September 2013

HOULE CHEVRIER ENGINEERING LTD.

Dust Assessment
Proposed Commercial Development
Fallowfield Road and Huntley Road
Ottawa, Ontario

Submitted to:
Houle Chevrier Engineering Ltd.

REPORT

Report Number: 13-1151-0082

Distribution:

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Golder Associates

Executive Summary

Golder Associates Ltd. (Golder) was retained by Houle Chevrier Engineering (Houle) to carry out a dust assessment in support of a compatibility assessment for IAQI Holdings Inc. under the Ontario Ministry of the Environment (MOE) Publication D-6. The dust assessment evaluated the impacts from the operation of the existing adjacent sand pit on IAQI Holdings proposed commercial development to the southeast of the pit. The proposed commercial development and the pit are identified in Figure 1.

The US EPA SCREEN3 model was used to predict the transport and dispersion of estimated fugitive dust emissions from the neighbouring sand pit and subsequent maximum dust concentration at the proposed commercial development.

Based on the results of the modelling, in comparison to provincial air quality criteria and/or guidelines, as well as published MOE guidance for environmental approvals under the Environmental Protection Act (EPA) Section 9, no anticipated dust impacts on the proposed commercial property are expected from the current sand pit operations.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Houle Chevrier Engineering (Houle) to carry out a dust assessment in support of a compatibility assessment for IAQI Holdings Inc. under the Ontario Ministry of the Environment (MOE) Publication D-6. The dust assessment evaluated the impacts from the operation of the existing adjacent sand pit on IAQI Holdings proposed commercial development to the southeast of the pit. The proposed commercial development and the pit are identified in Figure 1.

The proposed commercial development is located at the intersection of Fallowfield Road and Huntley Road in Stittsville, Ontario. The property is located to the south-east of an existing operating sand pit (The Pit) also identified in Figure 1. Due to the developments proximity to the Pit, the City of Ottawa has requested that a dust assessment study be completed to assess if the predicted air emissions from the Pit will comply with the appropriate regulations at the commercial property.

2.0 PIT OPERATIONS

The Pit is a sand extraction pit, which operates under a license from the Ontario Ministry of Natural Resources (MNR). The daily operations of the pit vary depending on the demand for specific products. The pit is licensed to extract below the water table.

Identification of potential air sources was completed through information provided by the pit operators in June 2013. Details of the dust sources are provided in the sections below.

The production rate and operating hours at the pit vary depending on market demand. There is no permanent processing equipment located at the site and it is understood that the site is used mainly for sand extraction and stockpiling. Pit operations are currently on hold and no activities are currently taking place at the site, although stockpiles are still present. The maximum production capacity of the pit is 200,000 tonnes of sand per year. For the purpose of this assessment, assumptions have been made based on a typical pit of this size and production capacity. For example, it has been assumed that 2,000 tonnes per day of sand are processed at the Pit. It has also been assumed that a portable screen may be used at the pit.

The following equipment was assumed to be used on-site:

- portable screen and conveyor system –including one screen and one conveyor with a maximum processing rate of 2,000 tonnes per day;
- loaders – It is assumed that loaders will be used to transfer material between stockpiles at a rate of 2,000 tonnes per day; and
- shipping – it is assumed that all 2,000 tonnes of material processed in one day could be shipped off-site in the same working day.

Wind erosion from the current on-site stockpiles was also considered as a source of dust emissions.

3.0 CRITERIA AND GUIDELINES

The Ontario Ministry of the Environment (MOE) Publication D-6 is a guideline that is intended to apply when a change in land use is proposed to minimize the encroachment of sensitive land use upon industrial land use and vice versa. This guideline categorizes industrial facilities into three Classes.

As per the D-6 guideline, quarries and pits can be categorized as Class II facilities. A Class II industrial facility can be described as follows:

> *A place of business for medium scale processing and manufacturing with outdoor storage of wastes or materials (i.e., it has an open process) and/or there are periodic outputs of minor annoyance. There are occasional outputs of either point source or fugitive emissions for any of the following: noise, odour, dust and/or vibration, and low probability of fugitive emissions. Shift operations are permitted and there is frequent movement of products and/or heavy trucks during daytime hours.*

Specifically, the D-6 guideline requires that fugitive air emission studies be carried out for sensitive development within 300 m of a Class II facility. The D-6 guideline applies to all types of proposed, committed and/or existing industrial land uses which have the potential to produce point source and/or fugitive air emissions such as noise, vibration, odour, dust and others, either through normal operations, procedures, maintenance or storage activities, and/or from associated traffic/transportation.

