Air Quality Impact Study

Mobile Sources

Sand & Gravel Mining and Accessory Uses
Empire Township, Dakota County, MN

February 7, 2005

Prepared by

URS

700 Third Street South, Suite 600
Minneapolis, MN 55415-1199

TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

1.1 Project Description

A consortium of mine operators and landowners (Mining Consortium) propose to open new mines and expand existing aggregate mining areas to include a total area of approximately 3,600 acres in the northwest portion of Empire Township, Dakota County. Mining would be conducted in a similar manner to the current practices at existing mines within and adjacent to the Mining Area. Routine functions as well as ancillary operations are described in detail below.

Mining and Aggregate Processing

- Clearing and grubbing the site of vegetation and structures, as necessary
- Relocation of infrastructure, as necessary
- Excavation and transport of the raw aggregate materials
- Excavation, stockpiling, and transporting of other soils materials, including clay and topsoil, which may be present within the Mining Area for shipment to sites out of the Mining Area or for use in reclamation
- Washing, grading and stockpiling aggregate materials for sale or later internal use
- Transporting and stockpiling waste "fines" for potential later use in reclamation
- Transporting finished aggregate materials internally for subsequent processing and to construction sites beyond the Mining Area
- Transporting, accepting, and stockpiling clean, compactable fill materials, typically referred to as "backhauled", for potential later use in reclamation
- Transporting, accepting, and stockpiling clean organic soil materials (i.e., peat) for potential later use in reclamation
- Eventual redistribution, compacting, grading of overburden and clean fill materials to reclaim the sites

Ancillary Manufacturing

- Manufacture and transport of asphalt products
- Manufacture, stockpiling, warehousing and transporting of ready-mixed concrete, bagged mortar products, concrete block, concrete pavers, concrete pipe, concrete plank, etc.
- Importing, grading, processing and stockpiling aggregates to be blended with local aggregates in the production of various products which will increase the effective use of the local aggregates and extend the life of the resource
- Transporting, accepting and recycling products returned from construction sites, including "come-back" asphalt, ready-mixed

concrete, bagged mortar products, concrete block, concrete pavers, concrete pipe, concrete plank, etc.

- Transporting, accepting, stockpiling and processing recycled construction materials for inclusion in new products

General Operations and Administrative

- Offices and sales areas
- Equipment maintenance areas
- Fuel storage and refueling areas

Currently, various companies included in the Mining Consortium either own, lease, or have purchase options on a majority of the Mining Area. Those properties not currently controlled by the mining companies are included in this study in recognition that future mining could occur. The mine operators with current and/or future interest or ownership in the Mining Area include:

- Aggregate Industries North Central Regional (Aggregate Industries)
- Cemstone Products Company (Cemstone)
- Dakota County Transportation Department (Dakota County)
- Fischer Sand and Aggregate Company (Fischer)
- Heikes Property (Heikes)
- McNamara Contracting, Inc. (McNamara)
- Tiller Corporation (Tiller)
- Don Peterson (Peterson)

1.2 Purpose of this Study

A Scoping Environmental Assessment Worksheet (Scoping EAW) was prepared for the proposed project in October 2003. The Scoping Decision Document required that additional analysis be completed for the Mining Area, addressing a number of topics, including air quality. This Air Quality Impact Study has been prepared to provide an analysis of potential air quality impacts in the Mining Area, and to identify options for mitigating these potential impacts. The findings of this Impact Study will be incorporated into the forthcoming EIS.

1.3 Project Location and Setting

The Mining Area evaluated in this Impact Study is located in Empire Township, in the central portion of Dakota County, Minnesota (**Figure 1)**. The proposed Mining Area is in the northwest portion of the township, occurring in all or part of T114N, R19W Sections 5, 6, 7, 8, 9, 10 and 16.

1.4 Study Area

The Study Area is largely contained within the proposed Mining Area, shown in **Figure 2**. This area was delineated according to current mining operations, and areas where mining operators have current and future interests in mining available aggregate deposits.

