Contents

1.0 Introduction 2

2.0 What is dust control? 2

3.0 Why use dust control methods? 2

4.0 Dust control options 4

5.0 Is Dust Control a Capital Cost? 6

6.0 Financial Comparison 8

7.0 Conclusion 9

1.0 Introduction

Communities of the Northwest Territories (NWT) and Members of the Northwest Territories Legislative Assembly have expressed concern about the negative impacts of dust emissions. The objective of this report is to provide a framework that describes the dust control methods that are Gas Tax Eligible and compare their characteristics, their expected life cycle and show why they would be beneficial in various communities of NWT. A recent report developed for the Department of Municipal and Community Affairs (MACA) by EBA Engineering Consultants Limited on dust control and an economic analysis among other sources were use as the basis for this discussion. The EBA report was based on extensive literature search, interviews with community road maintenance authorities, environmental authorities, dust suppressant suppliers and other experts in dust control.

2.0 What is dust control?

Dust control is a method of protection for transportation infrastructure such as roads constructed with granular material. This application acts as a surface barrier locking all dust particles within the structure. It also serves to provide a clean and safe environment for people that are using these roads.

3.0 Why use dust control methods?

Safety

Untreated roads may lead to more collisions due to loss of visibility from dust emissions and less traction due to loose gravel. Statistics of accident rates for the NWT have not been identified, but statistics from other jurisdictions indicate that approximately 2.3 times more accidents occur, per vehicle kilometre of travel on unpaved than paved roads (Hoover, 1971), (Kellerhals, 2000). As can be seen from the table 1, accidents on gravel roads result in more fatalities and the cost of accidents on gravel roads is greater than on paved roads.

Table 1

	Road Type		
	Gravel	**Two Lane Paved**	**Freeway**
Accident rate per million vehicle km	2.29	0.99	0.27
Composition (%)			
Fatal	10.9	7.8	3.2
Serious Injury	6.5	9.5	4.2
Slight Injury	10.9	17.7	19.6
Damage Only	71.7	65.0	73.0
Relative cost per accident UNIT	1.89	1.56	1.00

Health

“Particulates are known to aggravate symptoms in individuals who already suffer from respiratory or cardiovascular diseases” (Minister of Health, 2004). Very fine particulate matter is of most concern from a health perspective because these particles can enter the deepest parts of the lungs. A Canada-Wide Standards for very fine particulate matter that has a diameter of less than 2.5 microns has been established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME).

Environmental

Large amounts of dust falling on vegetation may stress plants due to increased heat absorption and decreased transpiration. High levels of dust falling into aquatic systems may adversely affect aquatic plants and fish that are not adapted to high levels of sedimentation.

Road Maintenance Costs

Roads that are not treated with a dust suppressant or sealant will have higher maintenance costs due to the higher loss of gravel and, hence, higher gravel replacement costs. Dow Chemical Company estimated in 1993 that the average untreated road loses 300 tons of aggregate per mile per year. The frequency of blading to maintain good road conditions will also be greater and more costly (EBA Engineering Consultants Ltd., 2005).

4.0 Dust control options

Methods of dust control for road structure surfaces that will be discussed for the purpose of this report will include:

- Asphalt concrete
- Chip seal
- Polymer dust suppressants

Asphalt Concrete

Asphalt concrete has been proven a very good method of dust control in some jurisdictions, however for the NWT's isolated communities it presents technical and logistical challenges that affect its sustainability. Asphalt concrete is extremely expensive when compared to other methods of dust control and requires large amounts of aggregate to produce, but it has a much longer life cycle than most other forms of dust control. The northern climate, the presence of permafrost, unsuitable soil conditions can also shorten the useful life. Cost estimates for the application of asphalt concrete on highways throughout Yellowknife is in excess of $300,000 per kilometre of 6 meter road. To apply this method of dust control in smaller communities these costs are going to increase significantly. In addition to the material used, there would be a substantial amount of equipment and labour that is required. Equipment would include the use of a Hot-mix batch plant, the use of multiple asphalt dump trucks, asphalt spreader, rolling equipment, and a labour crew. The relatively small volume of work in a community would increase the fixed cost of production asphalt. The mobilization and

de-mobilization cost alone can reach over $250,000 and if the equipment must be left in a community for over winter the cost could be substantially higher than that.

Chip Seal

Chip seal costs approximately 20% to 30% of the cost of asphalt concrete. It is one of the oldest methods and most successful of road surfacing. Chip seal involves spraying of asphalt emulsion followed immediately by a thin aggregate cover, which is compacted as soon as possible. It is not similar to hot mixed asphalt, as chip seal does not have structural strength.

Current practice in the NWT is to use a single layer application of chip seal to last for a period of approximately 3-5 years and then repair the single chip layer and place a second layer on top. However, recent records indicate that five years is not adequate and a three year useful life is more realistic. In at least one circumstance the chip seal lasted approximately one year before excessive deterioration of road condition was observed. Early indications point towards permafrost and soil movement as playing a large factor in the shortened lifespan of the chip sealing. The GNWT managed community chip seal program incurred chip seal application costs in excess of $90,000/km in 2005. Similarly to asphalt concrete, the roadway structure must be well designed and constructed before a chip seal is applied in order to ensure its longevity. With proper application chip seal can last two years before O&M costs will be incurred for replacing potholes.

