August 2017

COLACEM CANADA INC.
L'ORIGNAL, ONTARIO

Emission Summary and Dispersion Modelling Report

Version 1.1

This report documents the compliance status of the Facility as of August 31, 2017.

Submitted to:
Colacem Canada Inc.
L'Orignal, Ontario

REPORT

Report Number: 1529718

Distribution:

1 copy - Colacem Canada Inc., L'Orignal, Ontario

1 copy - Golder Associates Ltd., Mississauga, Ontario

Golder Associates

Document Version Control

This Emission Summary and Dispersion Modelling (ESDM) Report documents the operations at the Colacem Canada Inc. Facility in L'Orignal, Ontario (the Facility) and has been prepared in accordance with s.26 of Ontario Regulation 419/05 (O. Reg. 419/05) to document compliance with s. 20 of O. Reg. 419/05. The Report is a living document and should be kept up-to-date at all times. Therefore, it is necessary to have appropriate version control. This version control will allow facility personnel, compliance auditors, or the Ontario Ministry of the Environment and Climate Change (MOECC) to track and monitor ESDM Report changes over time.

As facility operations change and sources are added to or removed from the Facility, this ESDM Report will need to be updated as required. These changes are to be documented in a Modification Log. A sample of a Modification Log is included in Appendix A. When the ESDM Report is updated, the version number will be changed to correspond with the information in the Modification Log.

Version	Date	Revision Description	Prepared By	Reviewed By (Facility Contact)
1.0	May 3, 2016	Original ESDM Report to support the ECA Application	Golder Associates Ltd.	Marc Bataille
1.1	August 31, 2017	Revised ESDM in response to MOECC comments dated June 29 2017	Golder Associates Ltd.	Marc Bataille

Executive Summary

This Emission Summary and Dispersion Modelling (ESDM) Report was prepared to support an application for a Environmental Compliance Approval (ECA) for air and noise with Limited Operational Flexibility under Part II.1 of the *Ontario Environmental Protection Act* (EPA).

The contents of this ESDM Report satisfy the requirements of s.26 of Ontario Regulation 419/05 (O. Reg. 419/05). In addition, guidance in the Ontario Ministry of the Environment and Climate Change (MOECC) publication "*Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling (ESDM) Report, Version 3.0"*, dated March 2009 (ESDM Procedure Document) PIBS 3614e03 was followed, as appropriate.

Colacem Canada Inc. (Colacem) is proposing to build and operate a new Portland cement manufacturing facility located Lot 217, Parcel M100, County Road 17, United Counties of Prescott-Russell; L'Orignal, Ontario (the Facility). The Facility will have the capacity to produce 3,000 tonnes of clinker per day, with an estimated annual production of 1.16 Million tonnes of cement. It is anticipated that four types of Portland cement will be produced at the plant: general use cement (GU), general use limestone cement (GUL), high early strength cement (HE) and blended general use silica fume cement (GubSF). It can operate up to 24 hours per day, 7 days per week, 52 weeks per year.

The Facility is expected to emit suspended particulate matter, nitrogen oxides, sulphur dioxide, metals and organics. The North American Industry Classification System (NAICS) code that best applies to the Facility is 327310 (cement manufacturing). This NAICS code is not listed under Schedule 4 or 5 of O. Reg. 419/05.

The Facility's comfort heating is a prescribed activity under the Environmental Activity and Sector Registry (EASR); however, in order to have all equipment at the Facility permitted under a single ECA, the Facility intends to address EASR requirements upon the initialization of the technical review of the ECA Application since changes to Ontario Regulation 346/12 are still pending.

The Facility is subject to s.19 of O. Reg. 419/05 which allows for the use of models in the appendix to O. Reg. 346/90. The Facility wishes to demonstrate compliance with the Schedule 3 standards in advance using the MOECC-accepted regulatory dispersion model, AERMOD, therefore a *"Request Under s.20(4) to Have the Schedule 3 Standards Apply in Advance of the Date Required by O. Reg. 419/05*" form has been included with this ECA application.

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 and the data quality assessment follows the classification system outlined in the ESDM Procedure Document. Some of the sources were considered negligible in accordance with s.8 of O. Reg. 419/05.