1.5 Previous Studies

No previous site-specific air quality studies were referenced as a part of this document, as none were identified for areas near the Mining Area.

2.0 METHODOLOGY AND ASSUMPTIONS

2.1 Air Emissions

2.1.1. Airborne Pollutants

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions and the production of airborne pollutants by natural or artificial sources. The major airborne pollutant of interest from traffic is carbon monoxide.

Carbon monoxide (CO) is an odorless, colorless gas formed by the burning of fuels containing carbon. Motor vehicles are the principal source of CO emissions in urban areas. Maximum concentrations usually occur near intersections and other areas of traffic congestion, and decrease rapidly with distance from the source.

2.1.2. Regulatory Requirements

The Clean Air Act, which was last amended in 1990, requires Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards for pollutants considered harmful to public health and the environment. The state of Minnesota ambient air quality standards are shown in Table 2-1. These standards set the maximum allowed concentration of carbon monoxide (CO) for the state.

Table 2-1. Minnesota State Standards

Pollutant	Averaging Period	State Standards Primary
Carbon Monoxide (CO)	8-hour	9 ppm (10 mg/m^3)
	1-hour	30 ppm (34 mg/m^3)

2.1.3 Microscale Air Quality

The local air quality analysis consists of a microscale hot spot investigation for violations of the ambient air quality standards for CO. Vehicular traffic is the most significant source of CO emissions in the region. Because CO emissions dissipate rapidly with increasing distance from the source, the highest concentrations are likely to occur in the vicinity of roadway intersections or other locations where motor vehicles tend to idle for a period of time.

The methodology for identifying potential local air quality impacts follows the EPA-recommended procedure for CO microscale impact analysis. The general evaluation procedure, outlined in the *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA, 1992), includes a multiple intersection screening process, followed by microscale CO analysis with MOBILE 6.2 emission model and the CAL3QHC line-source dispersion model.

A multiple intersection screening analysis is used to identify locations in the project vicinity requiring further analysis for CO hot spots. The intersection screening process includes the following steps:

- Identify the signalized intersections in the project vicinity that will be impacted by the project alternatives
- Determine the delay and level-of-service (LOS) for those intersections
- Determine total intersection delay as the product of average delay and total intersection approach volume
- Rank the intersections according to delay and select the intersections with the highest vehicle delay for analysis

The selected intersections then are evaluated using a microscale analysis procedure. The procedure is used to estimate maximum 1-hour and 8-hour CO concentrations in the vicinity of each intersection for comparison with the state air quality standards. If microscale analysis does not identify significant local air quality impacts at the selected intersections, then impacts would be unlikely at any other location in the project vicinity.

The microscale analysis procedure includes the following steps:

- Assemble the required data for the analysis, including meteorological conditions, site characteristics, traffic parameters and emission variables.
- Estimate the future background CO concentration based on monitoring data and the expected change in regional emissions.
- Identify receptor locations near the intersection for simulation of future ambient CO concentrations.
- Compute the worst-case 1-hour CO concentration using CAL3QHC.
- Estimate the worst-case 8-hour CO concentration by applying a suitable persistence factor to the computed 1-hour concentration. The use of a persistence factor is intended to reflect the relationship between 1-hour and 8-hour traffic and meteorological conditions.
- Compare the results with the ambient air quality standards to identify adverse impacts, including new or aggravated violations.

The sidewalk averaging method, recommended by the EPA, was used for the intersections. In this method, the receptors are located along each sidewalk or side of the intersecting streets at approximately 10 meters and 50 meters from the edge of the intersecting roadway. The CO concentration at each of the receptors was modeled. The highest, or worst case, average CO concentrations for each receptor site was then calculated. The sidewalk averaging method results in higher predicted CO concentrations than would be expected at nearby receptors.