Emissions of particulate matter are addressed through the *Environmental Protection Act* (EPA), in particular Section 9 and Ontario Regulation 419/05 (Air Pollution – Local Air Quality).

In addition, the MNR publication "*Mineral Aggregate Resource Reference Manual*", dated in January 2001, suggests some mitigation options where potential conflicts are identified. These options include:

1) Identification of development restriction in the zone of influence – using compatibility analysis (i.e., as outlined in MOE publication D6 above), specific building or activity restrictions may be developed (e.g., no habitable buildings permitted within certain metres of a licensed site).

2) Lot relocation or redesign – lots can sometimes be relocated or reconfigured to reduce potential conflict. Lots and open space blocks within the commercial property can be arranged to place the open space block between the building and the Pit. Setbacks can be established between the building and the Pit.

3) Avoidance of truck traffic in road design – where options exist, access to public roads from the commercial property (or vice versa) should be directed to portions of the road system less likely to be used by trucks transporting aggregate materials. In the case of the Pit, the products from both pits are shipped through Huntley Road, which is close to the proposed commercial development.

4) Working with owner of the mineral aggregate – to reduce the impact, the owner could redesign the phase schedule such that material close to the proposed development is removed first; modify internal operations to reduce dust generation; establish landscape buffers or berms as necessary.

5) Removal of aggregate prior to development – if conflicts exists, parties involved may discuss the possibility of removing aggregate at locations closer to development prior to development.

The following sections discuss the relevant City of Ottawa and MOE guidelines.

4.0 DUST ASSESSMENT

Golder conducted a general dust assessment to evaluate the impacts from the operation of an existing open pit on a proposed commercial building to the southeast of the Pit in support of a compatibility assessment under the Ontario Ministry of the Environment (MOE) Publication D-6. For the purposes of this report, dust is the collective term used for particulate matter for the site. For air quality assessments in Ontario related to fugitive dust, particulate matter is typically categorized in the following three categories:

- total suspended particulate (TSP) – particles nominally less than 44 µm in diameter;
- particles nominally smaller than 10 µm in diameter (PM_{10}); and
- particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$).

Particulate matter is typically associated with airborne dust from vehicles travelling on paved roads and unpaved roads/haul routes, as well as material loading and unloading activities, crushing, screening and wind erosion of storage piles.

In Ontario, under the guidelines to apply for a Section 9 approval, limits and guidelines for regulating air quality are established under O. Reg. 419/05 (Air Pollution – Local Air Quality). These include standards, point-of-impingement (POI) guidelines and ambient air quality criteria (AAQC) for various compounds. The AAQC are commonly used in assessments of general air quality in a community, and the potential for causing an adverse effect, whereas the standards and POI guidelines are used to assess specific impacts of an individual facility for compliance and permitting requirements. Fugitive dust from pit operations excluding combustion sources are primarily emitted as TSP.

This dust assessment included the following steps:

- development of air inventory for all relevant sources at the Pit;
- prediction of air quality impacts of the combined emissions from the pits on the proposed commercial property; and
- comparison of predictions of dust to the relevant standards outline in O. Reg. 419/05.

Respirable crystalline silica concentrations were not assessed as a part of this study as the percentage of silica in the dust is not available for this site.

The dust assessment did not include mobile sources which are excluded from O. Reg. 419/05 or road traffic sources at the site. In accordance with MOE procedures, exclusion of the road sources is acceptable as long as the aggregate facility has implemented a fugitive dust Best Management Practices (BMP) Plan that includes the road emissions. For the purposes of this assessment it was assumed that a BMP Plan is in place for the Pit.

The air emission sources included in the assessment for each pit are summarized in the table below:

Table 1: Summary of Air Emission Sources at the Pit

Source	Significant Source of Dust Emissions?
Screen operations	Yes (portable)
Material transfer along conveyors	Yes
Material transfer to stockpile	Yes
Stockpile wind erosion	Yes
Truck loading operations	Yes
Vehicle Movements – Shipping	N/A

N/A – Not applicable, not subject to Section 9 air permitting requirements.