The modelling scenario, for the relevant averaging period, assumed operating conditions for the Facility that result in the highest concentration of each significant contaminant at a Point of Impingement (POI). A POI concentration for each significant contaminant emitted from the Facility was calculated based on the emission rate estimates and the output from the dispersion model; the results are presented in the Emission Summary Table in accordance with s.26 of O. Reg. 419/05.

The POI concentrations listed in the Emission Summary Table were compared against the standards listed in Schedule 3 of O. Reg. 419/05, as well as the applicable limits listed in the MOECC publication *Summary of Standards and Guidelines to support Ontario Regulation 419: Air Pollution - Local Air Quality (including Schedule 6 of O. Reg. 419 on Upper Risk Thresholds)*, dated April 2012 (List of MOECC POI Limits). At 71%, nitrogen oxide has the highest predicted POI concentration relative to the corresponding MOECC POI Limit.

A *"Supporting Information for a Maximum Ground Level Concentration Acceptability Request for Coumpounds with No Ministry POI Limit: Supplement to Application for Approval, EPA s.20.2"* was submitted for Portland Cement.

This ESDM Report demonstrates that the Facility can operate in compliance with s.20 of O. Reg. 419/05.

Table I: Emission Summary Table

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Maximum POI Concentration [µg/m³]	Averaging Period [hours]	MOECC POI Limit [µg/m³]	MOECC Screening Level [µg/m³]	Limiting Effect	Regulation Schedule No.	Percentage of MOECC Limit [%]
SPM	N/A-1	6.24E+00	AERMOD	5.44E+01	24	120	—	Visibility	Schedule 3	45%
PM10	N/A-2	3.38E+00	AERMOD	2.59E+01	24	—	50	—	AAQC	52%
PM2.5	N/A-3	2.26E+00	AERMOD	1.66E+01	24	—	25	—	AAQC	66%
Crystalline Silica	14808-60-7	1.43E-02	AERMOD	5.60E-01	24	5	—	Health	Guideline	11%
Ferric Oxide	1309-37-1	3.41E-02	AERMOD	4.33E+00	24	25	—	Soiling	Schedule 3	17%
Carbon Monoxide	630-08-0	7.70E+01	AERMOD	1.16E+02	½	6000	—	Health	Schedule 3	2%
Nitrogen Oxides	10102-44-0	2.31E+02	AERMOD	4.69E+01	24	200	—	Health	Schedule 3	23%
Nitrogen Oxides	10102-44-0	2.31E+02	AERMOD	2.86E+02	1	400	—	Health	Schedule 3	71%
Ammonia	7664-41-7	7.70E+00	AERMOD	1.56E+00	24	100	—	Health	Schedule 3	2%
Sulfur Dioxide	7446-09-5	3.85E+01	AERMOD	7.82E+00	24	275	—	Health & Vegetation	Schedule 3	3%
Sulfur Dioxide	7446-09-5	3.85E+01	AERMOD	4.76E+01	1	690	—	Health & Vegetation	Schedule 3	7%
Portland cement	65997-15-1	1.75E+00	AERMOD	4.40E+01	24	—	20	Health	JSL	MGLCA Request Submitted[1]
Dioxins and Furans (TEQ)	N/A-4	1.54E-08	AERMOD	3.13E-09	24	0.0000001	—	Health	Schedule 3	3%
Calcium Oxide	1305-78-8	5.29E+00	AERMOD	1.08E+00	24	10	—	Corrosion	Schedule 3	11%
Iron*	15438-31-0	2.68E-01	AERMOD	5.44E-02	24	4	—	Soiling	Schedule 3	1%

Note:
*Metallic iron
1. A "*Supporting Information for a Maximum Ground Level Concentration Acceptability (MGLCA) Request for Compounds with No Ministry POI Limits; Supplement to Application for Approval, EPA s20.2.*" was submitted.

