74.7	43.7%	-29.9
7	76.17	33.90%	78.9	30.7%	-27.0
8	76.29	29.10%	80.8	14.6%	5.0
9	50.01	32.60%	73.8	40.9%	-15.3

HEALTH SOCIO-ECONOMIC FACTORS OF'WINNING' CTs

CD	CT	Racial/Ethnic Diversity	> Housing Cost
1	5.00	52.1	42.8%
2	46.00	85.7	36.8%
3	16.00	77.9	44.5%
4	45.00	23.1	22.5%
5	73.04	76.3	26.7%
6	90.04	77.7	41.3%
7	76.17	82.1	47.0%
8	76.29	62.3	26.2%
9	50.01	46.8	26.7%

CRITERIA FOR EVALUATING CTs "REMOTE" FROM $PM_{2.5}$ POLLUTION SOURCES

★ **Population Density**

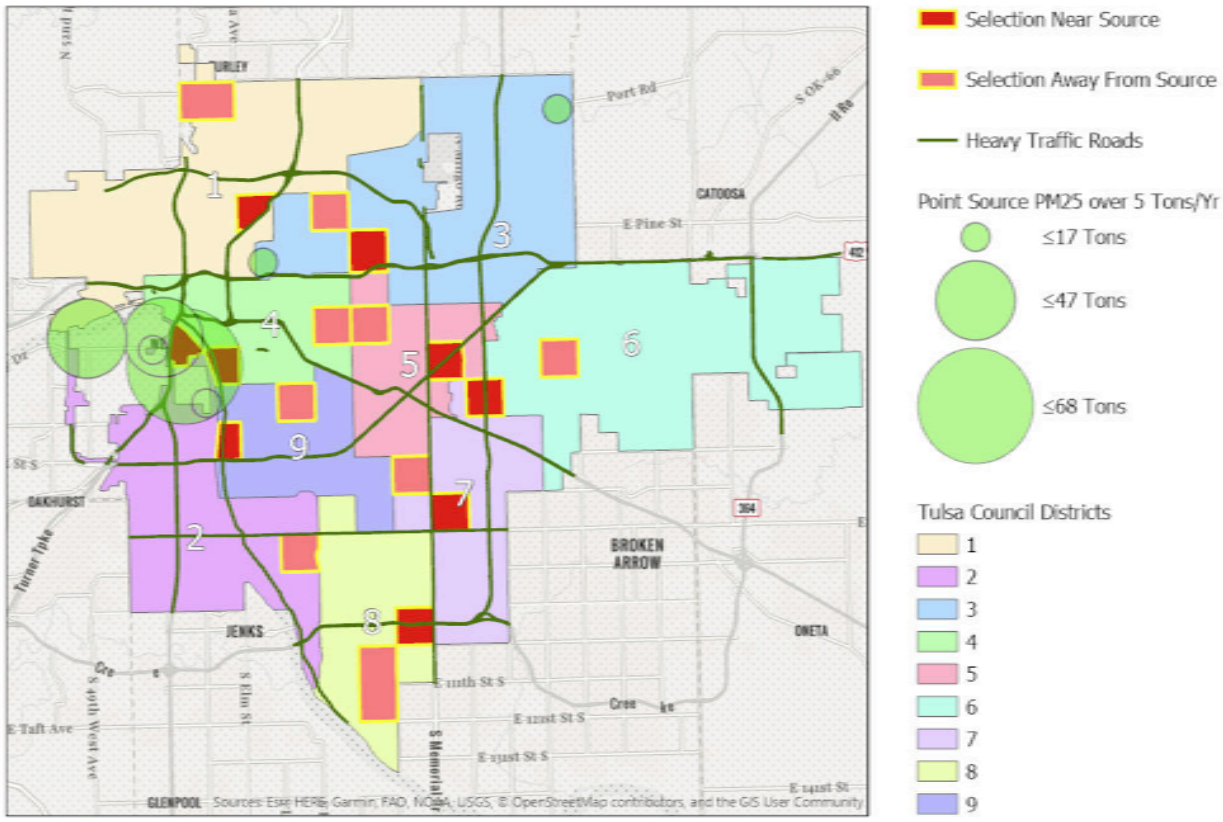
★ **Distance from Sources**

★ **Whether CT is in southerly direction from source**

(2019 Wind Data showed that Wind Blew most often from a southerly direction)

‘WINNING’ CTs REMOTE FROM POLLUTION SOURCES

CD	CT	N	S	W	E
1	79.00	56th St N	46th St N	Osage Drive	Peoria
2	76.12	71st St	81st St	Lewis Avenue	Harvard Avenue
3	3.00	Xyler St	Pine St/Ute	Harvard Avenue	Oswego/Pittsburg
4	37.00	11th St	21st St	Harvard Avenue	Yale Avenue
5	38.00	11th St	21st St	Yale Avenue	Sheridan Road
6	73.12	21st St	31st St	129th E Avenue	145th E Avenue
7	69.03	51st St	61st St	Sheridan Road	Memorial Drive
8	76.37	101st St	121st St	Yale Avenue	Sheridan Road
9	41.01	31st St	41st St	Lewis Avenue	Harvard Avenue


Selection Near Source
Selection Away From Source
Heavy Traffic Roads
Point Source PM25 over 5 Tons/Yr
≤17 Tons
≤47 Tons
≤68 Tons
Tulsa Council Districts
1
2
3
4
5
6
7
8
9
LIRLEY
Port Rd
CATOOSA
E Pine St
OAKHURST
BROKEN ARROW
JENKS
ONETA
GLENPOOL
E Taft Ave
Turner Tpke
Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Air Quality Sensor Recommendation

PurpleAir Air Quality Sensor

- ★ **Reasonable Price: $229**
- ★ **High Accuracy Relative to Competitors** (see http://www.aqmd.gov/aq-spec/evaluations/summary-pm)
- ★ **Real-Time PM2.5 Measurement**
- ★ **Built in Wifi enabling**
  - **Storage & Retrieval**
  - **Transmission to**
    - **Smart Devices**
    - **PurpleAir 24/7 Map**


NEXT
STEPS

- ★ **Acquire 18 PurpleAir PA-II Air Quality Sensors**
- ★ **Install Sensors after Selecting Appropriate Sites**
  - ***Must be secure***
  - ***Must provide electricity 24/7***
  - ***Must provide WiFi interconnection 24/7***
- ★ **Collect Sensor Data for at least 1 Year**
- ★ **Compare PM2.5 Data Sensors**
- ★ **Determine the Significance of the Comparative Data for**
  - ***Policy Development***
  - ***Future Actions***