The maximum emission rates for each significant contaminant emitted from the significant sources were calculated in accordance with s.11 of O. Reg. 419/05. Emission rates were calculated using emission factors taken from the United States Environmental Protection Agency publication "AP42 Compilation of Air Pollutant and Emission Factors, Volume 1: Stationary Point and Area Sources". Copies of the calculations used to prepare these emission estimates are included in Appendix A.

Table 2 lists the daily emission rates each of the emission sources that were used for the dust assessment.

Table 2: Existing Daily Emissions at the Pit

Source	Contaminant	Total Daily Emissions [kg/day]	24hr Averaged Emission Rate [g/s]	% of Total
Screen operations	TSP	2.20	0.0255	36%
	PM_{10}	0.74	0.0086	29%
	$PM_{2.5}$	0.05	0.0006	15%
Material transfer along conveyors	TSP	0.14	0.0016	2%
	PM_{10}	0.05	0.0005	2%
	$PM_{2.5}$	0.01	0.0002	4%
Material transfer to stockpile	TSP	0.70	0.0081	12%
	PM_{10}	0.33	0.0038	13%
	$PM_{2.5}$	0.05	0.0006	15%
Stockpile wind erosion	TSP	2.29	0.0265	38%
	PM_{10}	1.14	0.0132	44%
	$PM_{2.5}$	0.17	0.0020	51%
Truck loading operations	TSP	0.70	0.0081	12%
	PM_{10}	0.33	0.0038	13%
	$PM_{2.5}$	0.05	0.0006	15%

5.0 METHODOLOGY

For the purpose of this assessment, information collected from pit operators on emission sources was used to estimate emissions from the site. Emission rates are based on maximum production rates from the site. The Dust Assessment was conducted using the US EPA SCREEN3 dispersion model. SCEEN3 is a single source Gaussian plume model which provides maximum ground-level concentrations for point, area, flare and volume sources and is an accepted model in Ontario by the MOE. All dispersion modelling was carried out in accordance with the MOE's "*Air Dispersion Modelling Guideline for Ontario – Version 2.0"* dated March 2009 (ADMGO).

The dust sources associated with the Pit were modelled using a single area source. The largest source of emissions is wind erosion from the stockpile, therefore an area source size was selected to represent the approximate size of the stockpile, which was provided by the Pit operators. The modelling source parameters were selected in accordance with guidance outlined in the National Sand Stone and Gravel Association (NSSGA) publication "Modelling Fugitive Dust Sources" dated 2004. Emission rates associated with material movements, screening and truck loading were based on maximum predicted daily production activity levels which are assumed based on the pits annual maximum production capacity. Operations will vary by hour of day and month of year, thus the use of maximum production rates is a conservative approach in assessing the impact of the pits. Source parameters used in the modelling are given in Table 3, below.

Table 3: Modelling Source Parameters.

Emission Sources	Model Source Type	Area [m²]	Largest Side Length of Area Source [m]	Smallest Side Length of Area Source [m]	Release Height [m]
All	AREA	10,000	100	100	3

The model was run using the minimum distance between the pit stockpile centre and the proposed commercial property boundary (350m). No account was made for wet and dry deposition of particles in accordance with MOE modelling procedures for Section 9 Approval. This is a conservative approach as modelling deposition would reduce predicted ground level concentrations. SCREEN3 provides results for a 1hour averaging period. Results were converted to a 24 hour averaging period using the methods outlined in ADMGO.

A copy of the modelling input and output files are included in Appendix B.

6.0 RESULTS AND DISCUSSION

The maximum predicted 24-hour concentration of particulate matter for the pit operations is provided in Tables 4 and 5. For all cases, the predicted values are **below** the relevant MOE POI guidelines and/or AAQC at all receptor locations, indicating that the Pit is operating within the compliance limits for particulate matter as set by the MOE.