Ministry of the Environment | Ministère de l'Environnement

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Company Name:	Colacem Canada Inc.
Company Address:	Lot 217, Parcel M100, County Road 17, United Counties of Prescott-Russell
Location Facility	L'Orignal, Ontario

The attached Emission Summary and Dispersion Modelling Report was prepared in accordance with s.26 of O. Reg. 419/05 and the guidance in the MOECC document "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2009 and "Air Dispersion Modelling Guideline for Ontario" dated March 2009 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

Company Contact:	
Name:	Marc Bataille
Title:	Directeur d'usine Kilmar & Technique DMC
Phone Number:	1-819-242-4312 ext 275
Signature:	Original v.1 signed by Marc Bataille
Date:	

Technical Contact:	
Name:	Jamie McEvoy
Representing:	Golder Associates Limited
Phone Number:	905-567-6100 ext 1561
Signature:	Original v.1 signed by Jamie McEvoy
Date:	

 * This checklist is taken from the document titled "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated July, 2005

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

	Required Information			
			Submitted	Explanation/Reference
	Executive Summary and Emission Summary Table			
	1.1	Overview of ESDM Report	☒ Yes	Executive Summary
	1.2	Emission Summary Table	☒ Yes	Table I
1.0	**Introduction and Facility Description**			
	1.1	Purpose and Scope of ESDM Report	☒ Yes	Section 1.1
	1.2	Description of Processes and NAICS code(s)	☒ Yes	Section 1.2
	1.3	Description of Products and Raw Materials	☒ Yes	Section 1.2
	1.4	Process Flow Diagram	☒ Yes	Figure 4
	1.5	Operating Schedule	☒ Yes	Section 1.3
2.0	**Initial Identification of Sources and Contaminants**			
	2.1	Sources and Contaminants Identification Table	☒ Yes	Table 1
3.0	**Assessment of the Significance of Contaminants and Sources**		☒ Yes	
	3.1	Identification of Negligible Contaminants and Sources	☒ Yes	Section 3.1
	3.2	Rationale for Assessment	☒ Yes	Section 3.3
4.0	**Operating Conditions, Emission Estimating and Data Quality**			
	4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒ Yes	Section 4.1
	4.2	Explanation of Method used to calculate the emission rate for each contaminant	☒ Yes	Section 4.2
	4.3	Sample calculation for each method	☒ Yes	Section 4.3
	4.4	Assessment of Data Quality for each emission rate	☒ Yes	Section 4.4
5.0	**Source Summary Table and Property Plan**			
	5.1	Source Summary Table	☒ Yes	Table 2
	5.2	Site Plan (scalable)	☒ Yes	Section 5.2
6.0	**Dispersion Modelling**			
	6.1	Dispersion Modelling Input Summary Table	☒ Yes	Table 3
	6.2	Land Use Zoning Designation Plan	☒ Yes	Figure 2
	6.3	Dispersion Modelling Input and Output Files	☒ Yes	Appendix F
7.0	**Emission Summary Table and Conclusions**			
	7.1	Emission Summary Table	☒ Yes	Table 5
	7.2	Assessment of Contaminants with no MOECC POI Limits	☒ Yes	Section 7.2
	7.3	Conclusions	☒ Yes	Section 8
	Appendices			
	Modification Log		☒ Yes	Appendix A
	Emission Rate Calculations		☒ Yes	Appendix B
	Supporting Information		☒ Yes	Appendix C
	Assessment of Negligibility		☒ Yes	Appendix D
	Best Management Practices Plan		☒ Yes	Appendix E
	Dispersion Modelling Files		☒ Yes	Appendix F
			☐ Yes	

PIBS 5357e* This checklist is taken from the document titled “Procedure for Preparing an Emission Summary and Dispersion Modelling Report” dated July, 2005

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Best Management Practices Plan (BMPP)

APPENDIX F
Dispersion Modelling Files (On CD)

1.0 INTRODUCTION AND FACILITY DESCRIPTION

Colacem Canada Inc. (Colacem) is proposing to build and operate a new Portland cement manufacturing facility located at Lot 217, Parcel M100, County Road 17, United Counties of Prescott-Russell; L'Orignal, Ontario (the Facility). The Facility will have the capacity to produce 3,000 tonnes of clinker per day, with an estimated annual production of 1.16 Million tonnes of cement. It is anticipated that four types of Portland cement will be produced at the plant: general use cement (GU), general use limestone cement (GUL), high early strength cement (HE) and blended general use silica fume cement (GubSF).

The location of the proposed Facility is presented in Figure 1 – Site Location Plan and the land use designation of the site and surrounding area is presented in Figure 2 – Land Use Zoning Designation Plan.

For the ease of review, the required Ontario Ministry of the Environment and Climate Change (MOECC) larger tables (Table 1 to Table 5) have been provided at the end of this ESDM Report in the Tables section.

