Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)

Project Title: **ENRTF ID:** **090-E2**

Addressing Ozone and Particulate Matter Pollution in Minnesota

Topic Area: E2. NR Info Collection/Analysis

Total Project Budget: $ 262,932

Proposed Project Time Period for the Funding Requested: 2 yrs, July 2013 - June 2015

Other Non-State Funds: $ 0

Summary:

We will evaluate strategies to address ground-level ozone and particulate matter. Our approach builds on control scenarios developed by experts from industry and nonprofits; results will be shared with MPCA.

Name: Julian Marshall

Sponsoring Organization: U of MN

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Minneapolis MN 55455

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Email julian@umn.edu

Web Address www.umn.edu

Location

Region: Statewide

County Name: Statewide

City / Township:

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

PROJECT TITLE: Addressing Ozone and Particulate Matter Pollution in Minnesota

I. PROJECT STATEMENT

This project will combine regional air quality modeling, satellite measurements, and MPCA monitoring data to ***examine the effectiveness of potential control strategies proposed by experts from industry and nonprofits***. The project will complement, rather than duplicate, MPCA's work in this area, by investigating scenarios proposed by representatives from industry and nonprofits, and by focusing on health-related impacts rather than only regulatory compliance.

Ground-level ozone and particulate matter (PM) are two of the six criteria pollutants defined in the federal Clean Air Act. PM and ozone exposure contribute to

- increased susceptibility to respiratory infections;
- medication use by asthmatics;
- hospital admissions for individuals with respiratory disease; and
- premature death (especially in people with heart and lung disease).

Ozone can *harm natural habitats and reduce crop yields* (e.g. pine trees, soybean crops) by inhibiting healthy plant growth. Minnesota is in attainment with the current ozone and PM standards but is likely to violate stricter standards currently being discussed by the Environmental Protection Agency.

Ground-level ozone is not emitted directly, but instead is formed in the atmosphere via a series of complex chemical reactions involving precursor nitrogen oxides (NO_x) and volatile organic compounds (VOCs). The level of air quality improvement achievable by a given emission control strategy depends strongly on the relative abundance of those precursors; in some cases, emission reductions can worsen ozone concentrations. PM results from primary (direct) emissions in the atmosphere and from secondary formation (formed in the atmosphere from reactions of precursors). Formation of secondary PM depends strongly on local conditions, including meteorology and precursor concentrations.

Designing and testing effective control strategies for Minnesota requires a strong understanding of

- the current state of regional air pollution;
- urban, industrial, and natural emissions in the state and region; and
- the extent to which transboundary pollution from neighboring states affects pollution in Minnesota.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: *Characterize current pollutant levels and precursor emissions in Minnesota using ground-based observations, satellite data, and atmospheric modeling.*
Budget: $78,800
We will use ground-based observations, satellite measurements, and a high-resolution atmospheric model (CAMx, 4km grid) to develop a strong understanding of air pollution in Minnesota. This analysis provides fundamental information for effective ozone control, since controlling the wrong precursor pollutant can be ineffective in reducing ozone, and may even make things worse in some areas. It will also point to the most effective sources to control for PM. ***The results from Activity 1 will provide crucial information for designing and testing pollution control strategies most likely to be effective in Minnesota.***

Outcomes	Completion Date
1a. Model ozone and PM concentrations using a state-of-the-science model (CAMx). Deliverable: a report evaluating model output by comparing against MPCA measurements and against satellite observations.	4/30/2014
1b. Identify hotspot locations for air pollution throughout the state of Minnesota.	4/30/2014
1c. A diagnosis, based on satellite and models, of the sensitivity of pollution in Minnesota to specific sources and to transported pollutants. Deliverable: a report on these findings.	6/30/2014

Activity 2: *Evaluate control strategies proposed by experts from industry and nonprofits*
Budget: $183,752
We will apply the CAMx regional air quality model to study the effectiveness of potential control strategies in Minnesota determined by Environmental Initiative's Minnesota Clean Air Dialogue and to identify the societal benefits associated with each potential strategy. By using the strategies determined by the MN Clean Air Dialogue, we will be able to partner with experts from industry and nonprofits and test solutions they propose. We will also evaluate the impact of out-of-state pollution sources on air quality in Minnesota - this aspect informs what is achievable through Minnesota action alone. ***Our investigation will explore the extent to which ozone and PM exposures would increase or decrease for each control strategy investigated****.*

Outcomes	Completion Date
2a. Obtain proposed control scenarios from MN Clean Air Dialogue.	9/30/2013
2b. Creation of new emissions inventories based on the proposed control scenarios.	4/30/2014
2c. Deliver a report with projected air pollution concentrations for each scenario.	12/31/2014
2d. Deliver a report estimating societal costs associated with each control scenario.	6/30/2015

III. PROJECT STRATEGY

A. Project Team/Partners

This project will be carried out by a team of scientists at the University of Minnesota (UMN) in partnership with Environmental Initiative. Dr. Julian Marshall is an expert in exposure to air pollution. Dr. Dylan Millet is an expert in atmospheric chemistry and satellite data. Dr. Kristina Wagstrom is an expert in regional air quality modeling. This group has extensive experience with the modeling and other tools proposed here. Modeling and data analysis will be performed using resources at the Minnesota Supercomputing Institute at UMN. Environmental Initiative (EI) will coordinate efforts and outreach between the UMN team, Clean Air Dialogue members, State agencies, and other interested parties. This coordination will include the exchange of information; data; emission reduction strategies, models, and forecasts; scenario outcomes; and strategies to implement emission reduction projects. EI will hold regular meetings, perform research and analysis on project implementation, and carry out related efforts using this project's findings to improve air quality and health in Minnesota.