Table 4: Maximum Predicted SCREEN3 Concentrations for Dust

Contaminant	MOE POI Limit [µg/m^3]	Maximum Predicted Concentration [µg/m^3]	% of Limit	Location of Maximum
TSP	120	38.2	32%	350m from stockpile centre
PM_{10} [1]	50[1]	16.4	33%	350m from stockpile centre
$PM_{2.5}$ [2]	30[2]	2.1	7%	350m from stockpile centre

1 Interim air quality criteria

2 Canada Wide Standard based on a 3 year average of the 98th percentile.

In addition to evaluating the impact of the site activities, existing background air quality conditions were considered. There is no current ambient monitoring to determine background concentration levels for TSP or PM_{10} in Ontario. The closest air monitoring station to the site is Ottawa Central Station (45°22'57.08 N, 75°42'51.05 W) which monitors $PM_{2.5}$. $PM_{2.5}$ is a health based standard and as shown in Table 5 the $PM_{2.5}$ impact is below the Canada Wide Standard

Table 5: Maximum Dust Impact Including Background

Contaminant	Maximum Predicted TSP Concentration [µg/m^3]	Background Air Quality [µg/m^3]*	Operations + Background [µg/m^3]	MOE POI Limit [µg/m^3]	% of Limit
TSP	38.2	-	-	120	**
PM_{10}	16.4	-	-	50	**
$PM_{2.5}$	2.1	9.9	12.0	30	40%

* 90th percentile of 5-Year daily average PM2.5 data for 2007-2011 at Ottawa Central Station

** In Ontario the limit does not include background air quality.

7.0 CONCLUSIONS AND LIMITATIONS

7.1 Conclusions

Golder Associates Ltd. (Golder) was retained by Houle Chevrier Engineering (Houle) to carry out a dust assessment of the operation of the existing sand pit on the proposed commercial building to the southeast of the Pit to support a compatibility assessment under publication D-6.

Based on the evaluation conducted in accordance with the published Ministry guidance to obtain approval under the Environmental Protection Act (EPA) Section 9, of the operations of the sand pit, the anticipated dust impacts met the relevant MOE limits at the proposed commercial building.

Therefore, it is concluded that the proposed commercial development is considered a compatible land use as per MOE Publication D-6 provided that the Pit have implemented fugitive dust Best Management Practices.

7.2 Limitations

As indicated in the report, the information related to the Pit operations were obtained from the Pit operator. Due to current pit operations being on hold, the information contained in this report is based on the current stockpile parameters and assumptions on additional material handling and screening activities based on the Pits maximum annual operating rate. Golder has acted in good faith and used the information collected and accepts no responsibility for any deficiency, misstatements, or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of the persons involved.

Respirable crystalline silica concentrations were not assessed as a part of this study as the percentage of silica in the dust is not available for this site.

Golder prepared this dust study using its commercially reasonable best efforts consistent with the level and skill ordinarily exercised by members of the profession currently practicing under similar conditions, while ensuring that the study was prepared in general conformance with regulatory and guideline requirements.

This report was prepared for the exclusive use of Houle Chevrier Engineering. Persons other than Houle Chevrier using this report or observations, or conclusions stated within, may do so at their own discretion.

8.0 CLOSURE

We trust this report meets with your current requirements. If you have any questions regarding this report, please contact the undersigned.

Report Signature Page

GOLDER ASSOCIATES LTD.

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KSA/JDM/ADC/ng

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FIGURES

LEGEND

- Proposed Commercial Property
- Pit

REFERENCE

Base Data - MNR LIO, obtained 2009
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2012
Imagery - ESRI World Imagery WMS, DigitalGlobe, 0.5m, 2011/06/16
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 18

100 50 0 100 200 300

SCALE 1:10,000 METRES

PROJECT

HOULE-CHEVRIER DUST STUDY

TITLE

SITE LOCATION PLAN

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-151-0082			SCALE AS SHOWN	REV. 0.0
DESIGN	ME	23 Aug. 2013		
GIS	ME	23 Aug. 2013		
CHECK	KA	23 Aug. 2013		
REVIEW	AC	23 Aug. 2013		

FIGURE: 1

G:\Projects\2013\13-1151-0082_HouleChevrierDustStudy\GIS\MXDs\Reporting\Figure1_SiteLocationPlan.mxd

APPENDIX A

Emission Calculations

Source ID	1	Source Description	Portable Screen

Process Description	The pit may use a Portable Screen to filter out the sand from the sand storage piles. Detailed equipment and transfer list is provided in the Table below.