1.1 Purpose and Scope of ESDM Report

This Emission Summary and Dispersion Modelling (ESDM) Report was prepared to support an application for a Environmental Compliance Approval (ECA) for air and noise with Limited Operational Flexibility for the Facility.

The contents of this ESDM Report satisfy the requirements of s.26 of Ontario Regulation (O. Reg. 419/05). In addition, guidance in the Ontario Ministry of the Environment and Climate Change MOECC publication "*Guideline A-10: Procedure for Preparing an Emission Summary and Dispersion Modelling (ESDM) Report, Version 3.0"*, dated March 2009 (ESDM Procedure Document) PIBS 3614e03 was followed, as appropriate.

The Facility is subject to s.19 of O. Reg. 419/05, which allows for the use of models in the appendix to O. Reg. 346/90 and the use of Schedule 2 standards until February 1, 2020 at which time the use of more advanced dispersion models and Schedule 3 standards will be required. However, the Facility wishes to demonstrate compliance with the Schedule 3 standards in advance using the MOECC-accepted regulatory dispersion model, AERMOD, therefore a *"Request Under s.20(4) to Have the Schedule 3 Standards Apply in Advance of the Date Required by O. Reg. 419/05*" form has been included with this ECA application.

1.2 Description of Processes and NAICS Code(s)

The Facility will be comprised of several buildings/structures, including: raw material storage/silos, hoppers, conveyors, crushing and grinding systems, raw mill, preheater, rotary kiln, cooler and cooling tower, cement mill, concrete plant, and administrative offices and control room. The production of cement is a three-step process, as briefly described below:

- Raw material preparation: limestone and silica sand are analyzed, blended with additional mineral components such as bauxite, shale and iron depending on the type of limestone available then finely ground and dried in a mill for further processing.
- Clinker production: the materials are heated in a kiln reaching temperatures of 1,450˚C producing a molten product called clinker which is then rapidly cooled.
- Cement grinding and distribution: the clinker is mixed with gypsum and additional limestone, and supplementary materials such as fly ash and silica fume, depending on the type of cement being made, then ground to a fine powder.

There are nine production areas and one storage area for alternative fuels at the Facility. This assessment has only considered the storage and handling of the alternative fuels. These production areas at the Facility are further described in Section 1.3 and presented in Figure 3 – Facility Layout.

The North American Industry Classification System (NAICS) code that best applies to the Facility is 327310 (cement manufacturing).

1.3 Description of Products and Raw Materials

This section describes the process used to produce the cement products and the raw materials used at the Facility.

1.3.1 Raw Materials Receiving

The raw materials used in the cement manufacturing process arrive at the Facility via trucks. The raw materials include limestone, schist, bauxite, silica, iron oxide and gypsum and are received at the Raw Materials Receiving. The raw materials are unloaded or conveyed into hoppers that are located in covered buildings or enclosures and the dust emissions are controlled with dust collectors. The Raw Materials Receiving area is located in the northwest corner of the Facility indicated on Figure 3 – Facility Layout. The limestone is crushed prior to being transferred to the Raw Materials Storage Area. There are also raw materials received in the Raw Materials Receiving area that are sent to the Cement Mill (e.g., limestone and gypsum) to be blended with the clinker to produce the various grades of cement.

1.3.2 Raw Materials Storage and Transfers

The raw materials that enter the kiln process are transferred to the Raw Materials Storage Area by covered conveyor belts. The dust emissions generated during this step are controlled by dust collectors. At the Raw Materials Storage Area, the raw materials are stored in the Raw Materials Storage building.

1.3.3 Raw Mill

The raw materials are mixed and prepared for the kiln process in the Raw Mill to produce the raw meal. This includes blending, sizing, and drying the raw materials so that they have the desired characteristics of the clinker used in the various cements. Once the raw meal has met the desired specifications, it is temporarily stored in the homogenization silo prior to being conveyed to the five stage preheating/precalcining process.

1.3.4 Kiln

The purpose of the kiln is to convert the raw meal into clinker through a process referred to as pyroprocessing (i.e., heating the material to temperatures greater than 800˚C). The high temperatures of the kiln cause the ingredients in the raw meal to form clinker.

