

APPLICATION FOR GRANT FUNDS

NORTH DAKOTA INDUSTRIAL COMMISSION
OIL AND GAS RESEARCH PROGRAM

Investigation of methodologies to control
Dust on county roads in western North Dakota

Applicants: Dunn and Mckenzie County

Principal Investigator: Francis Schwindt
Date of Application: August 15, 2011

Amount Requested - \$220,000
Total Project Cost - \$440,000

Project Duration – September 2011 to January 2013

Contact: Francis Schwindt
2201 Harding Ave
Bismarck ND 58501
701.258.7206
701.471.9899
f_schwindt@msn.com

TABLE OF CONTENTS

1.0 Abstract	Page 3
2.0 Project Description	Page 4
3.0 Standards of Success	Page 6
4.0 Background/Qualifications	Page 7
5.0 Management	Page 7
6.0 Timetable	Page 8
7.0 Project Budget	Page 9
8.0 Matching Funds	Page 9
9.0 Tax Liability	Page 10
10.0 Confidential Information	Page 10
11.0 Patents and rights to technical data	Page 10
12.0 Appendix	Page 10

1.0 ABSTRACT

Due to the increased traffic volumes related to oil development in western North Dakota, dust along the many unpaved roads is causing many complaints to local road superintendents and County Commissioners. Residents are concerned about poor visibility, damage to vegetation and adverse health effects. County road crews cannot adequately maintain all roads that are impacted as existing treatments can be short lived or require repeated applications. Costs for maintaining roads are increasing and the sources of good aggregate for road surfacing are becoming scarce or are often poorly distributed within each county.

Mckenzie County has a very active dust control program for the past three years and provides about \$1.3 million per year just for dust control. Dunn County provides dust control for one fourth mile around each residence where complaints have been filed. Several counties have experimented with different chemicals and construction techniques to control dust. Williams and Mckenzie County have used soil stabilizers and Ward County has used an asphalt emulsion. Most counties are currently using magnesium chloride as it is readily available and allows the road to be maintained between applications.

This project proposes to evaluate and compare several different products and construction techniques. Magnesium chloride, flake calcium chloride, enzymatic soil stabilizers, and geotextiles will be used in road test strips of one-half to one mile in length. Candidate roads for testing will be selected within Mckenzie and Dunn counties by county personnel. Roads will be selected based on traffic volumes, road base materials and available aggregate quality. Where suitable aggregate is not available, aggregate may need to be imported.

Each test segment will be evaluated by county personnel. Evaluations will be based on effectiveness, ease of application, costs and longevity. Recommended construction techniques and dust control methods will be made available to all counties in North Dakota with special emphasis on oil producing counties.

2.0 PROJECT DESCRIPTION

Dust has always been an issue for unpaved roads and many products are available to reduce the amount of dust created by traffic. A report from the ND Department of Transportation in March 2011 summarizes the most common methods of dust control and roadway stabilization and references reports from the Federal Highway Administration and Environmental Protection Agency. Counties have been very active in pursuing alternative dust control strategies. However, the volume of heavy traffic associated with exploration for and development of oil in western North Dakota has surpassed the ability of counties to adequately maintain their roads. Residents are concerned with how the dust affects crop production, human and animal health and soil and water quality. Dust also creates a safety hazard for travel on these roads.

The objective of this research is to identify and evaluate cost effective methods to control dust on unpaved roads in western North Dakota. The study will be conducted on roads currently being impacted by heavy traffic loads in Dunn and Mckenzie Counties. Treatment techniques will be incorporated into new construction plans where possible. Construction and treatment techniques that minimize environmental impacts and effects on human and animal health will be considered.

Water is the most commonly used dust suppressant; however, the beneficial effects of its use are generally short lived. Magnesium chloride is the most commonly used chemical additive. It does not bind soil particles together but is hygroscopic in nature which means it draws moisture from the air and keeps the road surface damp. It does not perform as well during extended dry periods and can become slippery when wet. Calcium chloride is very similar in nature to magnesium chloride, but there is concern it is more corrosive than the magnesium chloride. Cost of the material, excluding roadbed preparation, is about \$6,500 per mile for a virgin roadway and about \$3,000 per mile to retreat a roadway. The chemical tends to leach from the road profile over time.

Soil stabilizers such as Permazyme (Pacific Enzymes, Inc) and Base One (Team Laboratories) bind soil particles together. Material costs range from \$6,000 to \$16,000 per mile excluding roadbed preparation. These products perform best when allowed to cure for up to 72 hours before being placed into service. Regrading of the stabilized surface is more difficult than roads treated with chloride. Fly ash is another soil stabilizer that will be considered.