Operating Scenario	Assumed 2000 tonnes per day processed.	Limitations	Based on 200,000 tonnes/year processing capacity

EMISSION CALCULATION

Production Rate:

Screen: 2000 tonnes/day

Methodology:	US EPA AP-42 Emission Factor
Source:	US EPA AP-42 Section 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (8/04)

Source	Contaminant	CAS	Uncontrolled Emission Factor			Controlled Emission Factor		
			Emission Factor [kg/tonne]	US EPA Quality Rating	MOE Quality Rating	Emission Factor [kg/tonne]	US EPA Quality Rating	MOE Quality Rating
Screening	PM	-	1.25E-02	E	Marginal	1.10E-03	E	Marginal
	PM10	-	4.30E-03	E	Marginal	3.70E-04	E	Marginal
	PM2.5[1]	-	2.91E-04	E	Marginal	2.50E-05	E	Marginal
Conveyor Drops	PM	-	1.50E-03	E	Marginal	7.00E-05	E	Marginal
	PM10	-	5.50E-04	D	Marginal	2.30E-05	D	Marginal
	PM2.5[2]	-	1.55E-04	E	Marginal	6.50E-06	E	Marginal

1 - Uncontrolled emission factor estimated from Screening (Controlled) EF based on ratio of PM2.5 to PM10

2 - Uncontrolled emission factor estimated from Conveyor Transfer Point (Controlled) EF based on ratio of PM2.5 to PM10

Calculation Formula:

Emission Rate [g/s] = Emission Factor [kg/tonne] x Activity Rate [tonnes/day] x 1000 [g/kg] x 1/24 [day/hr] x 1/3600 [hrs/second]

Sample Calculation:

Emission Rate [g/s] =	2.30E-05	kg	2000	tonnes	1000	g	1	day	1	hr	5.32E-04	g
		tonne		day		kg	24	hr	3600	seconds		s

Source ID	Equipment ID/ Description	Activity	Controlled	Control method	Maximum Capacity [Mg/day]	EMISSION FACTORS						EMISSION RATES		
						PM[3] [kg/tonne]	MOE Emission Factor Quality	PM10 [kg/tonne]	MOE Emission Factor Quality	PM2.5 [kg/tonne]	MOE Emission Factor Quality	PM [g/s]	PM10 [g/s]	PM2.5 [g/s]
SCR	Screen	Screen	Yes	High moisture material	2000	1.10E-03	Marginal	3.70E-04	Marginal	2.50E-05	Marginal	2.55E-02	8.56E-03	5.79E-04
SCRTR	Screen to Pile	Transfer Point	Yes	High moisture material	2000	7.00E-05	Marginal	2.30E-05	Marginal	6.50E-06	Marginal	1.62E-03	5.32E-04	1.50E-04
											TOTAL:	2.71E-02	9.10E-03	7.29E-04

3 - Emission factor represents Particulate Matter with diameter < 100 µm

Source ID	2

Source Description	Sand Dropping into Stock Pile after Extraction

Process Description	Sand is dropped into stock piles after it has been extracted.

Operating Scenario	Assumed 2000 tonnes per day processed	Limitations	Based on 200,000 tonnes/year processing capacity

EMISSION CALCULATION

Production Rate:

Truck Loading: 2000 tonnes/day

Methodology:	US EPA AP-42 Emission Factor
Source:	US EPA AP-42 Section 13.2.4 - Aggregate Handling and Storage Piles (11/06)

Emission Factor:

$$E = k(0.0016)\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where:

M:	7.4	%	1 - Typical moisture content of sand, US EPA AP-42 Section 13.2.4., Table 13.2.4-1
U:	3.53	m/s	2 - MOE Regional Meteorological Dataset, Ottawa MacDonald-Cartier International Airport

	PM	PM10	PM2.5
k	0.74	0.35	0.053

				Emission Factors [kg/tonne]								
Material	Drop Location	Moisture[1]	Wind[2]	PM	US EPA Quality Rating[3]	MOE Quality Rating	PM10	US EPA Quality Rating	MOE Quality Rating	PM2.5	US EPA Quality Rating	MOE Quality Rating
Sand	Outdoor	7.4	3.5302089	3.51E-04	B	Above-Average	1.66E-04	B	Above-Average	2.51E-05	B	Above-Average

