October 22, 2015

Ms. Kristina Handt
City of Scandia
14727 209th St N
Scandia, MN 55073

Re: Dust Emissions Monitoring – Zavoral Mine
Project #4055-004

INTRODUCTION:

This report presents the results of the recent air monitoring for potential fugitive dust and diesel exhaust emissions conducted by Indoor Environment Group, Inc. (IEG) in regard to mining operations at the Zavoral Mine in Scandia, Minnesota. Sampling was conducted on October 8 and 9, 2015.

The scope of our monitoring service was limited to the testing of nitrogen dioxide, carbon monoxide and sulfur dioxide levels and real time dust level monitoring from multiple locations adjacent to the mine and along the haul route. Services were performed in order to assess airborne emissions and potential environmental release related to the loading and hauling operations.

EXECUTIVE SUMMARY:

Monitoring activities assessed the levels of airborne particulates; specifically $PM_{2.5}$ as well as three potential aerosol emissions; nitrogen dioxide, carbon monoxide and sulfur dioxide.

The Environmental Protection Agency currently sets standards based on two categories of particulate matter (PM), "PM_{10}" and "$PM_{2.5}$." PM10 is matter 10 micrometers in diameter or less and is defined as inhalable course particles. The EPA defines PM2.5 as fine particle pollution and includes any particle that is 2.5 micrometers in diameter or smaller.

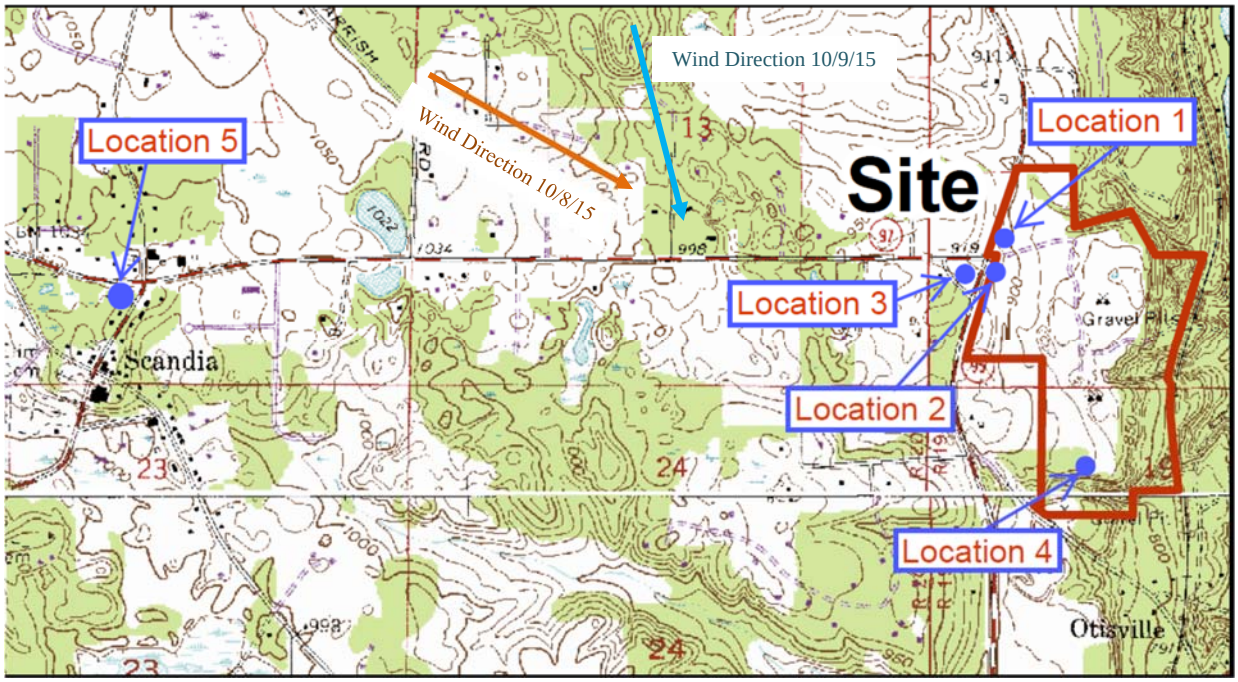
Our monitoring activities were designed to evaluate the dust levels within the range of primary concern which is the PM2.5 category. Accordingly, our air monitoring strategy utilized real-time dust monitors designed for isolating $PM_{2.5}$ (2.5µ) particulates.

Exhaust emissions monitoring was performed to determine the impact of loading and hauling equipment. Specifically, nitrogen dioxide, carbon monoxide and sulfur dioxide were selected as they are the most likely compounds released in a measurable quantity during these operations.

Monitoring activities were conducted at 5 locations including one upwind location for comparison purposes. All air sampling was conducted at a uniform vertical height of 5 feet using a tripod or existing structures. The mine was active during both days of sampling.

Sampling was performed at five locations. Locations were selected based on prevailing wind direction at the site. The sample locations are identified as follows:

Location #1:	Upwind edge of the mine
Location #2:	Downwind edge of mine entrance
Location #3:	Downwind of first acceleration zone on haul route
Location #4:	Downwind edge of mine site
Location #5:	Downwind at intersection of Highway 97 and Highway 3



Maps of the sampling locations are also provided in the attachments.

GENERAL FINDINGS:

Sample results for the current monitoring event can be summarized as follows:

- Particulate Monitoring (PM 2.5): Below EPA standards
- Nitrogen Dioxide: Below detectable levels
- Carbon Dioxide: Below OSHA standards
- Sulfur Dioxide: Below detectable levels

We did identify a slight increase in particulate levels during the first day of sampling as compared to previous sampling sessions. All other sampling results were consistent with sampling performed in previous testing sessions which included sampling on both active and non-active mining days.

Based on all sampling performed at the site, the best available research and current regulatory guidelines

and recommendations, it is our opinion that these operations currently pose no threat to public health or the environment. Additional information regarding the sample procedures, results and findings can be found in the following sections of this report.

METHODOLOGY:

Dust Monitoring – PM 2.5

Real-time dust monitoring was performed using four TSI DustTrak 8520 Aerosol Monitors with environmental enclosures. At each location the monitors were fitted with a PM 2.5 impactor.

Monitors were zero calibrated at the beginning of each sampling period. Sampling periods corresponded with the respirable dust sampling activities. Monitors were set to collect data every 30 seconds. All data was downloaded at the completion of daily monitoring.

Nitrogen Dioxide

The monitoring for Nitrogen Dioxide was conducted using a BW Honeywell Analytics Gas Alert Extreme with a nitrogen dioxide sensor. Nitrogen dioxide was measured in the range of 0-99.9 ppm with a .1 ppm resolution. Each unit was calibrated prior to use and set up in datalog mode with measurements taken every minute.

Sulfur dioxide & carbon monoxide

Sulfur dioxide (SO2) and carbon monoxide (CO) were also measured at each location using the MultiRAE Plus 3 Gas Monitor. Sulfur dioxide is measured in the range of 0-20.0 ppm with 0.1 ppm resolution and carbon monoxide in the range of 0-500 ppm with a 1 ppm resolution. Each unit was calibrated prior to use and set up in datalog mode with measurements taken every minute.

RESULTS:

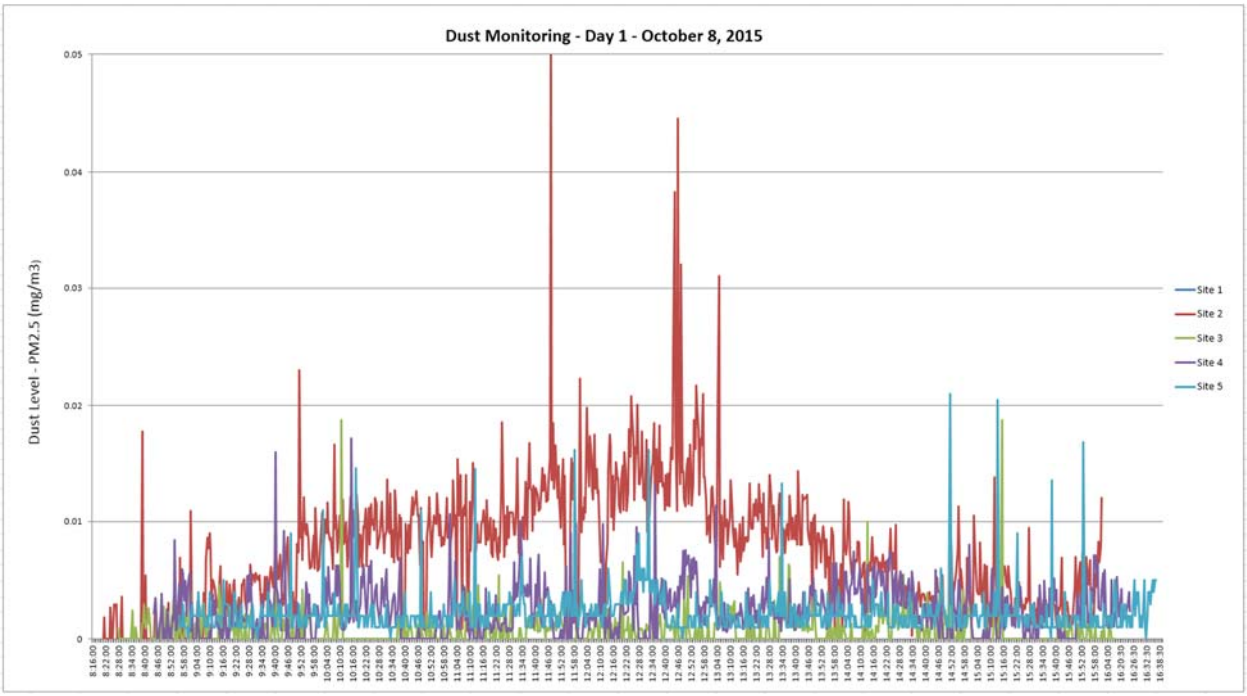
Sample results for all monitoring activities are summarized in the following tables.

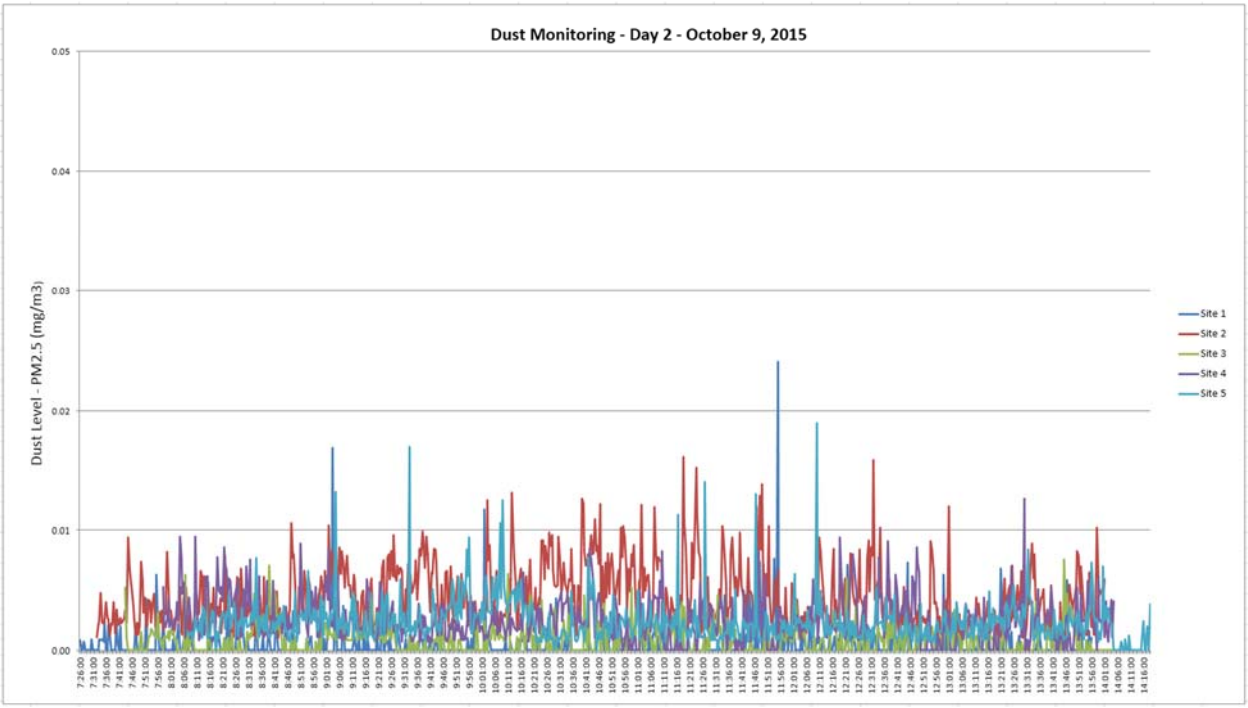
TABLE 1
PARTICULATE TESTING RESULTS

Date	Particle Size	Location	Low	High	Average	EPA Standard*
Day 1 10/8/15	2.5 µ	Site 1	0.000 mg/m^3	0.028 mg/m^3	0.001 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 2	0.000 mg/m^3	0.058 mg/m^3	0.007 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 3	0.000 mg/m^3	0.019 mg/m^3	0.001 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 4	0.000 mg/m^3	0.017 mg/m^3	0.002 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 5	0.000 mg/m^3	0.021 mg/m^3	0.002 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
Day 2 10/9/15	2.5 µ	Site 1	0.000 mg/m^3	0.024 mg/m^3	0.001 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 2	0.001 mg/m^3	0.016 mg/m^3	0.004 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 3	0.000 mg/m^3	0.008 mg/m^3	0.001 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 4	0.000 mg/m^3	0.013 mg/m^3	0.003 mg/m^3	0.012 mg/m^3 0.035 mg/m^3
		Site 5	0.000 mg/m^3	0.019 mg/m^3	0.002 mg/m^3	0.012 mg/m^3 0.035 mg/m^3

*The EPA standard for $PM_{2.5}$ of 0.012 mg/m^3 is the primary standard and is an annual mean averaged over three years. The daily (24 hour) standard 0.035 mg/m^3.

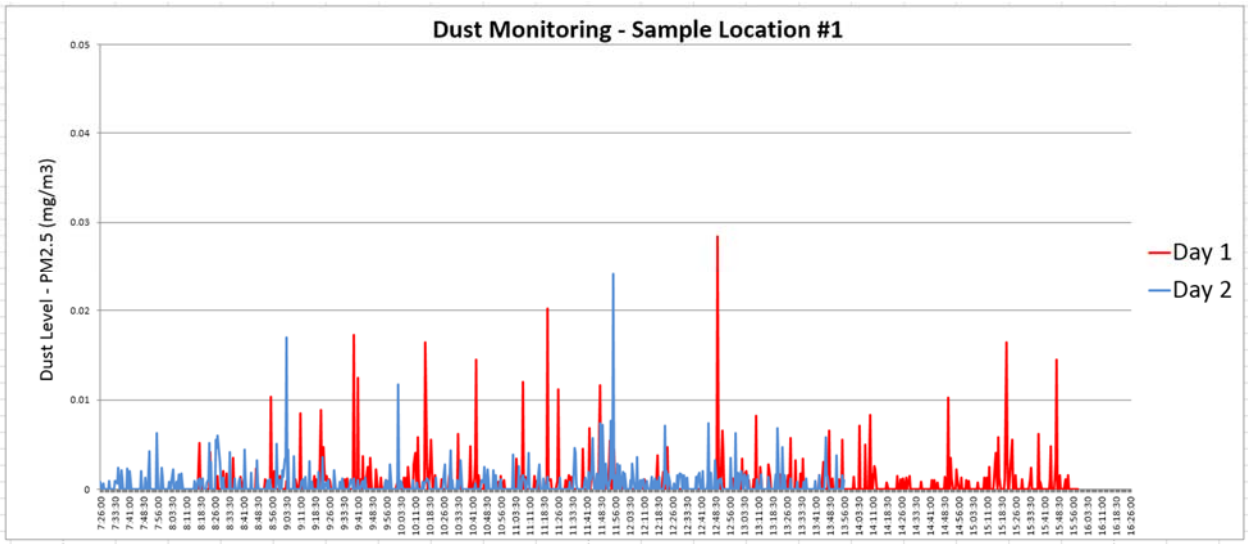
Particulate Monitoring Summary by day:

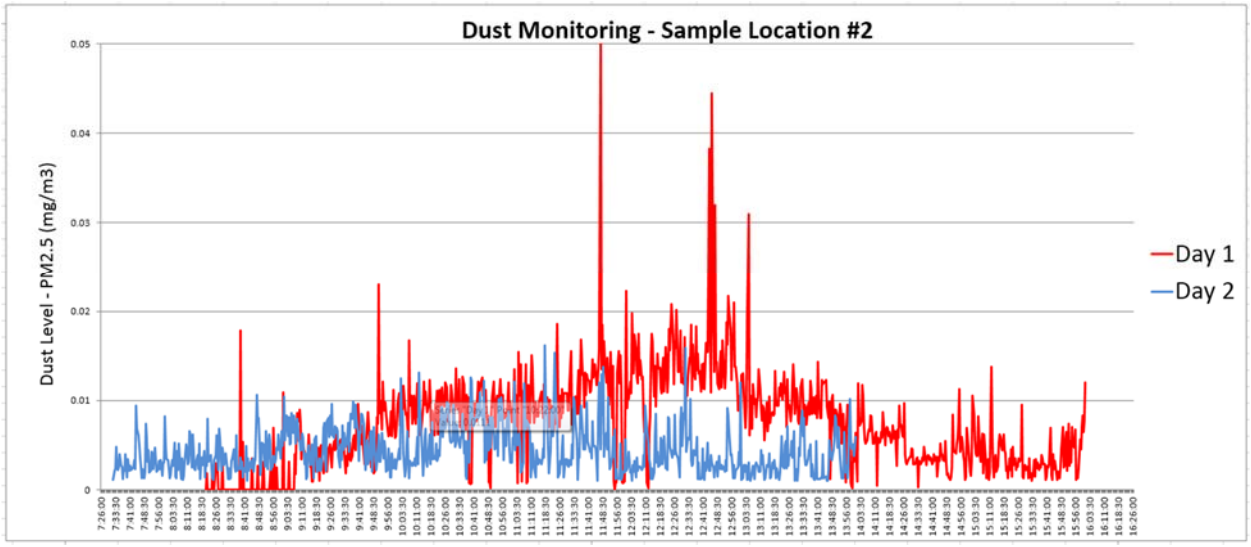


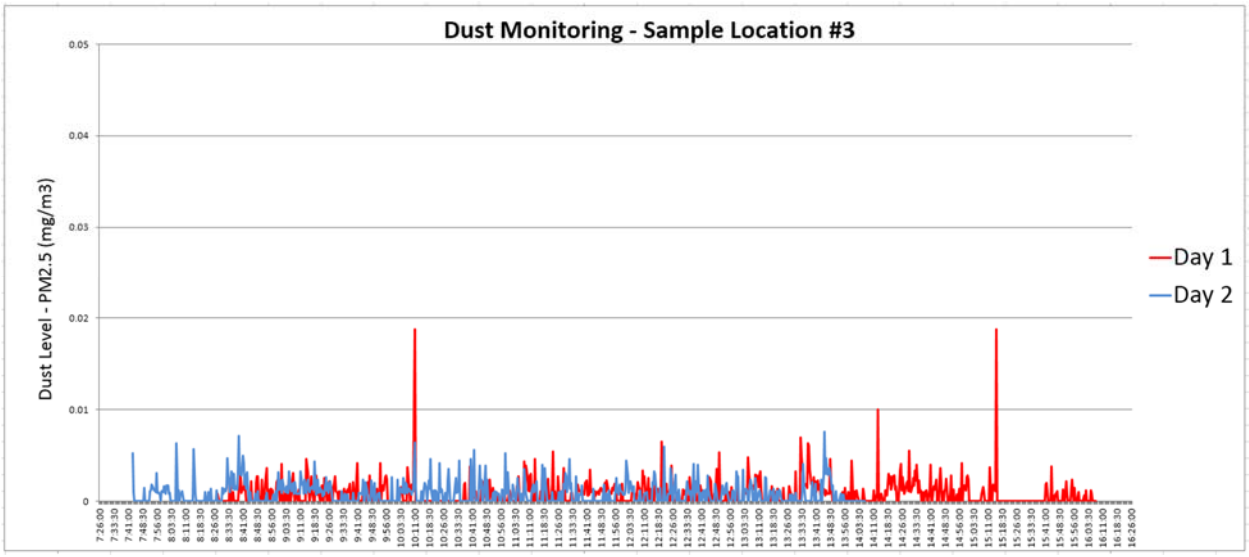


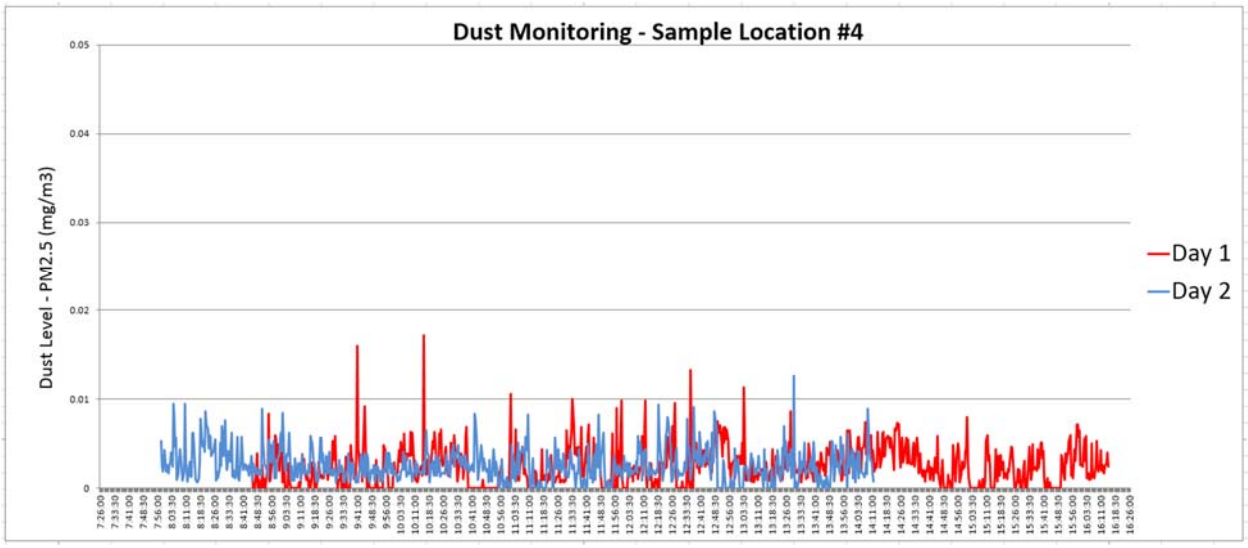
Full sized tables have been included as attachments.

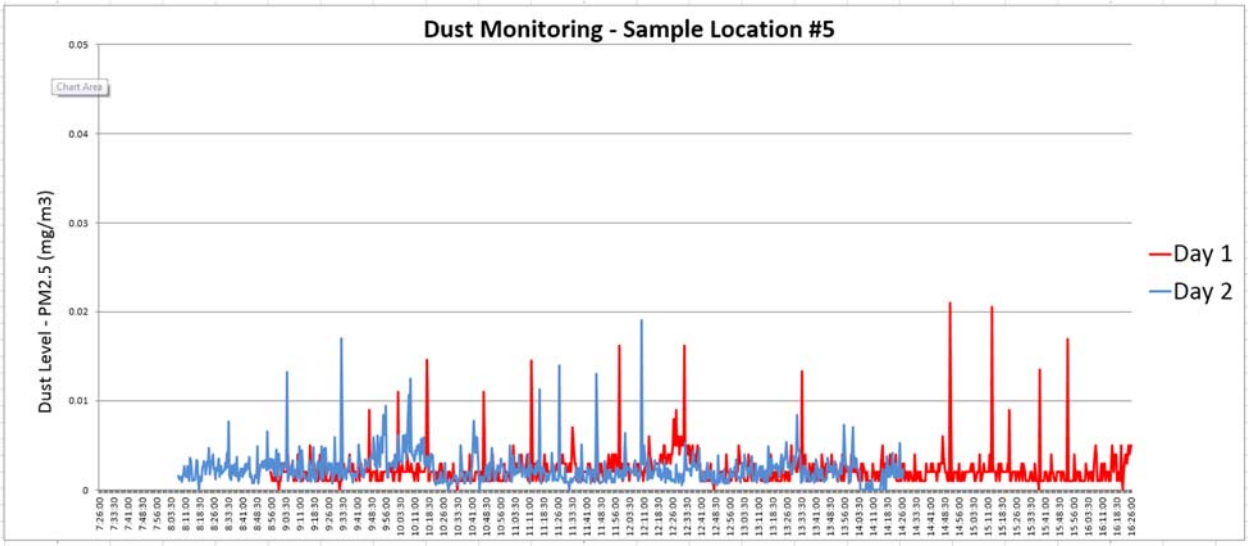
Particulate Monitoring Summaries by Site:




Dust Monitoring - Sample Location #2
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2


Dust Monitoring - Sample Location #3
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2


Dust Monitoring - Sample Location #4
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2



Full sized tables have been included as attachments.