The first step in the clinker manufacturing process is to convey the raw meal from the homogenization silo to the five-stage preheater where the raw meal undergoes a process referred to as precalcining through heat recovery of the fuel combustion gases. Once the raw meal completes the preheating stage, it enters the upper end of the rotary kiln for direct firing. The fuel for the kiln is introduced at the lower end of the kiln which is equipped with a burner (flame end). This design creates a counter-current flow with the raw meal and the fuel combustion gases. The raw meal is then conveyed towards the flame end and the fuel combustion gases are exhausted through the five stage preheater prior to treatment in the hybrid filter. The fuel combustion gases in the kiln will reach temperatures in excess of 1,450˚C.

Once the clinker exits the kiln, it is rapidly cooled in the clinker cooler by the incoming combustion air for the kiln. The clinker cooler is equipped with a dust collector to control the dust emissions from the clinker handling.

After the combustion gases from the flame end of the kiln are exhausted through the five-stage preheater they are then directed to a hybrid filter prior to exhausting to the natural environment out of the tall kiln stack. The hybrid filter is considered state-of-the-art as it incorporates both fabric filter and an electrostatic precipitator technology into the same housing. The system is designed to capture greater 99.99% of all particles sizes.

1.3.5 Petcoke Receiving and Grinding

The Facility receives petroleum coke (petcoke) via trucks where it is unloaded and stored in an open, below grade storage area. The petcoke is loaded into a hopper by a loader to be sent to the petcoke grinding area, which is located south of the Raw Materials Receiving.

1.3.6 Clinker Storage and Transfer

Once the clinker has cooled, it is conveyed to the clinker storage silo. Some of the clinker is loaded onto trucks and sent off-site as bulk clinker. The remainder is conveyed to the Cement Mill.

1.3.7 Cement Mill

At the Cement Mill, the clinker undergoes grinding and blending with other materials (e.g., limestone, gypsum, silica fumes, fly ash and other cement) to produce the various grades of cement.

1.3.8 Finished Cement

The finished cement is stored in one of several cement silos. The cement may be loaded on trucks to be sent off site or conveyed to be packaged in the Cement Packaging Area. Silo filling and unloading dust emissions will be controlled by dust collectors.

1.3.9 Cement Packaging

The Facility is equipped with a Cement Packing Plant with two packaging lines. Dust emissions generated during this process will be controlled with dust collectors.

1.3.10 Alternative Fuels

In addition, the Facility design has also included a building for the storage of alternative fuels. The use of alternative fuels has not been assessed in this ESDM Report as the Facility is not seeking approval for the use of alternative fuels at this time. However, the dust emissions generated from the storage and handling of alternative fuels in the Alternative Fuels building has been considered.

1.3.11 Other Sources

There are also support operations at the Facility that include the following:

- natural gas fired heating and ventilating equipment;
- maintenance welding in the Mechanical and Electrical Building;

Product usages and process information are provided in detail in Appendix B – Emission Rate Calculations and Appendix C – Supporting Information. Table 1 – Sources and Contaminants Identification Table contains a summary of the individual sources of emissions at the Facility.

1.4 Process Flow Diagram

A process flow diagram is provided in Figure 4 – Process Flow Diagram.

1.5 Operating Schedule

The Facility operates 24 hours a day, seven days a week, and 52 weeks per year.

1.6 Facility Production Limit

The Facility Production Limit is 1.16 Million tonnes of finished Portland cement annually.

1.7 Summary of Modifications

As outlined in the Version Control section, this is the version 1.1 of this ESDM Report. A modification log is included in Appendix A to document revisions to the ESDM Report.

2.0 INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

2.1 Sources and Contaminants Identification Table

Table 1 – Sources and Contaminants Identification Table includes all the emission sources at the Facility and the expected contaminants emitted from each source. Each of the identified sources has been assigned a source reference number.

The significant contaminants (i.e., point of impingement concentrations greater than 5%) expected are suspended particulate matter (SPM), nitrogen oxides (NOx), sulphur dioxide (SO_2), ferric oxide, crystalline silica, manganese and calcium oxide. A summary of the nine emission source areas and sources that are the subject of this ESDM Report are presented in Table II below.