3 - Quality rating downgraded with 1 letter for use of default moisture content

Calculation Formula:

Emission Rate [g/s] = Emission Factor [kg/tonne] x Activity Rate [tonnes/day] x 1000 [g/kg] x 1/24 [day/hr] x 1/3600 [hrs/second]

Sample Calculation:

$$\text{Emission Rate [g/s]} = \frac{3.51\text{E-}04\ \frac{kg}{tonne} \times 2000\ \frac{tonnes}{day} \times 1000\ \frac{g}{kg} \times 1\ \frac{day}{24\ hr} \times 1\ \frac{hr}{3600\ seconds}}{} = 8.12\text{E-}03\ \frac{g}{s}$$

Source ID	Material Handling Location	Material	Amount of Material Transferred [tonne/day]	EMISSION FACTORS						EMISSION RATES		
				PM[4] [kg/tonne]	MOE Emission Factor Quality	PM10 [kg/tonne]	MOE Emission Factor Quality	PM2.5 [kg/tonne]	MOE Emission Factor Quality	PM [g/s]	PM10 [g/s]	PM2.5 [g/s]
DROP	Stockpile	Sand	2000	3.51E-04	Above-Average	1.66E-04	Above-Average	2.51E-05	Above-Average	8.12E-03	3.84E-03	5.81E-04
									TOTAL:	**8.12E-03**	**3.84E-03**	**5.81E-04**

4 - Emission factor represents Particulate Matter with diameter < 30 µm

Source ID	3	Source Description	Storage Pile

Process Description	Sand is stored on an open storage pile.

Operating Scenario	Piles at maximum size with 100 % active area	Limitations	None

EMISSION CALCULATION

Methodology	US EPA AP-42 Emission Factor
Source:	U.S. EPA, Control of Open Fugitive Dust Sources, EPA-450/3-88-008, Sptember 1988, Page 4-17

$$E = 1.9\left(\frac{s}{1.5}\right)\left(\frac{f}{15}\right)$$

Where:

E = Emission Factor [kg/ha/day]

s = silt loading [%]

f= % Time Wind Speed > 5.4 m/s 13.18 % MOE Regional Meteorological Dataset, Ottawa MacDonald-Cartier International Airport

	PM	PM10	PM2.5
Scaling Factor:	1	0.5	0.075

Sample Calculation

$$PM = \frac{2.9\ \text{kg}}{\text{ha/day}} \times \frac{1\ \text{ha}}{10000\ \text{m}^2} \times \frac{7910.33\ \text{m}^2}{} \times \frac{1000\ \text{g}}{\text{kg}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3600\ \text{s}} = \frac{2.65\text{E-}02\ \text{g}}{\text{s}}$$

Source ID	Storage Pile ID	Pile Description	Radius [m]	Height [m]	Exposed Area [m^2]	Silt Content[1] [%]	EMISSION FACTORS						EMISSION RATES (without natural mitigation)[2]		
							PM [kg/ha/day]	MOE EF Quality	PM10 [kg/ha/day]	MOE EF Quality	PM2.5 [kg/ha/day]	MOE EF Quality	PM [g/s]	PM10 [g/s]	PM2.5 [g/s]
SP1	SP1	Sand	50	6	7,910	2.6	2.893	Marginal	1.446	Marginal	0.217	Marginal	2.65E-02	1.32E-02	1.99E-03
												TOTAL:	**2.65E-02**	**1.32E-02**	**1.99E-03**

1 - Typical silt content for sand, US EPA AP-42 Section 13.2.4., Table 13.2.4-1

2 - Emission rates used for 24-hr impact assessment

Source ID	4	Source Description	Sand Loading from Stock Piles to Truck

Process Description	Sand is loaded from stock piles to trucks for transfer off-site.