Geotextiles are not used directly in dust control but can be used to stabilize the sub base. This is accomplished by providing a barrier to the movement and mixing of aggregate into the sub grade of the road. A more stable sub base can increase the load carrying capacity of road beds and decrease the maintenance required of the surface aggregate. If the sub base is more stable, less dust should result from the road surface.

McKenzie County has a total of about 1400 miles of road and a significant portion of those roads are constructed with silty material. This material does not provide a stable road bed and does not bond with the surface aggregate. It does not withstand heavy traffic volumes or loads. The use of a geotextile fabric and 8 inches of existing regraded road material and 4 inches of a class 13 aggregate will be evaluated on an existing high volume traffic road such as County Route 6 or County Route 12. An additional road segment with geotextile fabric, existing regraded road material and a soil stabilizer will also be evaluated. Surface aggregate with 5 to 8% clay will be used to complete the road surface. If there is insufficient clay in the existing regraded road material, clay will be added as the material is relaid. The test sections will be selected by County personnel. Routing of traffic through a detour will be required during construction.

Dunn County has about 1200 miles of road. Dunn County's supplies of good quality gravel are located on the southern end of the county. In addition, a primary source of gravel, located in the Killdeer Mountains in the northern portion of the County contains erionite, an asbestos like mineral. Dust containing erionite may present a health hazard; therefore, the State has directed the County to discontinue use of this gravel source. Scoria has been used extensively as road aggregate in parts of the County. This material does not withstand heavy truck traffic or increased volumes of traffic. Dunn county roads tend to have more clay content than some McKenzie County roads.

A geotextile fabric will be placed under aggregate containing erionite and a soil stabilizer will be added to the erionite aggregate. A surface layer of new aggregate will cover the stabilized erionite. The selected location will be determined by the County with input from the ND Department of Health and EPA. Because of the higher clay content in Dunn County roads, several dust control additives will be tested to determine effectiveness on other test segments.

The research coordinator will conduct a review of available treatment techniques and propose alternative construction and treatment schemes for consideration by the county personnel. The

road test segments will be selected by the County Engineer and County Road Superintendent with input from the County Commissioners and research coordinator. The research coordinator will work with the ND Department of Mineral Resources and ND Department of Health to review and modify the current “Guidelines for the Use of Oilfield Salt Brines for Dust and Ice Control” to determine if changes to the Guidelines are necessary to make them more cost effective and environmentally compatible.

3.0 STANDARDS OF SUCCESS

The goals of the study are to evaluate several different products and construction techniques to reduce dust and maintenance costs on unpaved county roads. Costs for each test segment will be tracked by County Auditors and project management. County personnel, including Commissioners, County Engineers, County Road Superintendents and equipment operators will evaluate the costs, effectiveness, longevity and ease of construction and maintenance for each road test segment. A final report will be prepared and shared with all counties in North Dakota with special emphasis on oil producing counties.

This research will be readily transferable to other counties in western ND where dust control from oil field traffic creates unsafe living and working conditions. Private companies who are responsible for dust control on haul roads or oil rig sites will also find the research results beneficial in their work. Better dust control will reduce one of the impacts from oil exploration and development and reduce the number of complaints to county officials.

It is not anticipated that there will be a specific commercial use for this research effort although commercial products already in the market place will be used during the research. If specific products perform better than others, increased marketing of those products is likely to occur.

If cost effective dust control strategies are not developed, County Commissions may be faced with limiting oil exploration and development to the extent that Counties can safeguard their residents and infrastructure. A partial shutdown of oilfield traffic occurred this spring due to the flooding and wet, soft roads. The opposite may also be true. If extended drought conditions occur in the future,

Counties may be forced to limit traffic to reduce unsafe travel conditions and impacts to crops and county residents.

4.0 Background/Qualifications

Dunn and Mckenzie Counties have extensive full time Road Departments to construct and maintain county roads. Each County has a County Engineer and a County Road Superintendent that oversee the Road Departments. These personnel have been involved in all aspects of road construction and maintenance including dust control. Mckenzie County has dedicated one staff person to manage their dust control program. This research is designed to provide practical, cost effective solutions for the County Road Departments. Their participation and feedback is critical to the success of this research as county personnel not only need to know which technique provides the best result, they must also know the best method of treatment application.

Each County has a County Auditor and accounting staff that provide fiscal management to the County.

Research coordination, grant communication and report preparation will be conducted by Francis (Fritz) Schwindt. Mr. Schwindt lives in Bismarck ND and is retired from the ND Department of Health where he was the Chief of the Environmental Health Section. In the 30 years he was with the Department of Health, he was responsible for implementing the environmental programs in the state including air and water quality, drinking water, hazardous and solid waste and radiation control. He began his career in engineering by working for two years with the Department of Transportation. Mr. Schwindt has Bachelor of Science and Master of Science degrees in Agricultural Engineering and is a Registered Professional Engineer in North Dakota (retired). He also owns and operates an irrigation and consulting business, Underground Soaking Systems, Inc.