TABLE 2
NITROGEN DIOXIDE SAMPLES

Location	Peak Value	Min Value	Average	TWA*	OSHA PEL/ ACGIH TLV
Site 1	0.0	0.0	0.0	0.0	5 ppm 0.2 ppm
Site 2	0.0	0.0	0.0	0.0	5 ppm 0.2 ppm
Site 3	0.0	0.0	0.0	0.0	5 ppm 0.2 ppm
Site 4	0.0	0.0	0.0	0.0	5 ppm 0.2 ppm
Site 5	0.0	0.0	0.0	0.0	5 ppm 0.2 ppm

OSHA PEL = Occupational Safety and Health Administrations current Permissible Exposure Limit
ACGIH TLV = American Conference of Governmental Industrial Hygienists threshold limit value

TABLE 3
CARBON MONOXIDE SUMMARY

Location	Peak Value	Min Value	Average	TWA*	OSHA PEL**
Site 1	0.0	0.0	0.0	0.0	50.0
Site 2	0.1	0.0	0.0	0.0	50.0
Site 3	0.0	0.0	0.0	0.0	50.0
Site 4	0.0	0.0	0.0	0.0	50.0
Site 5	0.2	0.0	0.0	0.0	50.0

All values are expressed in parts per million (ppm).
TWA = 8 hour Time Weighted Average
OSHA PEL = The OSHA permissible exposure limit as an 8-hour TWA concentration

TABLE 4
SULFUR DIOXIDE SUMMARY

Location	Peak Value	Min Value	Average	TWA*	OSHA PEL**
Site 1	0.0	0.0	0.0	0.0	5.0
Site 2	0.0	0.0	0.0	0.0	5.0
Site 3	0.0	0.0	0.0	0.0	5.0
Site 4	0.0	0.0	0.0	0.0	5.0
Site 5	0.0	0.0	0.0	0.0	5.0

All values are expressed in parts per million (ppm).
TWA = 8 hour Time Weighted Average
OSHA PEL = The OSHA permissible exposure limit as an 8-hour TWA concentration

DISCUSSION:

Airborne particulate levels, nitrogen dioxide, carbon monoxide and sulfur dioxide were tested on two consecutive days in areas at or adjacent to the Zavoral Mine in Scandia, Minnesota to evaluate fugitive dust emissions and air quality impact.

Sampling stations were established at five locations based on the wind direction at the time of sampling. One station was located upwind of the mine and the remaining four were located at likely dust release locations on or near the mine or along the haul route.

Sampling was performed on two consecutive days; Day 1 (10/8/2015) and Day 2 (10/9/2015). Site activities on both days included normal mining, loading and hauling activities.

Activities witnessed on both days included mining, stockpiling and loading activities within the mine as well as transportation of the material to a processing facility. Driveway and road sweeping operations were performed on both days by an independent contractor. Sweeping began at 12:45 pm on October 8, 2015 and continued for the remainder of the day. There was a significant buildup of dust and debris on the driveway and roadway by the time sweeping work started on that day. Sweeping activities were performed throughout the entire day on October 9, 2015.

Airborne Particulates

Particulate levels were determined using five TSI DustTrak 8520 Aerosol Monitors with environmental enclosures. One monitor was place immediately upwind of the loading operations and other four monitors located at downwind sites. At each location the monitor was fitted with a PM 2.5 impactor.

$PM_{2.5}$ levels ranged from 0.000 mg/cm^2 to 0.058 mg/cm^2 over the two days of sampling. In general, downwind samples showed only a slight increase as compared to the upwind sample. A few spikes were detected on the downwind sample at the mine entrance and coincided with equipment offloading activities and road cleaning operations.

Averages at each location were all well below the EPA National Ambient Air Quality Standards. However, the average dust levels at Site 2 (downwind at the gate) were higher than levels detected at that location during previous sampling events. The average $PM_{2.5}$ levels ranged from 0.0006 mg/m^3 and 0.0075 mg/m^3. Previously, the highest average detected at any sampling location was 0.0060 mg/m^3

The highest sustained dust levels were also detected downwind at the mine entrance gate (Site 2). In previous years the highest sustained levels were recorded downwind from the mine itself (Site 4). Levels detected at Site 2 ranged from 0.0000 mg/m^3 to 0.0580 mg/m^3 on Day 1 and 0.0000 mg/m^3 to 0.0162 mg/m^3 on Day 2. We believe that the higher levels detected on Day 1 were due to the buildup of dust on the driveway and roadway. These areas were much cleaner on Day 2 and that was reflected in the particulate sampling results.

For daily monitoring such as this sampling activity we normally compare the results to the EPA's National Ambient Air Quality Standards, specifically those levels regarding daily averages. Current EPA daily average standard for $PM_{2.5}$ is 0.035 mg/m^3 (35 µg/m^3). Airborne levels detected at all locations were significantly below this standard.

Nitrogen Dioxide

Nitrogen dioxide is an indicator contaminant found in conjunction with diesel exhaust and was, for that reason, sampled at each location to detect any impact on local air quality. No nitrogen dioxide was detected at any location.

Carbon Monoxide

Carbon Monoxide levels were monitored at each sampling location. The peak reading of 0.2 PPM was detected at sampling location #5 at the intersection on the north end of Scandia. A peak reading of 0.1 PPM was detected at location #2. No carbon monoxide was detected at any other time at any location.

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for carbon monoxide is 50 parts per million (ppm) parts of air as an 8-hour time-weighted average (TWA) concentration. The OSHA levels are the legal limit for occupational exposure and should not be considered "safe levels."

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for carbon monoxide of 35 ppm as an 8-hour TWA and 200 ppm as a ceiling [NIOSH 1992]. The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned carbon monoxide a threshold limit value (TLV) of 25 ppm as a TWA for a normal 8-hour workday and a 40-hour workweek.

Levels detected at each location were well below regulatory and recommended exposure levels.

Sulfur Dioxide

Sulfur Dioxide levels were monitored at each sampling location. As indicated, no sulfur dioxide was detected at any location.

DUST CONTROL SITE REVIEW

During the sampling activities, Indoor Environment Group, Inc. visually monitored dust control activities at the site. During these times we noted the following:

Task/Item	Completed as per DCP			Notes/Recommendations
	Yes	No	N/A	
Haul Road				
Paving - maintain first 300 feet	X			
Asphalt millings - main haul road	X			
Dust control application	X			
Watering - as needed to control dust	X			
Washing - at least 2x per day		X		Only witnessed watering of the haul road on one occasion
Sweeping - 1-2 times per week	X			
Tracking	X			
Records	X			
Excavation Area				
Watering - as necessary			X	
Load equipment washed			X	
Hauling Operations				
Covered trucks	X			3 loads were uncovered while leaving the site. 2 of these loads remained uncovered the entire route.
15mph site speed	X			
No idle >15 minutes	X			
Trucks washed			X	

SUMMARY:

The sampling performed during this monitoring session confirmed that current mining and hauling operations are having little on local air quality levels. Based on our findings we feel that the current Dust Control Plan is effectively keeping dust and exhaust emissions to a minimum.

We did notice a significant amount of dust buildup on the mine entrance driveway and on Highway 97 as well as elevated airborne particulate levels at sampling location 2 on Day 1 of the sampling activity. This is likely due to the precipitation early on October 8, 2015 and the lack of sweeping prior to that day. Once sweeping operations were completed the airborne particulate levels returned to normal. For that reason, we recommend continued adherence to the Dust Control Plan as well as periodic monitoring of Dust Control Activities. Daily sweeping activities may be necessary to control dust levels at the mine entrance.

Overall, current site dust control activities appear to be in compliance with the Dust Control Plan. The exceptions were as follows:

- 3 uncovered loads leaving the mine site

- Watering of haul road twice per day – only witnessed watering activity one time during the two days we were on site. However, the haul road was adequately wet for the duration of Day 1 and for most of Day 2.

RECOMMENDATIONS:

Based on the findings of this sampling activity, Indoor Environment Group, Inc. recommends the following activities:

1. Continue annual dust sampling activity – preferably during the summer months

2. Continue monthly dust control site review (AOP Item 12)

3. Maintain compliance with the current Dust Control Plan

4. Remind truck drivers to cover loads prior to leaving the mine site.

We did not find any reason to recommend any changes to the current Dust Control Plan at this time.