Table II: Sources by Production Area

Source Category	Types of Sources	Contaminants	Sources
Raw Materials Receiving	dust collectors; fugitive dust sources	SPM, ferric oxide, crystalline silica	E1 to E4, FUG1 to FUG6
Materials Storage and Transfers	dust collectors		E5 to E12
Raw Mill	dust collectors		E13 to E17
Kiln	hybrid dust collector and dust collector	SPM, NOx, SO_2, metals and organics	E18 and E27
Petcoke Receiving and Grinding	dust collectors; fugitive dust sources	SPM, crystalline silica	E19 to E25 and FUG7, FUG8
Clinker Storage and Transfer	dust collectors		E28 to E32
Cement Mill	dust collectors		E33 to E42
Finished Cement	dust collectors		E43 to E54
Cement Packaging	dust collectors		E55 to E56

The Facility also has sources related to maintenance welding and comfort heating.

There may be general ventilation from the Facility that only discharges uncontaminated air from the workspaces or air from the workspace that may include contaminants that come from commercial office supplies, building maintenance products or supplies and activities; these types of ventilation sources are considered to be negligible and were not identified as sources at the Facility. General ventilation located in the process area that does not vent process emissions is also considered to be negligible.

3.0 ASSESSMENT OF THE SIGNIFICANCE OF CONTAMINANTS AND SOURCES

Contaminants and sources at the Facility were assessed for significance following the guidance outlined in the ESDM Procedure Document.

3.1 Identification of Negligible Contaminants and Sources

Contaminants that are discharged from the Facility in negligible amounts and/or sources that discharge a contaminant in a negligible amount were excluded from further analysis.

The following sources have been identified as negligible and the rationale has been provided below:

- Fugitive dust emissions from roads and outdoor storage piles: The Facility will operate with a Best Management Practices Plan (BMPP) and as per section 7.4 of the ESDM Procedure Document, these emissions have been excluded from the dispersion modelling analysis. Please refer to Appendix E - BMPP.
- Comfort heating equipment: The Facility will have natural gas-fired comfort heating equipment that has been considered negligible. The comfort heating equipment will emit significantly less than 5% of the Facility's nitrogen oxides as a result of the kiln and can be considered negligible as per Section 7.2.2 of the ESDM Procedure Document. Additionally, nitrogen oxides would be the only contaminant requiring assessment from the comfort heating as per section 7.1.1 of the ESDM Procedure Document.
- Maintenance welding: The facility may have minor maintenance welding which has been considered negligible as per Table B-3 of the ESDM Procedure Document.

3.2 Identification of Significant Contaminants Using an Emission Threshold

The list of negligible contaminants were identified using the Emission Threshold calculation in s.7.1.2 of the ESDM Procedure Document and can be found in Appendix D – Assessment of Negligibility. These contaminants were excluded from the dispersion modelling analysis.

As per the ESDM Procedure Document, contaminants that are emitted from a specific facility may be identified as negligible when they are below the emission thresholds that are developed using the following formula:

$$Emission\ Threshold\ \left(\frac{g}{s}\right) = \frac{0.5\ MOECC\ POI\ Limit\ \frac{\mu g}{m^3}}{Dispersion\ Factor\ (\frac{\mu g}{m^3}\ per\ \frac{g}{s})}$$

The dispersion factor selected for the Facility was the MOECC rural dispersion factor of 10,000 (µg/m^3 per g/s emission) for a distance from source of 20 m and based on a 1-hour averaging period. This dispersion factor was developed by the MOECC using a series of conservative modelling factors for a short stack on a 6 m tall building and can be found in Table B-1 of the ESDM Procedure Document. The majority of the sources at the Facility are short stacks; however, the majority are located much greater than 20 m away from the nearest point of impingement (POI) locations and are either located much higher than 6 m above ground or on buildings that are much higher than 6 m. This results in a very conservative dispersion factor for the Facility as it is reasonable to assume that a taller stack located farther away from a POI location will have greater dispersion and lower predicted POI concentrations than a short stack that is closer to ground level and nearer to the POI location. For contaminants that had MOECC POI that are not based on 1-hour averaging periods, the conversion to the appropriate averaging periods was completed using the MOECC recommended conversion factors, as documented in the ADMGO.

Of the 70 contaminants assessed, 30 were considered negligible using the Emission Threshold calculation. The other 40 contaminants were carried forward into the dispersion modelling analysis.