After all the necessary parameters and assumptions had been defined for the selected intersections, the CAL3QHC model was run for each project analysis scenario (Build for Years 2005, 2015 and 2025).

The microscale modeling process requires a number of parameters and assumptions. The model inputs listed below are consistent with current EPA recommendations, and are intended to represent reasonable worst-case scenarios at the selected intersections.

- Meteorological, Fuel and Vehicle Characteristics
  - Absolute Humidity: 75.0 grains/lb.
  - Altitude: Low Altitude
  - Evaluation Month: January
  - Speed Class: Uniform Arterial Speed
  - Minimum Temperature: 16 degrees Fahrenheit
  - Maximum Temperature: 38 degrees Fahrenheit
  - Fuel Program: Conventional Gasoline East
  - Fuel Reid Vapor Pressure: 9.0 lbs./square inch
  - Oxygenated Fuels: Alcohol with 99.9 Percent Market Share and 2.7 Percent Oxygen Content
  - Vehicle Age: Based on data provided by the MPCA
  - Averaging Time: 60 minutes
  - Surface Roughness: 108 cm
  - Settling Velocity: 0 cm/sec
  - Deposition Velocity: 0 cm/sec
  - Wind Speed: 1.0 m/sec
  - Stability Class: D
  - Mixing Height: 1,000 meters
  - Wind Direction: 360 degrees at 10 degree increments

- Traffic Characteristics
  - Lane configuration, link volume, signal cycle length, red time and lost time were taken from the traffic analysis completed for the Mining Area (Traffic Impact Study 2004).
  - The Build configuration incorporates the Mitigation Option 2 as analyzed in the Traffic Impact Study for this project.
  - Signal timings are optimized for each scenario. Optimization maximizes the capacity at each intersection while maintaining coordination with adjacent signalized intersections. The level of service of an intersection could show an improvement from no-build to the build scenarios even though traffic volumes have increased due to this optimization.

- Site Characteristics
  - Intersection layouts and roadway geometry were determined from maps and aerial photographs of the study area, and match those used in the Mining Area Traffic Impact Study.

- Emission Characteristics
  - Running emission rates were generated with MOBILE 6.2. The posted speed limit was used for all roadway links
  - Idle emission rates were calculated by converting the 2.5 mph MOBILE 6.2 running rate from grams per mile to grams per hour
  - The EPA-recommended default persistence factor of 0.7 was used to estimate 8-hour CO concentrations

2.2 Particulate Emissions

Particulate emissions for gravel roadways within the Mining Area are addressed in the Stationary Source and Site Operations Air Quality Impact Study. Particulate emissions for public roadways are addressed here using the same guidance used in the Site Operations Study. Emission factors for mining operation trucks were used directly from the Site Operations Study for mining operation trucks. Emission factors for public roadway particulate emissions for existing, No-Build, and mining operation auto traffic followed AP-42 guidance documentation for public roadways.

For purposes of this analysis, worst-case moisture content (0.03%), and worst-case silt content (35%) was used to determine the greatest potential particulate emissions as part of the project. While these emissions are emitted over significant distances, this demonstrates the potential emissions from gravel roads.

The vehicle miles traveled (VMT) on each gravel roadway (public) within the project area was determined using the Traffic Impact Study. The VMT of mining operation trucks was determined for each vehicle weight for application of each Emission Factor that was used from the Site Operations Study.

2.2.1. Particulate Emissions Regulations

The Minnesota Pollution Control Agency (MPCA) requires that facilities have air emissions permits based on the type and size of operations. The MPCA requirements base the permit decision on the 'potential to emit' of pollutants. That requires sources (of all types) to assume that operations occur 24 hours per day, 365 days per year regardless of any local restrictions. Also, for this determination, no controls can be considered. This basis is used ***only*** for the initial determination of whether or not a permit is needed. Once that decision is made ('yes' a permit is required or 'no' it is not), controls and limits can be considered in permitting documents as appropriate.

