

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 132-E

Deploying New Technology to Understand Urban Air Pollution

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: \$ 981,564

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

This project will operate a network of 250 sensors at 50 sites to monitor 5 pollutants in each of the metro zip codes to understand urban air pollution variability.

Name: Monika Vadali

Sponsoring Organization: MPCA

Address: 520 Lafayette Rd
St.Paul MN 55155

Telephone Number: (651) 757-2776

Email monika.vadali@state.mn.us

Web Address _____

Location

Region: Metro

County Name: Hennepin, Ramsey

City / Township: Minneapolis - St.Paul

Alternate Text for Visual:

Example of one-site per zip code project design. The final site locations will be determined once the project is underway. This map is for illustration purposes only.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



PROJECT TITLE: DEPLOYING NEW TECHNOLOGY TO UNDERSTAND URBAN AIR POLLUTION

I. PROJECT STATEMENT

This project will deploy an innovative monitoring approach using new air sensor technology to increase understanding of the variability of harmful air pollutants in urban areas. The project will achieve three objectives:

1. Improve understanding of air pollution variability within densely populated areas. This information will be used to evaluate pollution reduction opportunities, and to compare with population vulnerability and health outcome data.
2. Evaluate the use of new technologies in air pollution sensors as an innovative, cost-effective monitoring strategy.
3. Expand the availability of ambient air quality data to inform decisions, especially regarding public health improvement opportunities.

The pollutants to be monitored are fine particles, ozone, nitrogen oxides, sulfur dioxide, and carbon monoxide. We will also collect data on wind speed, wind direction, temperature and relative humidity.

This project is needed because concern is rising about the effects of air pollution on human health, even at the levels seen in Minnesota. Of particular concern are urban areas where there are many sources of air pollution. For example, the recent Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Health (MDH) report *Life and Breath: How air pollution affects public health in the Twin Cities* showed that air pollution is associated with public health impacts such as premature death and hospitalizations.

Understanding small-scale differences in air pollution is essential to minimizing exposure to harmful air pollutants, particularly among vulnerable communities such as communities of concentrated race or poverty. Traditional air monitoring methods are cost-prohibitive to deploy at the level of coverage needed to investigate this important question. New, lower-cost sensors that measure air pollutants of concern are now available. Use of these sensors will allow MPCA to locate more monitors in a given area to answer the question about small-scale differences.

This project will purchase, deploy, and operate a network of 250 air pollution sensors at 50 sites (5 sensors per site). This will provide one site in each zip code of St. Paul and Minneapolis. The cities of Minneapolis and St. Paul, MDH, and local public health advocates all have a strong interest in the approach this project describes, and the data that will be generated. Additionally, a special emphasis will be placed on sharing the data with the public. While data collection will be focused on Minneapolis and St. Paul, the project will evaluate a monitoring strategy that can be used in other parts of Minnesota. The data may also benefit other efforts, such as climate change research on heat island conditions.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Deploy 250 air pollution sensors at 50 sites (5 sensors/site; \$13,000 per site) Budget: \$650,000

Site identification will be informed by modeled air concentrations, known air pollution sources, potential environmental justice areas of concern, and community input.

Outcome	Completion Date
1. Identify specific site locations in each zip code (50 total)	July 31, 2017
2. Purchase air monitoring equipment (250 sensors plus meteorological equipment)	September 30, 2017
3. Acquire required permits and permissions for installing the sites	September 30, 2017
4. Start monitoring for five pollutants at each of the 50 sites	October 31, 2017



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Activity 2: Conduct monitoring for five air pollutants at 50 sites for two years

Budget: \$150,000

Outcome	Completion Date
1. Operate and maintain air monitoring equipment on a continual basis, including at least bi-weekly site visits, data quality checks, and sensor maintenance as needed.	October 31, 2019
2. Conduct at least two community outreach events.	April 30, 2020

Activity 3: Compile, analyze and communicate project data

Budget: \$181,564

Outcome	Completion Date
1. Identify and establish effective ways for the public to access the data.	January 1, 2018
2. All data are quality assured and available to the public.	January 30, 2020
3. Summarize project results to inform citizens and partners about air pollution and public health, such as creating a map of fine particles and ozone levels for the metro area.	March 30, 2020
4. Evaluate the performance of the sensors vs. traditional monitoring methods and recommend changes to Minnesota’s air monitoring strategy.	April 30, 2020
5. Publish two papers in peer-reviewed journals.	June 30, 2020

III. PROJECT STRATEGY

A. Project Team/Partners

MPCA Project Team

- Dr. Monika Vadali, Project Manager
- Cassie McMahon, Data Analyst

Project partners receiving funding

- Minnesota State University, Mankato, Department of Mechanical Engineering: Provide student time for setting up and maintaining monitoring stations.