3.3 Rationale for Assessment

For each source and contaminant that has been deemed negligible, information required to substantiate this classification, including references to MOECC guidance where applicable, is provided in Table 1 and Appendix D – Assessment of Negligibility.

In accordance with s.8 of O Reg. 419/05, emission rate calculations and dispersion modelling does not have to be performed for emissions from negligible sources. The emissions of the 30 negligible contaminants are included in the emission rate calculations; however, are excluded from the dispersion modelling assessment.

4.0 OPERATING CONDITIONS, EMISSION ESTIMATING AND DATA QUALITY

4.1 Description of Operating Conditions

Section 10 of O. Reg. 419/05 states that an acceptable operating condition is a scenario in which operating conditions for the Facility would result, for the relevant contaminant, in the highest concentration of the contaminant possible at the point of impingement.

The maximum emission scenario for the dispersion modelling analysis includes all sources at the Facility operating simultaneously at their respective maximum rates.

A summary of the sources at the Facility and their corresponding operating conditions and assumptions are presented in Table III below.

Table III: Operating Conditions

Source Type	Emission Estimating Technique/Methodology	Activity Throughput/Rate
Dust Collectors (throughout the Facility) (E1 to E17, E19 to E56)	Engineering Calculation	■ All dust collectors will be designed to achieve a minimum of 15 mg/m^3 outlet concentration. ■ The maximum fan flow rate of the dust collectors ranged from 3000 m^3/hr to 260,000 m^3/hr (209,970 Nm^3/hr). ■ The dust collectors have various operating times ranging from 4 to 24 hours depending on the activity the dust collector is controlling.
Fugitive Dust Sources at the Raw Material Receiving and Petcoke Receiving Areas (FUG1 to FUG8)	Emission Factor: US EPA AP-42, Chapter 13.2.4 Aggregate Handling and Storage Piles	■ Wind Speed of 1 mph for transfers located in enclosures and 8 mph (average wind speed from Ottawa airport) for transfers located outside. ■ Various moisture and material throughputs depending on the material.
Kiln End Hybrid Filter (E18)	Engineering Calculation	■ Dust collector flow rate of 1,000,000 m^3/hr (692,780 Nm^3/hr) ■ The kiln hybrid filter will be designed to achieve a minimum of 20 mg/m^3 for particulate matter, 1200 mg/m^3 for NOx and 200 mg/m^3 for SO_2. ■ Dioxins and furans were assessed using the Canada Wide Standard in stack limit for cement kilns of 80 pg/m^3. ■ 24-hour operation. ■ 3000 tpd of clinker.
	Emission Factor: other trace contaminants were assessed using US EPA AP-42 Chapter 11.6 Portland Cement Manufacturing	■ 1,000,000 m^3/hr (692,780 Nm^3). ■ 24-hour operation. ■ 3000 tonnes per day of clinker.

The averaging periods for the maximum rates provided in Table III were selected based on the averaging periods for the MOECC POI Limits of the significant contaminants emitted from each source. However, the daily maximum rates were applied to averaging periods greater than a day (e.g., 30-days) for conservatism. The use of the above maximum rates to estimate emission rates of contaminants for each emission source results in an operating condition which satisfies section 10 of O. Reg. 419/05. More details on the maximum operating rates are provided in Appendix B – Emission Rate Calculations.

4.2 Explanation of the Methods Used to Calculate Emission Rates

The maximum emission rates for each significant contaminant emitted from the significant sources were estimated in accordance with requirements of s.11 of O. Reg. 419/05 and the ESDM Procedure Document. These rates and methods are summarized in Table 2 – Source Summary Table.

4.3 Sample Calculations

Sample calculations are presented in Appendix B – Emission Rate Calculations. All of the emission estimation methods are acceptable methods as outlined in the ESDM Procedure Document. Where the emission rate calculation relies on data that is not readily available, the data are provided in Appendix C – Supporting Information for Emission Rate Calculations.

4.4 Assessment of Data Quality

The data quality for each contaminant emission rate is documented in Table 2 – Source Summary Table and Appendix B – Emission Rate Calculations.