Table 2-2 provides a summary of the MPCA permit requirement thresholds for all pollutants. Again, these are not limitations on operations. Being over the threshold does not mean that emissions must be reduced; only that a permit is required. The MPCA permit will then address specific requirements for the permitted operations.

Table 2-2 MPCA Permitting Levels

Pollutant	MPCA Permit Requirement Thresholds (tons/yr)
PM	100
PM_{10}	25
SO_2	50
NO_x	100
CO	100
VOC	100
Lead	0.5

In addition, Dakota County's 2025 Transportation Plan indicates that gravel roads with average daily traffic (ADT) that exceed 300 vehicles may be more cost effective if paved.

As is discussed in the mitigation section of this document, paving of gravel roadways is anticipated to occur prior to significant mining activities. As a result, the emissions presented in the Impact Analysis section of this report are unlikely to occur.

3.0 EXISTING CONDITIONS

3.1 Background Carbon Monoxide

Background CO levels were provided by the MPCA during a meeting held with MPCA staff on October 13, 2004. Areas similar to the project area typically have very low background CO levels. The background CO levels provided by the MPCA are 3.0 ppm for the one-hour average, and 2.0 ppm for the eight-hour average.

3.2 Particulate Emissions

The primary source of particulate emissions (dust emissions) in the project area (excluding internal mine haul roads) are gravel roads. Two gravel roadways exist in the project area, and include Biscayne Avenue from CSAH 66 to CSAH 42, and 170th Street from TH3 to the east of the project area. Dakota County's 2025 Transportation Plan indicates that roadways with an ADT of 300 or greater are considered for paving, given cost effectiveness and safety reasons. Of the roadway segments identified, Biscayne Avenue north of 160th Street already exceeds 300 ADT.

4.0 MINING IMPACT ANALYSIS

4.1 Carbon Monoxide

4.1.1. Intersection Screening

Using the results from the Traffic Impact Study for the Mining Area, the potential intersections for analysis were identified, ranked and selected for further evaluation. The intersections studied in the Traffic Impact Study for the proposed mining area are listed in **Table 4-1**.

A total of three intersections within the study area were selected for air quality analysis based on the projected future traffic delay:

- 160th Street at Pilot Knob Road
- 160th Street at Cedar Avenue
- 160th Street at TH 3

These intersections with a LOS of D or worse are highlighted in gray in **Table 4-1,** and are shown in **Figure 3**. These intersections were selected based on their highest delay per vehicle for the Year 2025 Build condition, and their level of impact associated to the project.

Table 4-1. Intersection Screening Results

Build Year 2025
With Residential Development and traffic Mitigation Option 2
Empire Township Traffic Study
PM Peak Hour

LOS & Delay

INTERSECTION	Total Volume	Delay / Vehicle	Total Delay	LOS
160th St. & Pilot Knob Rd.	7,297	48.4	353,175	D
160th St. & Cedar Ave.	7,771	47.3	367,568	D
160th St. & TH3	4,563	43.6	198,947	D
Pilot Knob Rd. & 170th St.	4,826	38.4	185,318	D
TH3 & 150th St.	3,816	36.9	140,810	D
150th St. & Pilot Knob Rd.	6,115	35.6	217,694	D
TH 3 & Elm St.	2,914	30.1	87,711	C
TH3 & 220th St.	2,914	28.8	83,923	C
160th St. & Diamond Path	3,604	26.3	94,785	C
Pilot Knob Rd & Dodd Blvd.	4,324	25.7	111,127	C
160th St. & Biscayne	2,142	21.5	46,053	C
TH 3 & 170th St.	3,245	21.3	69,119	C
160th St. & Galaxie	4,305	18.8	80,934	B
160th St. & A.I. Mining Access	3,384	18.7	63,281	B
160th St. & Flagstaff	3,903	9.3	36,298	A
TH 3 & CSAH 66	2,415	8.8	21,141	A
160th St. & Foliage	3,973	8.4	33,373	A
160th St. & Chippendale	2,547	7.8	19,761	A
160th St. & Shannnon Parkway	2,598	7.2	18,583	A
170th St. & Cemstone	1,362	6.9	9,423	A
170th St. & Biscayne Ave	181	3.6	660	A

Source: URS
Notes: (1) Delay is measured in seconds
(2) Gray shading indicates intersections for which air quality analysis was performed.