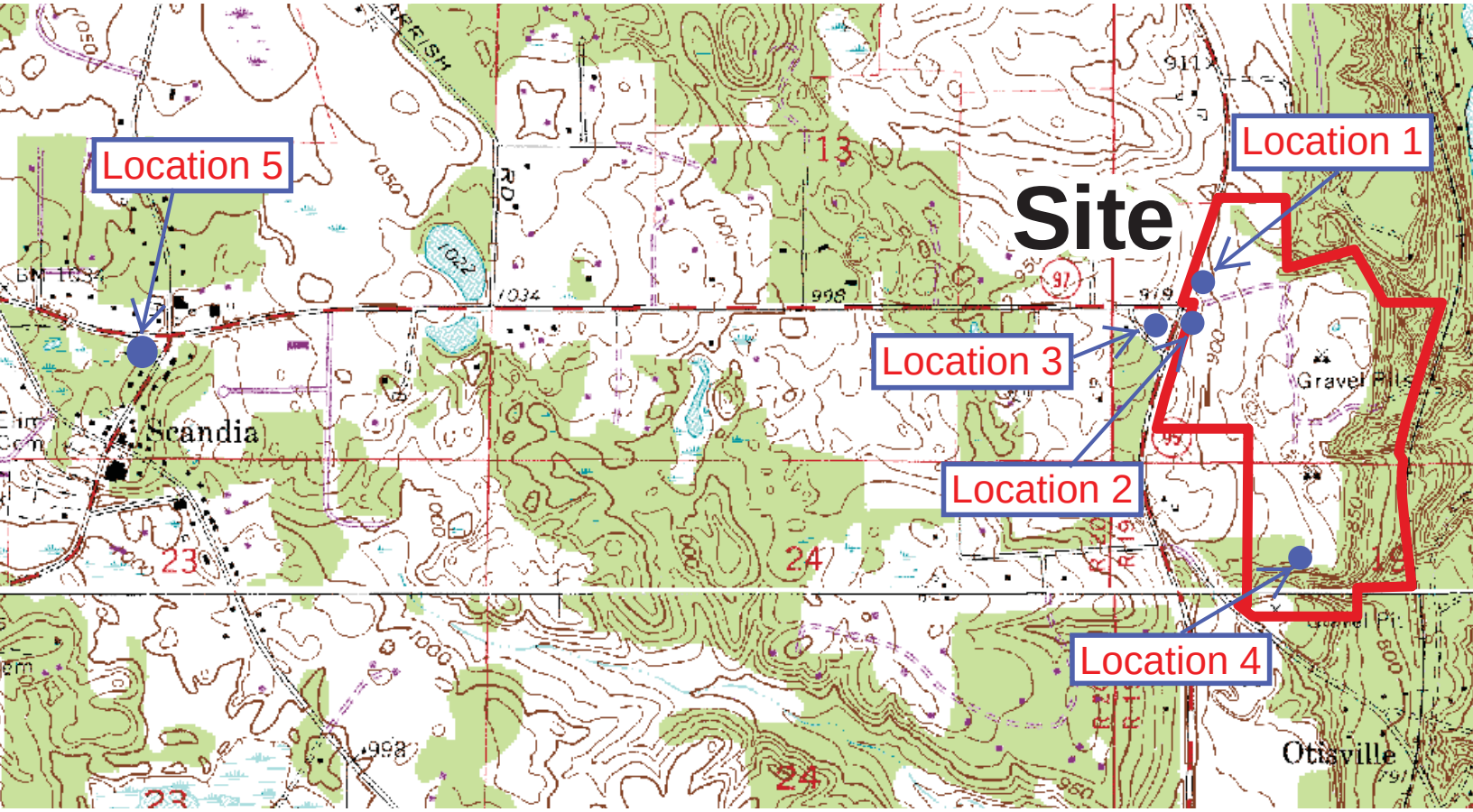
REMARKS:

The environmental services provided by Indoor Environment Group's industrial hygienists, technicians, analysts and project managers for this project have been conducted in a manner consistent with the degree of care and technical skill exercised by environmental professionals currently practicing in this area under similar budget and time constraints.

Recommendations contained in this report represent our professional judgment at the time the project was performed.

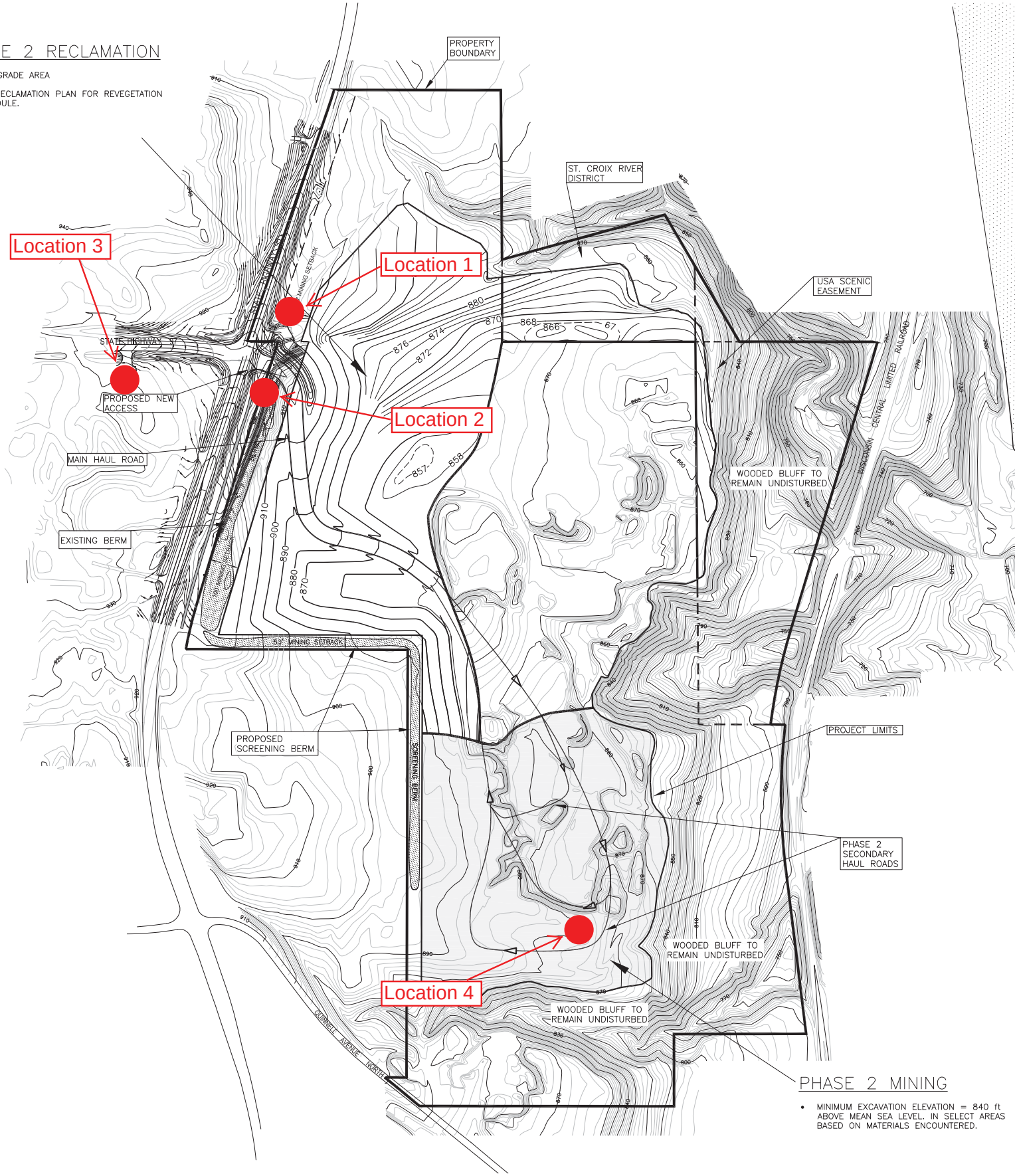
This concludes our report. Any questions regarding the fieldwork, sample results or presented findings should be directed to Indoor Environment Group, Inc.