Project partners providing in-kind support

- City of Minneapolis: Provide assistance for identifying monitoring locations, assist with required permits.
- City of St. Paul: Provide assistance for identifying monitoring locations, assist with required permits.
- Minnesota Department of Health: Assist with developing risk-communication material for the public.

B. Project Impact and Long-Term Strategy

MPCA will work with the cities and other partners to follow up on any small-scale differences in air quality detected by the sensors, to identify and address potential sources through pollution prevention efforts. Project results will also further inform our understanding of the relationship between public health and air pollution. This knowledge will help us refine existing air quality program strategies to protect and enhance public health.

This project is also vital to developing MPCA and partner expertise on the use, interpretation and communication of results from new air sensor technology. After the project, the MPCA could move the sensors to other parts of Minnesota that would benefit from finer-scale air quality monitoring. The sensors could also support citizen-science efforts. Building upon the strong expertise of the MPCA and our partners, the project will improve access to air quality information and result in better protection of public health into the future.

C. Timeline Requirements

The entire project will be completed in 36 months. Selecting site locations, procuring the sensors and required permits and initial set up of monitoring stations will require four months. The actual monitoring and data collection will take place for the next 24 months. The last 6-8 months will be dedicated to data analysis, developing community outreach materials and publishing the results of the project.

2017 Detailed Project Budget

Project Title: *DEPLOYING NEW TECHNOLOGY TO UNDERSTAND URBAN AIR POLLUTION*

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	\$ 288,014
Unclassified MPCA Project Manager (30% fringe, 29.19% indirect); 50% FTE for 3 years	\$ 183,398
Unclassified MPCA Data Analyst (30% fringe, 29.19% indirect); 20% FTE for 3 years	\$ 69,167
2 MSU-Mankato Student Workers (30% fringe, 29.19% indirect); 25% FTE for 3 Years	\$ 35,448
Professional/Technical/Service Contracts:	\$ 100,000
Data transfer software, database, and public data access system development (MN.IT)	\$ 100,000
Equipment/Tools/Supplies:	\$ 568,550
250 air pollution sensors (5/site) plus meteorological equipment	\$ 437,625
Cellular data plan at 50 sites (to transmit sensor data in real time)	\$ 8,400
Operation and maintenance of 50 sites	\$ 122,525
Additional Budget Items:	\$ 25,000
Site leases/permits and preparation of 50 sites (\$500/site)	\$ 25,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 981,564

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period: <i>N/A</i>	NA	
Other State \$ To Be Applied To Project During Project Period: <i>Data from five existing monitoring stations will be compared to the new air sensors. Operation of those five stations will be covered by existing funding (Environmental Fund). \$3000/yr x 5 monitors x 2 years</i>	\$30,000	<i>Secured</i>
In-kind Services To Be Applied To Project During Project Period: <i>MPCA: Project oversight and support (including contracting, purchasing specialist, lease agreements for sites), communication support, data QA/QC, community engagement support. ~\$30,000/year</i>	MPCA: \$90,000	<i>Secured</i>
<i>City of Minneapolis and City of St. Paul: Site identification, community engagement, communications support, limited operational support. ~ \$10,000/year/city</i>	Cities: \$60,000	<i>Secured</i>
<i>MDH: Collaboratiing in risk communication material development, assisting with data interpretation, community engagement. ~ \$15,000/year</i>	MDH: \$45,000	<i>Pending</i>
Funding History: <i>N/A</i>	NA	
Remaining \$ From Current ENRTF Appropriation: <i>N/A</i>	NA	

Project Title: Deploying new technology to understand urban air pollution

Proposal study map compared to existing ambient air monitoring network

This project will deploy an innovative monitoring approach using new air sensor technology to increase understanding of the variability of harmful air pollutants in urban areas. The experience gained working with this technology will support future efforts to expand air monitoring across Minnesota.

Figure 1. Example of one-site-per-zip-code project design (note that this map is for illustration purposes; final site locations will be determined once the project is underway).