The selection of these three intersections is used as a method to determine if the CO concentrations exceed state standards at several the worst-case intersections. If the conclusion can be drawn that no exceedances of the state standards will occur at the worst intersections as a result of the Mining Area, no impacts would be expected at the other intersections within the Study Area as a result of mining.

4.1.2. Predicted Intersection Carbon Monoxide Levels

Table 4-2 provides the results of the CO modeling at the three selected intersections. For each location, the table shows the highest predicted 1-hour and 8-hour CO concentrations under each Year of analysis. No violations were encountered under any of the Years of analysis. Because the selected intersections represent the worst locations in the study area in terms of traffic volume and vehicular delay, it is reasonable to conclude that other locations in the study area would not experience violations of the ambient CO standards under any of the proposed alternatives.

Table 4-2. Maximum Predicted CO Concentrations
Build Scenarios for Year 2005, 2015, and 2025

Intersection	Averaging Period	Maximum Concentration (ppm)[a,b]				
		State Standards	2005	2015	2025	Violation
160th Street / Cedar Avenue	1-hour	30	8.1	7.1	6.8	None
	8-hour	9	5.6	4.9	4.7	None
160th Street / Pilot Knob Road	1-hour	30	6.9	6.6	6.4	None
	8-hour	9	4.7	4.5	4.4	None
160th Street / TH 3	1-hour	30	6.0	5.7	5.6	None
	8-hour	9	4.1	3.9	3.8	None

Source: URS
Notes:
a. Results include estimated background CO levels of 3.0 ppm (1-hour) and 2.0 ppm (8-hour).
b. The applicable State ambient CO standards for the 1-hour and 8-hour averaging periods are 30 ppm and 9 ppm, respectively. The applicable Federal ambient CO standards for the 1-hour and 8-hour averaging periods are 35 ppm and 9 ppm, respectively

4.1.3. Impact Summary

No-Build Alternative
The No-Build Alternative would have no mobile source impacts on microscale air quality.

Build Alternatives
The mobile source air quality analysis completed for the project demonstrates that all applicable state and federal regulations are satisfied and that neither the 2015 or 2025 scenarios were found to cause CO standard exceedances at worst-case locations, under worst-case conditions.

Future year concentrations typically decrease due to improved emission controls of the vehicle fleet. This often occurs even with increased traffic volumes and intersection delay.

4.2 Particulate Emissions

Table 4-3 demonstrates the results of the particulate emissions predicted in the project area.

Table 4-3. Maximum Predicted Particulate Emissions from Gravel Roads

Annual PM Emissions (tons) with 50% Control			
	Source:		
Scenario	Mining Operations Trucks	Non-Mine traffic and Mine Autos	All Vehicles
2005 NB	0	2,952	2,952
2005 BD	0	2,952	2,952
2015 NB	0	4,240	4,240
2015 BD	1,174	8,622	9,796
2025 NB	0	5,811	5,811
2025 BD	1,024	8,338	9,362

Assumptions:

High Silt Content (35%), and Low Moisture Content (0.03%)

The results of the analysis indicate that particulate emissions as a result of truck traffic are not necessarily the dominant source. However, other mining operation traffic contributes significantly, and the overall particulate emissions for the 2015 and 2025 Build scenarios are approximately double the emissions from No-Build scenario.

5.0 MITIGATION OPTIONS

5.1 Carbon Monoxide

The Build Alternative will have no adverse impacts to air quality. Therefore, no specific mitigation plan is recommended.