Dave Gutterud
Director of Operations


Location 5
Site
Location 1
Location 3
Location 2
Location 4
Scandia
Gravel Pits
Otisville
13
23
24
19

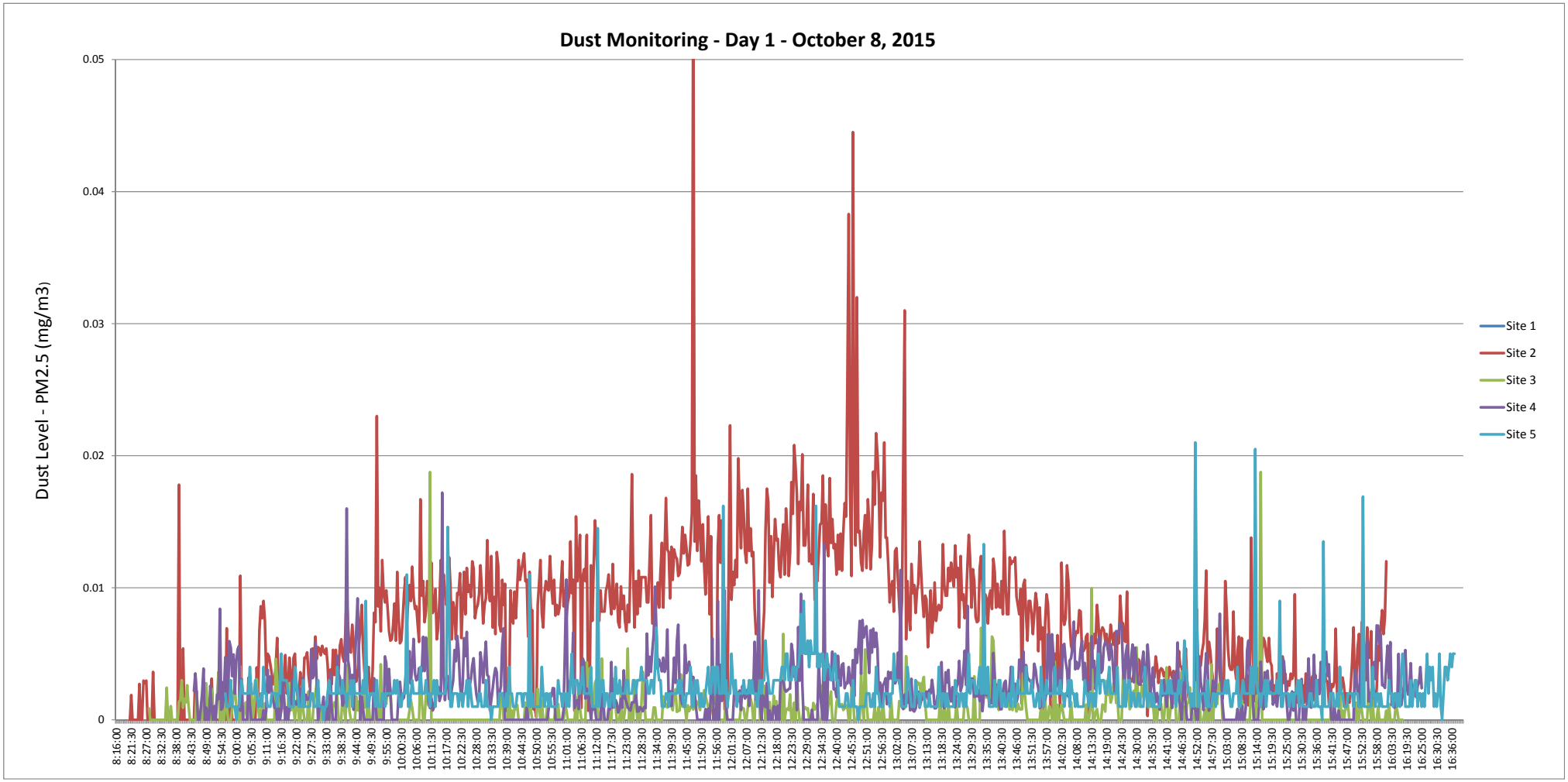
PHASE 2 RECLAMATION

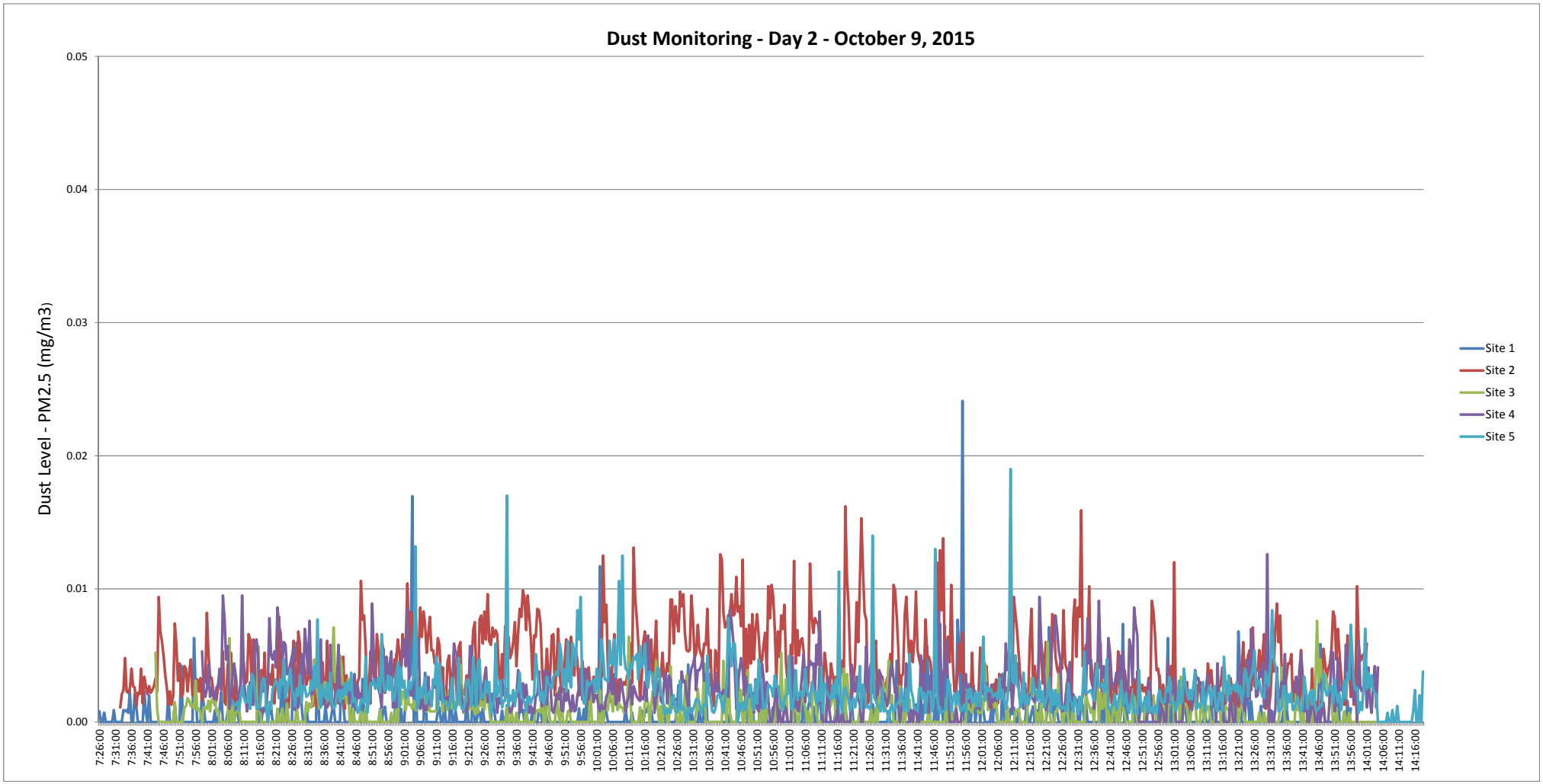
- FINE GRADE AREA
- SEE RECLAMATION PLAN FOR REVEGETATION SCHEDULE.