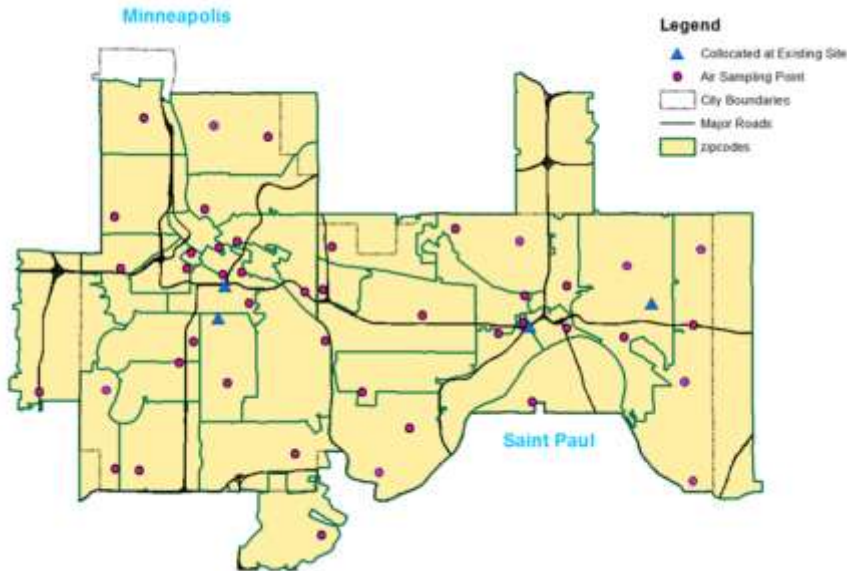
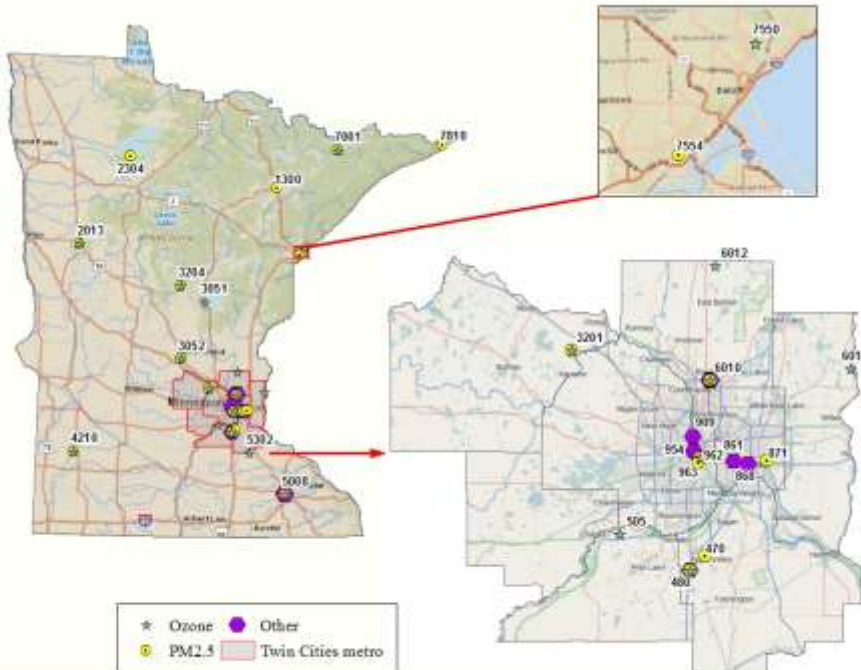


Figure 2. MPCA 2016 air monitoring network



Project manager qualifications

Dr. Monika Vadali, Research Scientist, Minnesota Pollution Control Agency will be the project manager of the proposed work. Dr. Vadali received her Ph.D. in **Environmental health** from the University of Minnesota. As a research scientist at the agency, she currently manages two other air quality related projects, one of which is the agency's air quality index (AQI), which follows EPA's guidelines to report daily air quality conditions to the public in a simplified manner. This involves studying the results of air pollutants from the states monitoring networks on a daily basis, understanding the health implications of the AQI numbers and make decisions on when to issue an air quality advisory or an alert, to be proactive in protecting public health and limiting exposure to unhealthy air. The other project she manages is the Minnesota statewide risk screening (MNRISks) tool. This incorporates data for point, area and mobile sources from the emission inventory, air dispersion modeling to predict air concentrations and estimate risks to the general public. She has also worked on a project using sensors (Air beams) to measure air quality to set up an exhibit for the State fair. Having a solid understanding of air quality, air modeling and monitoring and related data gaps puts her in an advantageous position to lead this project. In addition to several research publications with the University, working with MPCA staff, she has also published two papers on Minnesota's air quality and peer reviewed the "Life and Breath" report. In this project we are proposing to set up a monitoring network to measure the air concentrations of fine particles, ozone, nitrogen oxides, Sulphur dioxide and carbon monoxide. Her knowledge in using sensor technology, superior project management and technical writing skills will add to the success of this project.

Publications at MPCA:

Gregory C. Pratt, **Monika L. Vadali**, Dorian L. Kvale, Kristie M. Ellickson. "Traffic, Air Pollution, minority and Socio-Economic Status: addressing inequities in Exposure and Risk". 2015. International Journal of Environmental Research and Public Health. 12(5), 5355-5372.

Monika L. Vadali. "The Effects of Air quality: Understanding the metrics". 2015. Minnesota Health Care news. Vol (13) number 11, 12-13, 34.