Operating Scenario	Assumed 2000 tonnes per day processed	Limitations	No information provided on truck loading rates or number of trucks loaded per hour

EMISSION CALCULATION

Production Rate:

Truck Loading: 2000 tonnes/day

Methodology:	US EPA AP-42 Emission Factor
Source:	US EPA AP-42 Section 13.2.4 - Aggregate Handling and Storage Piles (11/06)

Emission Factor:

$$E = k(0.0016)\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where:

M:	7.4	%	1 - Typical moisture content of sand, US EPA AP-42 Section 13.2.4., Table 13.2.4-1
U:	3.53	m/s	2 - MOE Regional Meteorological Dataset, Ottawa MacDonald-Cartier International Airport

	PM	PM10	PM2.5
k	0.74	0.35	0.053

				Emission Factors [kg/tonne]								
Material	Drop Location	Moisture[1]	Wind[2]	PM	US EPA Quality Rating[3]	MOE Quality Rating	PM10	US EPA Quality Rating	MOE Quality Rating	PM2.5	US EPA Quality Rating	MOE Quality Rating
Sand	Outdoor	7.4	3.5302089	3.51E-04	B	Above-Average	1.66E-04	B	Above-Average	2.51E-05	B	Above-Average

3 - Quality rating downgraded with 1 letter for use of default moisture content

Calculation Formula:

Emission Rate [g/s] = Emission Factor [kg/tonne] x Activity Rate [tonnes/day] x 1000 [g/kg] x 1/24 [day/hr] x 1/3600 [hrs/second]

Sample Calculation:

Emission Rate [g/s] =	0.000	*kg*	2,000	*tonnes*	1000	*g*	*1*	*day*	1	*hr*	0.19	*g*
		tonne		*day*		*kg*	*24*	*hr*	3600	*seconds*		*s*

				EMISSION FACTORS						EMISSION RATES		
Source ID	Material Handling Location	Material	Amount of Material Transferred [tonne/day]	PM[4] [kg/tonne]	MOE Emission Factor Quality	PM10 [kg/tonne]	MOE Emission Factor Quality	PM2.5 [kg/tonne]	MOE Emission Factor Quality	PM [g/s]	PM10 [g/s]	PM2.5 [g/s]
TRLOAD	Sand Loading to Truck	Sand	2000	3.51E-04	Above-Average	1.66E-04	Above-Average	2.51E-05	Above-Average	8.12E-03	3.84E-03	5.81E-04
									TOTAL:	**8.12E-03**	**3.84E-03**	**5.81E-04**

4 - Emission factor represents Particulate Matter with diameter < 30 µm

APPENDIX B

SCREEN3 Model Files

```
C:\Lakes\Screen View\Houle.scr
A
0.0001
3
100
100
0
R
Y
1
Y
350 1000
N
N
```

08/29/13

11:09:45
  *** SCREEN3 MODEL RUN ***
  *** VERSION DATED 96043 ***

 C:\Lakes\Screen View\Houle.scr

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE   =   AREA
    EMISSION RATE (G/(S-M**2)) =   0.100000E-03
    SOURCE HEIGHT (M)   =   3.0000
    LENGTH OF LARGER SIDE (M)   =   100.0000
    LENGTH OF SMALLER SIDE (M) =   100.0000
    RECEPTOR HEIGHT (M)   =   0.0000
    URBAN/RURAL OPTION   =   RURAL
 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

    MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

 BUOY. FLUX =   0.000 M**4/S**3; MOM. FLUX =   0.000 M**4/S**2.

 *** FULL METEOROLOGY ***

 ****
 *** SCREEN AUTOMATED DISTANCES ***
 ****

 *** TERRAIN HEIGHT OF   0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
350.	1367.	6	1.0	1.0	10000.0	3.00	45.
400.	1228.	6	1.0	1.0	10000.0	3.00	45.
500.	1010.	6	1.0	1.0	10000.0	3.00	45.
600.	847.3	6	1.0	1.0	10000.0	3.00	45.
700.	723.3	6	1.0	1.0	10000.0	3.00	45.
800.	630.6	6	1.0	1.0	10000.0	3.00	45.
900.	555.9	6	1.0	1.0	10000.0	3.00	45.
1000.	493.9	6	1.0	1.0	10000.0	3.00	45.

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   350. M:

350.	1367.	6	1.0	1.0	10000.0	3.00	45.

      ****

*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	1367.	350.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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