5.0 MANAGEMENT

As project co-sponsors, each County will manage and construct the road test segments in their respective County and document expenses involved in the research. The grant funds will flow to the County Auditors for payment of invoices that are received and approved for payment by the County Commission.

The Mckenzie County staff includes: Michael Greer, the County Engineer, Mark Koeser, the County Road Superintendent, Mike Dollinger, the County dust control specialist, Carol Kieson, Dust Contol Coordinator and Linda Svihovec the County Auditor. In addition, all five County Commissioners, Dale Patten, Richard Cayko, Richard Lawler, Roger Chinn, and Ron Anderson will provide oversight and recommendations on the conduct of the research.

The Dunn County staff include Richard Benz, the County Engineer, Mike Zimmerman, the County Road Superintendent and Reinhard Hauck, the County Auditor. The five County Commissioners are Daryl Dukart, Glenn Eckelberg, Tim Steffan, Donna Scott and Robert Kleeman.

6.0TIMETABLE

This research program will begin as soon as grant agreements are approved. The literature review and meetings with the Department of Health, the Department of Mineral Resources and the State Geologist will be conducted as they can be scheduled. It is our intent to select the road test segments and treatment technologies over the fall and winter when County staff may become more available. Materials can be ordered and be available for construction in the spring. Construction of the road test segments will begin as soon as weather conditions and work priorities allow equipment and personnel to be available. Monitoring and evaluation of the test segments will be conducted throughout the summer and fall of 2012. A final report will be prepared and submitted to each County Commission and the Research Council by January 2013. Ongoing evaluations of the test segments will be part of the Road Departments' routine maintenance programs.

Tasks:

Grant award	September 2011
Conduct literature review	November 2011
Meet with Depts. of Health and Mineral Resources	October – December 2011
Select road test segments	January 2012
Provide interim report to Counties and Council	February 2012
Order materials	March 2012
Install treatment techniques	April – July 2012
Provide interim report to Counties and Council	August 2012

Evaluate treatment techniques August – November 2012
 Provide final report to Counties and Council January 2013

7.0 PROJECT BUDGET

PROJECT ACTIVITY	NDIC share	Applicant share – in kind
Geotextile fabric	\$80,000	0
Treatment chemicals	\$80,000	0
Aggregate	\$30,000	\$110,000
Planning, Monitoring, Evaluation(County Personnel)	0	\$30,000
Test segment construction (County personnel and equipment)	0	\$80,000
Research coordination, grant communication and reporting	\$30,000	
TOTAL	\$220,000	\$220,000

8.0 MATCHING FUNDS

The funds from the ND Oil and Gas Research Fund will be matched on a 50/50 basis with in-kind services from Dunn and Mckenzie Counties. The matching funds from the two counties have been approved. Contributions from equipment and product suppliers and interested oil companies will be solicited over the winter as specific project test segments are identified.

Total project expenses \$440,000
 Grant Funds requested \$220,000
 Dunn County contribution (in-kind) \$110,000
 Mckenzie County contribution (in-kind) \$110,000

If the total requested grant funds are unavailable, the research will be scaled to match available funds. Fewer funds will mean fewer alternatives will be evaluated.

9.0 TAX LIABILITY

I, Linda Svihovec, Mckenzie County Auditor certify that Mckenzie County does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

I, Reinhard Hauck, Dunn County Auditor certify that Dunn County does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

10.0 CONFIDENTIAL INFORMATION

Dunn and Mckenzie Counties do not request any of the information related to this application be confidential.

11.0 PATENT RIGHTS TO TECHNICAL DATA

Dunn and Mckenzie Counties do not request to reserve any patent rights to technical data.