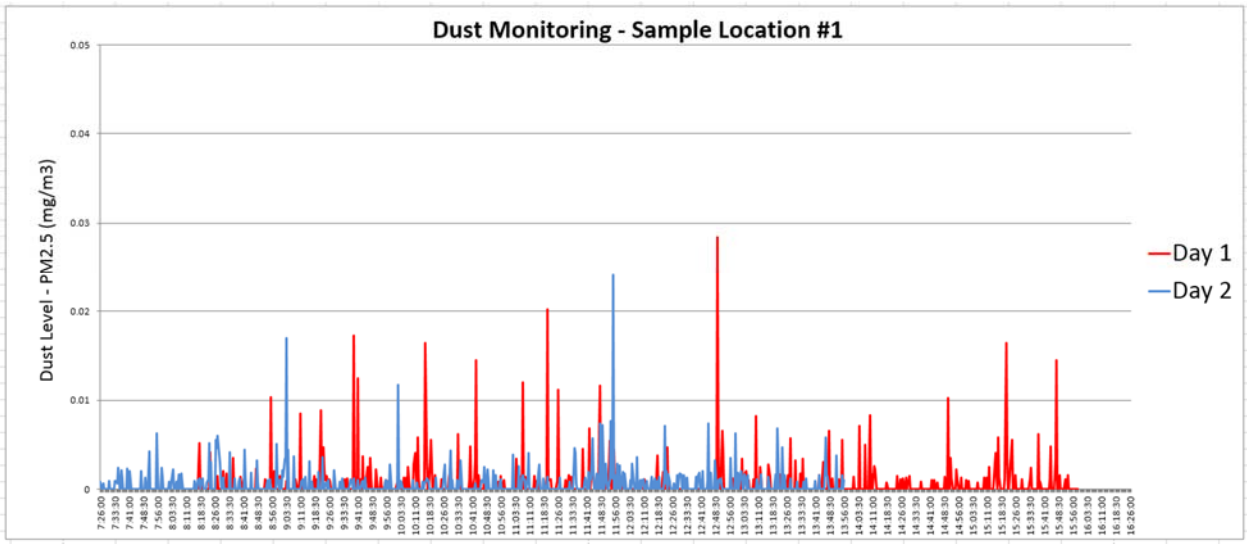


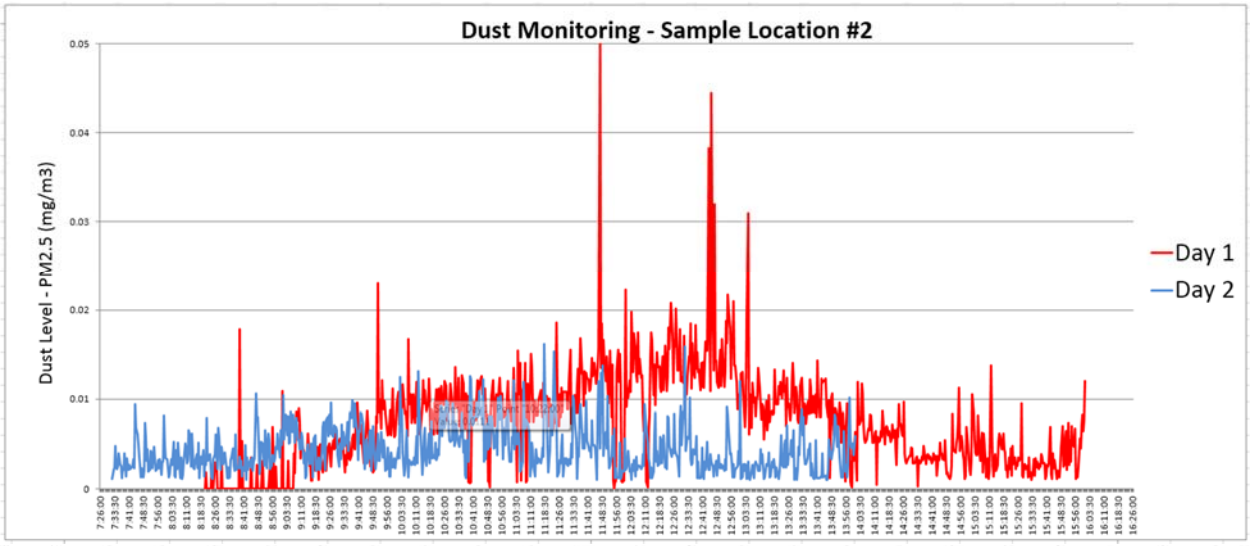
PHASE 2 MINING

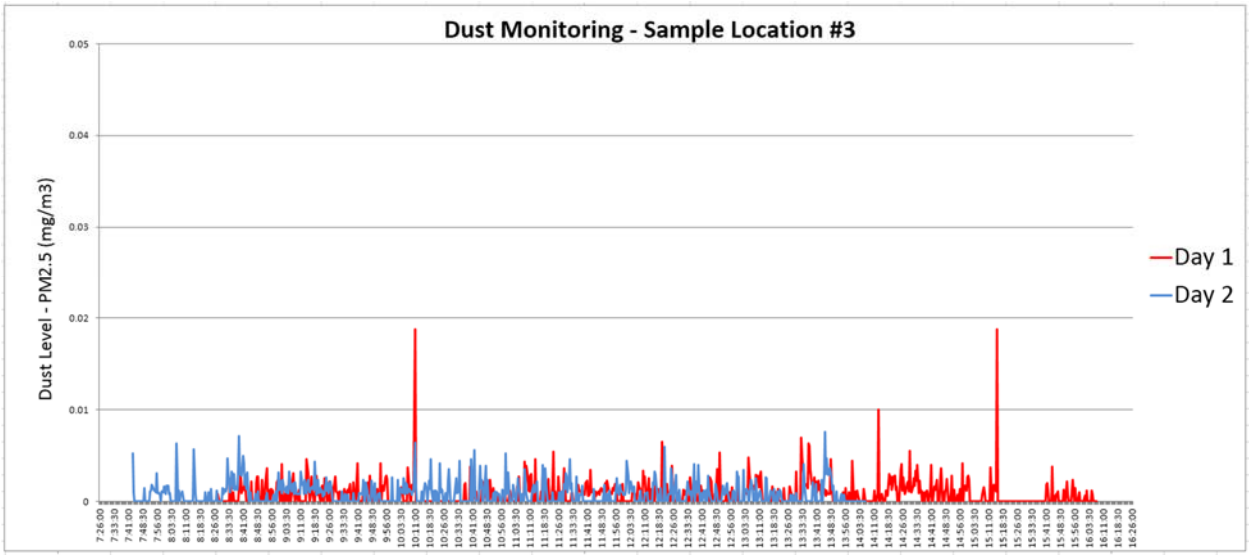
- MINIMUM EXCAVATION ELEVATION = 840 ft ABOVE MEAN SEA LEVEL. IN SELECT AREAS BASED ON MATERIALS ENCOUNTERED.

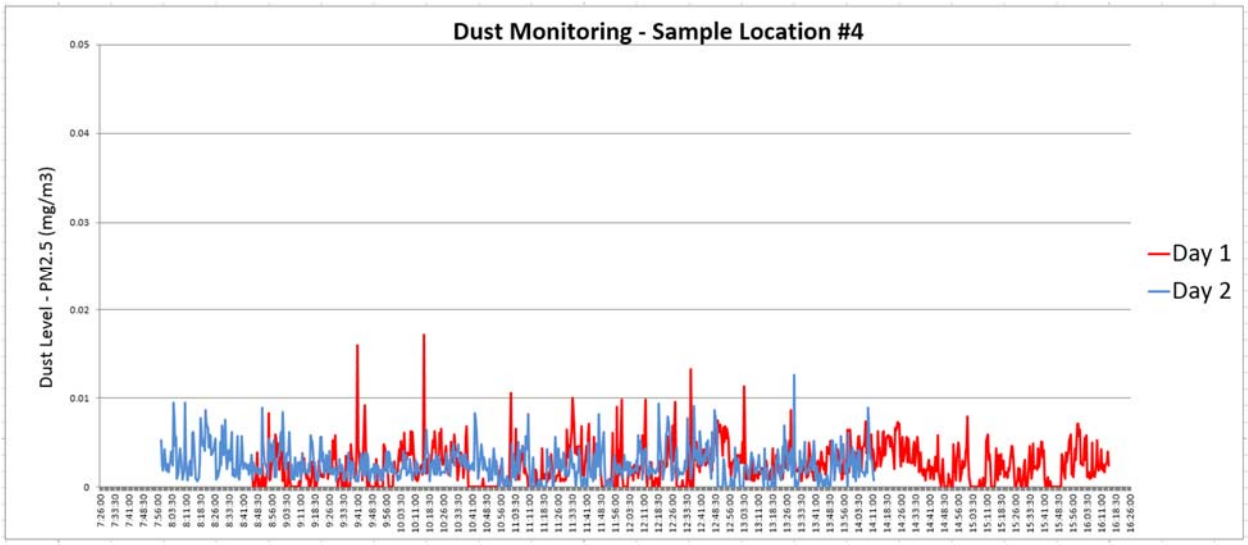

Dust Monitoring - Day 1 - October 8, 2015
Dust Level - PM2.5 (mg/m3)
0.05
0.04
0.03
0.02
0.01
0
Site 1
Site 2
Site 3
Site 4
Site 5