5.2 Particulate Emissions

The Build Alternative has potential for adverse impacts to air quality from gravel roadways. Mitigation for controlling dust on gravel roadways can include watering and chemical application. However, paving the gravel roadway may be a more cost effective measure.

The Dakota County 2025 Transportation Plan states that gravel roadways are typically considered for reconstruction and paving when the ADT is greater than 300. This is to provide cost effective roadways and increase mobility, safety and maintenance efficiency.

County Roads

170th Street is located within the mining area, and is gravel between approximately TH 3 and Biscayne Avenue. 170th Street in this segment will exceed 300 ADT by the Year 2015 for the No-Build Alternative. While the mining operation traffic will increase the traffic, paving of the roadway should be considered by the County regardless of the proposed mining operations.

Non-County Roads

170th Street to the east of Biscayne Avenue is not planned to be used by the mining operations. However, the ADT on this roadway segment is anticipated to exceed 300 before the Year 2015.

Biscayne Avenue is currently a gravel roadway between 150th Street and CSAH 66. Biscayne Avenue within the Mining Area is planned for use by mining operations. The segment south of the Mining Area (approximately 0.8 miles south of 170th Street) is not anticipated to exceed 300 ADT by the Year 2025, and no mining operation traffic is expected to use this segment.

The segment of Biscayne Avenue north of 160th Street is currently gravel and currently exceeds 300 ADT, and will continue to increase even without the mining operation traffic. While the mining operation traffic will increase the traffic, paving of the roadway should be considered regardless of proposed mining operations.

The segment of Biscayne Avenue south of 160th Street and extending to the southern most mining access point is currently gravel. This segment of roadway is not anticipated to exceed 300 ADT by the Year 2025 without the proposed mining operations. However, as a result of the mining operations, the traffic volume north of 170th Street will exceed 300 ADT by the Year 2015, and the traffic volume south of 170th Street will exceed 300

ADT by the Year 2025. These segments of Biscayne Avenue should be considered for paving as a result of the proposed mining operations (**Figure 4**).

6.0 CONCLUSIONS

6.1 Carbon Monoxide Conclusions

Intersections with the highest delay were analyzed for air quality impacts, and no impacts were found. Based on this analysis of worst-case locations, no carbon monoxide impacts will occur in the entire project area as a result of traffic-related activities.

6.2 Particulate Emission Conclusions

Mobile source particulate emissions from unpaved public roadways as a result of the project will require mitigation. As traffic volumes increase on these road segments, dust suppression treatments could be applied. However, once volumes exceed an ADT of 300, the County generally considers paving to be the most efficient method of dust control. Therefore, segments that exceed 300 ADT due to Mining Area traffic (Biscayne Avenue between 160th Street and 170th Street, and between 170th Street south to the proposed mining entrance) should be paved with cost-sharing by the Mining Consortium, in coordination with the appropriate road authorities.

7.0 REFERENCES

- Empire Township Sand & Gravel Mining and Accessory Uses Traffic Impact Study, December 2004
- Meeting with Mr. Innocent Eyoh, MPCA, October 13, 2004.
- USEPA, *Guideline for Modeling Carbon Monoxide from Roadway Intersections*, EPA-454/R-92-005, November, 1992.
- USEPA, *User's Guide to MOBILE6 (Mobile Source Emissions Factor Model),* May, 1994.
- USEPA, *User's Guide to CAL3QHC, Version 2.0: A Modeling Methodology For Predicting Pollutant Concentrations Near Roadway Intersections*, EPA-454/R-92-006, Revised, September, 1995.
- USEPA, *Guideline for Air Quality Maintenance Planning and Analysis Volume 9 (Revised); Evaluating Indirect Sources*, USEPA-450/4-78-001, September, 1978.
- Revisions to AP-42 Section 13.2.2, "Unpaved Roads", EPA Contract 68-D-002, Work Assignment No. 1 1-03 MRI Project No. 110130.1.003

FIGURES