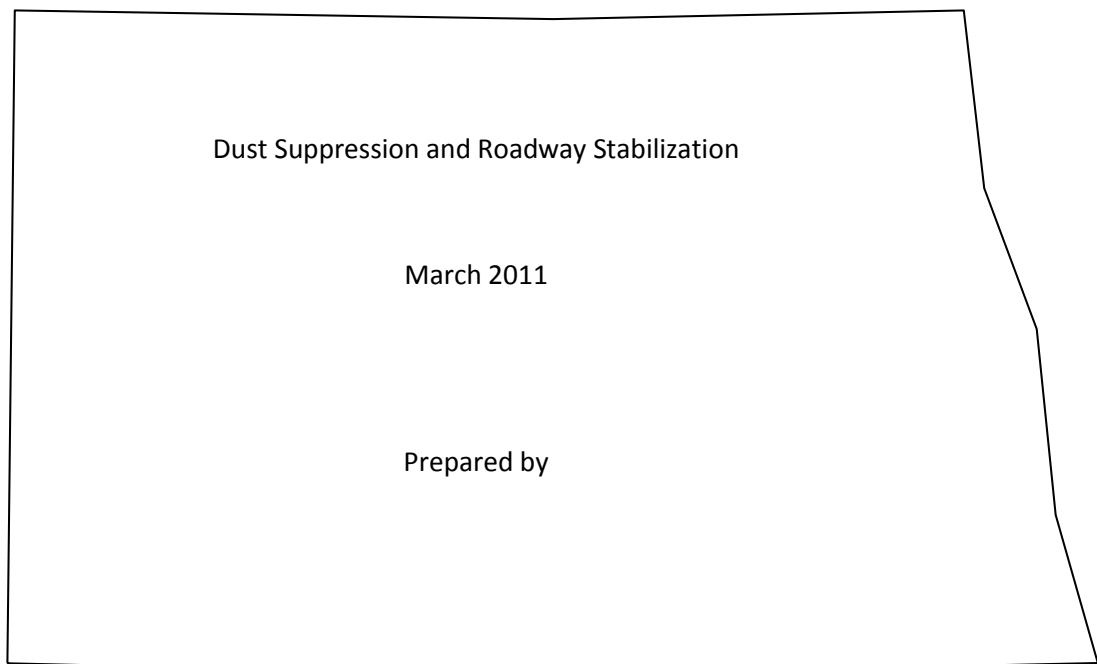
12.0 APPENDIX

Dust Suppression and Roadway Stabilization – ND Department of Transportation

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH

DIVISION



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

BISMARCK, NORTH DAKOTA

www.dot.nd.gov

DIRECTOR

Francis G. Ziegler, P.E.

MATERIALS AND RESEARCH DIVISION

Ron Horner, P.E.

Written by: M & R

Dust Suppression and Roadway Stabilization

Water

- Commonly used by all the NDDOT Districts.
- Effective at suppressing dust but must be applied more frequently than chemical suppression methods.
- The cost of water will vary depending on the availability and distance from the location of need.

Magnesium Chloride

- Used by multiple NDDOT Districts on haul roads.
- Used by multiple counties on gravel roads.
- Comments from the various entities are that application is simple and it has performed well. The gravel road could still be bladed/maintained without additional difficulty.
- Cost of the material varies from \$0.75/Gal to \$0.90/Gal. Per mile cost is approximately \$5,500 per mile for a virgin roadway and about \$3,000/mile to retreat a roadway.
- Price per mile can vary depending on application rate and mobilization costs.
- In most cases one to two applications must be performed annually to achieve adequate dust suppression.

Calcium Chloride

- Has been applied with water on haul roads in the Fargo district
- Calcium Chloride was found to perform as well as Magnesium Chloride and cost about the same; approximately \$3000-4000/mile again depending on application rate and mobilization cost.

Note: Chlorides may not perform well with High PI or low CBR soils causing a slippery roadway surface under saturated conditions. They also tend to leach into the soil/water table. Therefore, use should be avoided if wetland watersheds are in the immediate vicinity.

Base One® (Manufactured by Team Lab)

- This product has been used by Ward County
- This product provides dust control as well as base stabilization.
- This product provides stabilization by increasing the aggregates ability to achieve maximum

compaction.

- The product performs best with a gravel that has a high PI and when good installation procedures are followed.
- Cost is approximately \$6,000 per mile plus the cost of installation.

Permazyme 11X Soil Stabilizer (Manufactured by Pacific Enzymes, Inc.)

- This product was installed in the fall of 2010 just west of Wild Rose in Williams County North Dakota.
- This is an enzyme based soil stabilizer.
- One mile of roadway was treated with 25 gallons of material.
- Costs were gathered from Bob Skarphol shortly after the installation.
- The Permazyme product cost was \$350/gallon. The company provided a representative and 45 gallons of material for a cost of \$19,750 to the ND Petroleum Council.
- The county provided the construction equipment. The county superintendent estimated it would cost \$43,000 for two miles if this work would have been contractor applied.
- This spring they are planning to treat one more mile of roadway. They have 20 gallons on hand to perform this work. Performance is still to be determined.
- This product also functions as a roadways stabilizer.

Armor Coat

- This processes has been used by Ward County
- Rock is placed on the roadway and held in place with an emulsion. The process is similar to a double chip seal application.
- Cost is approximately \$40,000 per mile
- Surface similar to a paved road is created.
- One drawback is the public expects the road to remain paved.

For additional information on a wide variety of dust control methods please follow the links below:

http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_lt_01_002.pdf

<http://www.epa.gov/owow/NPS/gravelroads/sec4.pdf>