B. Timeline Requirements - The project will be completed in two years.

C. Long-Term Strategy and Future Funding Needs

This is a stand-alone project that complements ongoing work at the University of Minnesota and through Environmental Initiative. The goal is to provide information and tools that MPCA and state regulators can use to improve air quality in Minnesota for the betterment of human and ecosystem health, while helping avoid costly federal requirements associated with violating air quality standards.

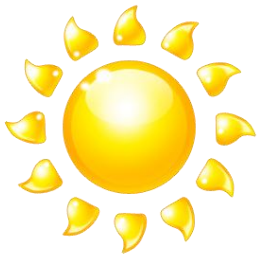
2012-2013 Detailed Project Budget

IV. TOTAL ENTRF REQUEST BUDGET (*2 years*)

BUDGET ITEM	AMOUNT
Personnel:	
Professor Julian Marshall, PI (1 month summer salary per year for two years, $28,889 salary, $6,375 fringe, 18.1% fringe rate)	$ 35,264
Professor Dylan Millet, Co-PI (1 month summer salary per year for two years, $28,354 salary, $6195 fringe, 17.9% fringe rate)	$ 34,548
Postdoctoral Associate (full support for two years, $88,000 salary, $20,196 fringe, 22.95% fringe rate)	$ 108,196
Graduate Research Assistant, Master's Student (full support for one year, $22,786 salary $17,337 (76.08% fringe - includes health care and tuition))	$ 40,123
Summer Undergraduate Research Assistant (3 months per year for two years)	$ 13,000
Contracts: Environmental Inititative.	
Bill Droessler, Sr. Strategic Project Director (427 hours over 2 years, professional services rate of $47.80 per hour)	$ 20,411
Mark Lundgren, Director of Environmental Projects (200 hours over 2 years, professional services rate of $47.80 per hour)	$ 9,560
Equipment/Tools/Supplies:	$ -
Acquisition (Fee Title or Permanent Easements):	$ -
Travel: Travel for collaboration. (10 trips for 3 people at $15 per trip)	$ 450
Additional Budget Items: Page charges for a published peer-reviewed journal article in the second year.	$ 1,000
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$ 262,552

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:		
Computational Expenses at the Minnesota Supercomputing Institute (MSI does not charge us for the use of the resources)	$ 15,000.00	



Sunlight

Major Sources:
Motor Vehicles
Off-road Vehicles
Fossil Fuel Combustion

NOx

Major Sources:
Off-road Vehicles
Motor Vehicles
Solvent Use
Vegetation

Volatile Organic Compounds

Other Impacts:
Reduced Crop Yields
Harm to Natural Ecosystems

Ground-level Ozone

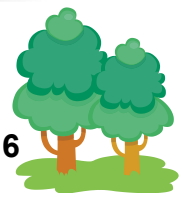
Health Impacts:
Respiratory Problems
Premature Death

Direct Emissions:
Motor Vehicles
Off-road Vehicles
Fossil Fuel Combustion

Health Impacts:
Respiratory Problems
Cardiopulmonary Impacts
Premature Death

Particulate Matter

Chemical Formation:
Motor Vehicles
Vegetation
Fossil Fuel Combustion
Agriculture



Project Manager Qualifications and Organizational Description

Dr. Julian Marshall
Assistant Professor, Department of Civil Engineering, University of Minnesota

B.S., 1996, Chemical Engineering, Princeton University
M.S., 2002, Energy and Resources, University of California, Berkeley
Ph.D., 2005, Energy and Resources, University of California, Berkeley

Dr. Julian Marshall will be the overall coordinator of this project. Dr. Marshall is an expert in human exposure to air pollution, including particulate matter and ozone.

Dr. Dylan Millet
Assistant Professor, Department of Soil, Water and Climate, University of Minnesota

B.S., 1998, Chemistry, University of British Columbia
Ph.D., 2003, Ecosystem Science, University of California, Berkeley

Dr. Dylan Millet's research involves using measurements and models to understand the impacts of human activity on the chemical composition of the atmosphere. He has carried out many research projects using satellite data to better understand atmospheric composition.

Dr. Kristina Wagstrom
Postdoctoral Associate, Department of Civil Engineering, University of Minnesota

B.S., 2004, Chemical Engineering, Illinois Institute of Technology
Ph.D., 2009, Chemical Engineering, Carnegie Mellon University

Dr. Kristina Wagstrom's research involves regional air quality modeling and applications of source apportionment to study pollutant transport and to differentiate impacts by source type.

University of Minnesota
The University of Minnesota is one of the top research universities in the nation making it an excellent place to carry out this research. The computational resources available at the University of Minnesota through the Minnesota Supercomputing Institute further support this location for the project.