**PROJECT TITLE: DETECTING ROAD DUST CONTROL CHEMICALS IN AIR/WATER**

**I. PROJECT STATEMENT**

The objective of this project is to analyze (chemical constituents and mass concentrations) dust from rural unpaved roads in Minnesota’s environmentally sensitive areas. Dust from unpaved roads has documented negative human health and environmental effects, as well as being a safety hazard by obscuring driver visibility (Jones et al., 2013). Therefore, dust control on unpaved roads is an important and necessary function by local road authorities. However, the Minnesota Local Road Research Board (LRRB) has stated: **“*In rural Minnesota, research is needed to learn if chemicals used for dust control travel from the road to adjacent bodies of water—and ultimately, if agencies are creating a bigger problem than the one they’re trying to solve*” (LRRB Technical Summary, 2013RIC6.7TS)**. Addressing this need of MN public works departments, this project will:

* Identify dust control chemicals such as chlorides (CaCl2 and MgCl2), which impact or damage sensitive environments by accumulating and causing harm to aquatic life, while also depleting oxygen. Once deposited, they cannot be removed!

These chlorides can adhere (adsorb) to the surface of dust or scientifically - mineral particulate matter (PM), thus creating a transport mechanism when stirred-up by vehicle movement on unpaved road surfaces. Dust can then be transported by prevailing winds and/or local stream tributaries, along with any chemicals it is carrying, into sensitive waters. Using Minnesota’s North Shore of Lake Superior as a test location, this study will utilize several analytical techniques that have been used successfully to identify chemicals on PM (dust) as potential sources of pollution in a specific environmental location (Monson Geerts, et al., 2018).

The NRRI researchers and project collaborators will conduct extensive (seasonal) aerosol sampling in targeted problem areas defined by local road authorities in Cook, Lake and/or St. Louis Counties adjacent to Lake Superior. Soil, stream and shallow groundwater samples will also be collected at these same locations in an effort to identify and quantify chemicals used in dust mitigation. NRRI scientists will use a combination of in-house analysis (soil, shallow ground water and surface water samples), as well as contracting with a certified laboratory to analyze the PM for pollutants (elemental concentrations) that may be transported to Lake Superior or other sensitive surface waters. Multiple benefits to Minnesota include the following project deliverables:

* creating foundational natural resource data (Priority A) regarding the scientific characterization of PM generated from rural unpaved roads located adjacent to environmentally sensitive areas;
* identification and quantification of contaminants (Priority E) associated with dust mitigation efforts as a “first-ever approach” to relating chemical transport to PM (road dust); and
* outcomes from this study will allow the local road authorities (Public Works Departments) to make informed decisions regarding the use of both environmentally sustainable and cost-effective dust-suppression technologies. This knowledge base can then be applied to other localities state-wide.

**II. PROJECT ACTIVITIES AND OUTCOMES**

|  |  |
| --- | --- |
| **Activity 1:****Collection and analysis of aerosol PM, soil, stream and shallow ground water samples at specific sites and background locations. Seasonal sampling 2020 to 2023.**The project team will collect multiple aerosol PM samples (total 36 sample events) from three selected sites seasonally while recording meteorological data during sampling. Sampling to begin summer 2020 and end spring 2023. Simultaneous collection of soil, stream and shallow ground water samples will also take place.**ENRTF BUDGET: $200,485** |  |
| **Outcome** | **Completion Date** |
| 1. Creation of foundational natural resource data and information in environmentally sensitive areas selected with the aid of local (county) road – public works departments. | 4/2023 |
| **Activity 2: Aerosol PM, soil and water sample analysis. Statistical analysis of derived chemical data results. Communicate the findings of this study to the county public works departments.**Aerosol PM samples will be analyzed gravimetrically at the NRRI to determine mass concentrations. Chemical analysis will be conducted by Elemental Analysis, Inc. (EAI), using Proton Induced X-ray Emission (PIXE) to determine elemental chemical concentrations of PM. Soil, stream and shallow ground water samples will be analyzed in-house (UMN) using Inductively coupled plasma atomic emission spectroscopy (ICP-AES). The NRRI team will statistically analyze the chemical analytical results of the aerosol PM, soil, stream and shallow ground water samples. The findings of this study will be presented to the respective county public works department(s) to develop more environmentally sustainable and cost-effective dust-suppression methods.**ENRTF BUDGET: $79,741** |  |

|  |  |
| --- | --- |
| **Outcome** | **Completion Date** |
| 1. Determine the mass concentrations of the full-range of PM for each aerosol sample. | 6/2023 |
| 2. Identification of specific pollutants (elemental concentrations) in the PM, soil, stream and shallow ground water related to and originating from unpaved road surfaces. | 6/2023 |
| 3. Statistical analysis of samples as it relates to the chemical analyses. | 6/2023 |
| 4. Report the findings of this assessment to aid the respective MN county public works departments into making informed decisions regarding environmental and cost-effective dust-suppression methods. | 6/2023 |

**III. PROJECT PARTNERS:**

Cook, Lake and St. Louis County Public Works Departments have committed project collaboration.

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:**

This project provides an innovative “first-ever approach” of utilizing the chemical analysis of particulate matter (dust) to better understand potential chronic environmental impacts, especially as a transport mechanism for pollutants. The outcomes of this study will provide county public works departments, as well as researchers and regulatory scientists throughout Minnesota, with the necessary foundational data to make informed decisions regarding dust suppression methods and improved environmental monitoring of road dust in the future.

**V. TIME LINE REQUIREMENTS:**

The project duration would require three years of ENRTF funding from 7/1/2020 to 6/30/2023. NRRI researchers and project partners will be fully equipped to commence project activities on July 1, 2020.

|  |  |  |
| --- | --- | --- |
| **Activity** | **Commence** | **Complete** |
| Activity 1 | Summer of 2020, shortly after 07/01/2020 | 04/2023 |
| Activity 2 | Fall of 2020, approximately 3 months after first sample event | 06/2023 |

**VI. SEE ADDITIONAL PROPOSAL COMPONENTS:**

**A. Proposal Budget Spreadsheet**

**B. Visual Component or Map**

**C. Parcel List Spreadsheet**

**D. Acquisition, Easements, and Restoration Requirements**

**E. Research Addendum (not required at proposal stage)**

**F. Project Manager Qualifications and Organization Description**

**G. Letter or Resolution**

**H. Certified Audit or 990 Tax Information**