Dust Suppressants

Listed below are the six main groups of dust suppressants:

- Water based
- Water absorbing
- Organic petroleum
- Organic non-petroleum
- Electrochemical derivatives
- Synthetic polymer derivatives

Many characteristics separate the different methods of dust control however in this report we are focusing on dust suppressants that are known to have a lifecycle of more than one year before reapplication. As a result this report will only discuss the characteristics of synthetic polymer dust suppressants.

Synthetic Polymer

Application costs of synthetic polymers for dust suppressants will be significantly reduced when compared to chip seal. Synthetic polymers are composed of long-chained molecular structures which can stick to more particles and bridge greater gaps between dust particles. This configuration results in an excellent dust palliative and soil stabilizer. When applied according to manufacturers' recommendations polymers are considered non-toxic and environmentally friendly. The application of polymers dust suppressants is most effective in lightly trafficked surfaces which are indicative of traffic patterns in communities. The application process is also less complex and less demanding of heavy equipment. One truck resembling a water truck with spray nozzles on the back of it plus labourers is all that is needed. If it is desired to work polymers into the top layer of material a grader may also want to be used.

Polymers have the ability to maintain structural integrity for more than eighteen months and some manufacturers indicate these polymers are able to retain eighty percent of its initial characteristic features after the one year period (Midwest Industrial Supplies Ltd., 2002). When reapplication is required only 30% of the original application amount is required as this is a cumulative process resulting in lower material costs.

5.0 Is Dust Control a Capital Cost?

Capital, according to the GNWT, is any infrastructure that can be considered accepted under the Community Public Infrastructure (CPI) Policy. Capital must serve and provide the criteria stated below.

Under the GNWT Department of Municipal and Community Affairs (MACA) Community Public Infrastructure Policy, MACA may provide funding to support community

governments with the provision of community public infrastructure required to support community government programs and services.

CPI is non-financial assets having physical substance that:

i. Are held for use in the production or supply of goods and services;
ii. Have useful economic lives extending beyond an accounting period;
iii. Have been acquired to be used on a continuing basis; and
iv. Are necessary to support community government programs and services.

A Tangible Capital Asset (TCA) must also meet the specific criteria stated below that relates directly to CPI criteria.

According to Part IV under the Financial Administration Manual (FAM), “Accounting for Public Property”, Section 2201 defines TCA’s as non-financial assets having physical substance that is acquired, constructed or developed and:

i. Is held for use in the production or supply of goods, delivery of services or program outputs;
ii. Has a useful life beyond one fiscal year;
iii. Is intended to be used on a continuing basis; and
iv. Is not intended for resale in the ordinary course of operations.

TCA’s are a significant economic resource managed by the Government and a key component in the delivery of many programs and services. TCA’s include such diverse items as roads, building, vehicles, equipment, land, aircraft, computer systems, water systems and bridges.

Consideration as a betterment to an asset or community is important criteria when awarding Gas Tax Funding.

Betterments are defined by GNWT as a costs incurred to enhance the service potential of a TCA. This TCA does not necessarily have to last longer however it must improve the quality this service is providing including:

i. Increasing its previously assessed service capacity;
ii. Significantly lowering its operating costs;
iii. Extending its useful life; or
iv. Improving its output quality.

A dust suppressant such as synthetic polymer is a material that will improve community health, safety, environmental concerns, maintenance and overall quality on an unpaved road serving as betterment to a tangible capital asset.

6.0 Financial Comparison

Recent estimates place the cost of initial application dust control methods for an area of road one kilometre long and seven meters wide would cost:

- Asphalt Concrete - $300,000 (Material, application)
- Chip Seal - $90,000 (Material, application and maintenance)
- Synthetic Polymer - $5,805 (Material, application and maintenance)

As stated above, in most cases the lifecycle of chip seal will outlast that of a synthetic polymer. However, due to the harsh climate weather and permafrost encountered in communities located throughout the Northwest Territories, the life of chip seal could last anywhere from 15 months to four years. When compared to the cost of applying a dust suppressant such as a synthetic polymer it is evident that even if 12 months was the final lifecycle of the polymer and four years was the extended lifecycle of the chip seal than it would still be more cost effective to apply a synthetic polymer as shown below:

Application, maintenance, material for polymer: $5,805.00

- Re-apply @ month 12: 30% of $5,805.00 + 4% inflation = $1,811.16
- Re-apply @ month 24: 30% of $6,278.69 + 4% inflation = $1,883.61
- Re-apply @ month 36: 30% of $6,529.84 + 4% inflation = $1,958.95

$11,458.72

Investment Strategy

Investment in dust control over the life cycle of roadways is justified from an economic basis alone. The reduction of aggregate loss (300 tonne per km per year) would save communities and average cost of $10,000 per km of road annually. When this is coupled with the associated health and safety benefits the benefits are undisputable.

MACA's Community Public Infrastructure Policy considers betterment a "cost incurred to enhance the service potential of a tangible asset." "Service potential is enhanced where the associated operating costs are lowered or the useful life of the asset is extended." (MACA, 2007) The application of Synthetic polymers as a form of dust control meets

both of these criteria. A typical investment strategy would see a 100% application of polymer in the first fiscal year and a subsequent 30% application for the next 3 years.

7.0 Conclusion

Dust control methods that have a useful life that exceeds one year after the initial application return benefits that are in accordance with Canada – Northwest Territories Agreement on the transfer of Federal Gas Tax Revenues Under the new Deal for Cities and Communities 2005-2015.

It is the recommendation of the Territorial co-chair that Synthetic Polymers and any dust palliative that has demonstrated useful life upon initial application in excess of twelve calendar months be eligible under the above noted program.