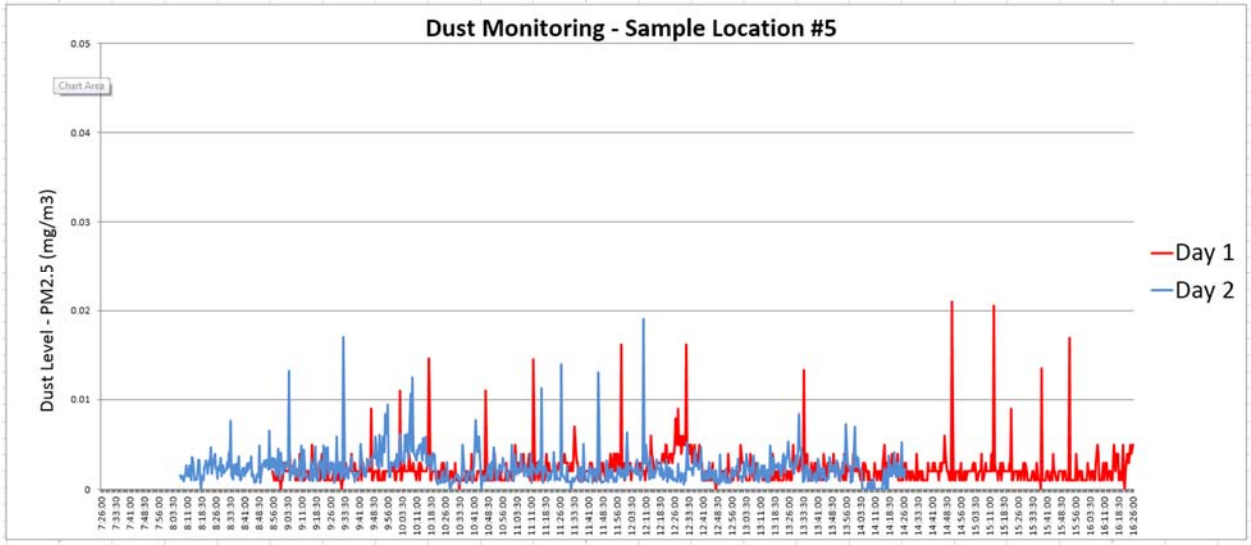

Dust Monitoring - Day 2 - October 9, 2015
Dust Level - PM2.5 (mg/m3)
0.05
0.04
0.03
0.02
0.01
0.00
Site 1
Site 2
Site 3
Site 4
Site 5


Dust Monitoring - Sample Location #1
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2


Dust Monitoring - Sample Location #2
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2


Dust Monitoring - Sample Location #3
Dust Level - PM2.5 (mg/m3)
Day 1
Day 2


Dust Monitoring - Sample Location #4
Dust Level - PM2.5 (mg/m3)
0.05
0.04
0.03
0.02
0.01
0
Day 1
Day 2


Dust Monitoring - Sample Location #5
Chart Area
Dust Level - PM2.5 (mg/m3)
0.05
0.04
0.03
0.02
0.01
0
Day 1
Day 2

INDOOR ENVIRONMENT GROUP
2487 7th Ave E
North St. Paul, MN 55109

Dust Control Activities
Monthly Site Review

Report Type:
- [x] Investigation summary
- [ ] Abatement/remediation summary
- [ ] Project update
- [ ] Site Clearance report

Additional Reports/information to follow?
- [ ] Yes
- [x] No

Client:	Contact:	Date of Investigation
City of Scandia	Kristina Handt	10/8/15
Project Name: Zavoral Mine Dust Emissions Monitoring		Report Date:
Project Location: Zavoral Mine, Scandia MN		Project # 2055-004

Project Description:
Dust control monitoring and oversight during aggregate mining and hauling operations

Task/Item	Completed as per DCP: Yes	No	N/A	Notes/Recommendations
Haul Road				
Paving - maintain first 300 feet	X			
Asphalt millings - main haul road	X			
Dust control application	X			
Watering - as needed to control dust	X			ROAD WET FROM RAIN
Washing - at least 2x per day			X	
Sweeping - 1-2 times per week	X			STARTED AT 12:45 - CONTINUED ALL DAY
Tracking	X			
Records	X			
Excavation Area				
Watering - as necessary			X	
Load equipment washed			X	
Hauling Operations				
Covered trucks		X		2 TRUCKS UNCOVERED - ALL THE WAY TO TRANSFER SITE #4113
15mph site speed	X			
No idle >15 minutes	X			
Trucks washed			X	
Wind Direction				W/NW 9-16 MPH LIGHT RAIN EARLY AM

Operations in compliance with Dust Control Plan? (Yes) No Other:

Findings/Recommendations/Actions:
- DIRT BUILDUP ON DRIVEWAY & HWY 97 IN THE MORNING. VISIBLE DUST IN AIR WHEN TRUCKS LEFT. VERY DUSTY WHEN SWEEPING ACTIVITIES STARTED @ 12:45

Remarks:
The environmental services provided by Indoor Environment Group's industrial hygienists, technicians, analysts and project managers for this project have been conducted in a manner consistent with the degree of care and technical skill exercised by environmental professionals currently practicing in this area under similar budget and time constraints. Recommendations contained in this report represent our professional judgment at the time the project was performed. This is only a summary of work performed. Following or implementing the recommendations presented should not be considered final completion or closure of this project. Additional work may be necessary to correct current and/or future problems. No warranty is implied or intended.

Summary Report Prepared/Submitted by:		Summary Report Review by:	
Dave Gutterud			
Title: Director of Operations	Phone number: 651-779-4300 x6	Title:	Phone number:
Signature		Signature	

INDOOR ENVIRONMENT GROUP
2487 7th Ave E
North St. Paul, MN 55109

Dust Control Activities
Monthly Site Review

Report Type:
- [x] Investigation summary
- [ ] Abatement/remediation summary
- [ ] Project update
- [ ] Site Clearance report

Additional Reports/information to follow?
- [ ] Yes
- [x] No

Client:	Contact:	Date of Investigation
City of Scandia	Kristina Handt	10/9/15

Project Name:	Report Date:
Zavoral Mine Dust Emissions Monitoring	

Project Location:	Project #
Zavoral Mine, Scandia MN	2055-004

Project Description:
Dust control monitoring and oversight during aggregate mining and hauling operations

Task/Item	Completed as per DCP: Yes	No	N/A	Notes/Recommendations
Haul Road				
Paving - maintain first 300 feet	✓			
Asphalt millings - main haul road	✓			
Dust control application	✓			
Watering - as needed to control dust	✓			
Washing - at least 2x per day		✓		ONLY 1 TIME - HAUL ROAD STILL DAMP FROM YESTERDAY
Sweeping - 1-2 times per week	✓			SWEPT HOURLY - 3RD PARTY DUSTBUSTERS
Tracking	✓			
Records	✓			
Excavation Area				
Watering - as necessary	✓			
Load equipment washed	✓		✓	
Hauling Operations				
Covered trucks		✓		1 TRUCK UNCOVERED UNTIL FIRE DEPT
15mph site speed	✓			
No idle >15 minutes	✓			
Trucks washed	✓			
Wind Direction				N-NW 4-10 MPH

Operations in compliance with Dust Control Plan? Yes (circled) No Other:

Findings/Recommendations/Actions:
- SWEEPER ONSITE ALL DAY - GOING FROM MINE TO DUMP SITE HOURLY
- DUST LEVELS VISIBLY LOWER TODAY

Remarks:
The environmental services provided by Indoor Environment Group's industrial hygienists, technicians, analysts and project managers for this project have been conducted in a manner consistent with the degree of care and technical skill exercised by environmental professionals currently practicing in this area under similar budget and time constraints. Recommendations contained in this report represent our professional judgment at the time the project was performed. This is only a summary of work performed. Following or implementing the recommendations presented should not be considered final completion or closure of this project. Additional work may be necessary to correct current and/or future problems. No warranty is implied or intended.

Summary Report Prepared/Submitted by:		Summary Report Review by:	
Dave Gutterud			
Title: Director of Operations	Phone number: 651-779-4300 x6	Title:	Phone number:
Signature		Signature	