4.5 Conservatism of Emission Estimates and Operating Condition

The following assumptions were included in the development of the emission estimates and operating condition for the Facility:

- The highest emission rate that each source is capable of (i.e., maximum usage rates or throughputs) was used to characterize the emissions.
- All sources are assumed to be operating simultaneously at the corresponding maximum emission rate for the averaging period.
- For compounds without emission factors, in-stack compliance limits were used (e.g., dioxins and furans). These are considered conservative as the kiln will be designed to meet the in-stack limits.
- Due to the nature of the hybrid filter on the kiln stack, it is likely that it can achieve much lower particle outlet loading concentrations than the design outlet loading of 20 mg/Nm^3.
- The kiln is designed to be equipped with a selective non catalytic reduction (SNCR) system that will significantly reduce the estimated NOx emissions from the Kiln. It is likely the outlet loading concentration of NOx used in this ESDM Report will be much lower once in operation.
- Fugitive emissions were considered from all raw material receipts. These will be much lower in operation as many of the transfers are not likely to contribute to fugitive emissions as they are located in enclosures and equipped with dust collectors.

Based on the conservative assumptions summarized above and detailed in Appendix B – Emission Rate Calculations, the emission rates listed in Table 2 are not likely to be an underestimate of the actual emission rates.

5.0 SOURCE SUMMARY TABLE AND SITE PLAN

5.1 Source Summary Table

The emission rates for each source of significant contaminants are documented in Table 2 – Source Summary Table in accordance with requirements of sub paragraph 8 of s.26(1) of O. Reg. 419/05.

5.2 Site Plan

The presentation of the pertinent physical data at the Facility (e.g., Facility location, property boundary, and significant sources) is provided in Table IV below with a reference to which Figure the data is presented on.

Table IV: Required Site Plan Information

Criteria	Required Information	Figure
Property Boundary and Coordinates	■ the property boundary ■ the co-ordinates for sufficient points on the property boundary to accurately describe the boundary	Figure 1 – Site Location Plan
Structures on the Property	■ the location, dimensions and elevation of every structure on the property	Figure 3 – Equipment Layout Figure 7 - BPIP Plan*
Significant Sources	■ each source of significant contaminants (i.e., all stacks and fugitives)	Figure 5 – Source Layout Figure 6 – Dispersion Modelling Plan
On-site Sensitive Receptors	■ an indication of which structures contain sensitive receptors (if applicable)	There are no sensitive receptors (e.g., child care facility, health care facility, senior's residence, long-term care facility or an educational facility) located at the Facility. Therefore, a 'same structure contamination' assessment was not conducted

*Building Profile Input Program

Where reasonable, the location, dimensions, and elevations of only those on-site structures that may affect the dispersion of emissions from significant sources are included.

For ease of reference, each of the sources is labelled with the source reference number in Table 2 – Source Summary Table.

6.0 DISPERSION MODELLING

Dispersion modelling was conducted in accordance with the MOECC *publication "Guideline A-11: Air Dispersion Modelling Guideline for Ontario, Version, 2.0"*, dated March 2009 (ADMGO) PIBS 5165e02.

The Facility is subject to s.19 of O. Reg. 419/05 which allows for the use of models in the appendix to O. Reg. 346/90 and the use of Schedule 2 standards until February 1, 2020 at which time the use of more advanced dispersion models and Schedule 3 standards will be required. However, the Facility wishes to demonstrate compliance with the Schedule 3 standards in advance using the MOECC-accepted regulatory dispersion model, AERMOD, therefore a *"Request Under s.20(4) to Have the Schedule 3 Standards Apply in Advance of the Date Required by O. Reg. 419/05*" form has been included with this ECA application.

The AERMOD modelling system is made up of the AERMOD dispersion model, the AERMET meteorological pre-processor, the AERMAP terrain pre-processor and the BPIP building downwash pre-processor. The AERMET pre-processor was not used in this assessment; however the most recent pre-processed MOECC meteorological dataset was used.

The following is a list of the model and pre-processors which were used in this assessment, along with the version numbers of each:

- AERMOD dispersion model (v. 14134);
- AERMAP surface pre-processor (v. 09040); and,
- BPIP building downwash pre-processor (v.04274).

The dispersion modelling was conducted in accordance with the ADMGO and the Ministry technical bulletin *Methodology for Modelling Assessments with 10-Minute Average Standards and Guidelines under O. Reg. 419/05*, dated April 2008 (Ministry Technical Bulletin). A general description of the input data used in the dispersion model is provided below and summarized in Table 3.

The emission rates used in the dispersion model meet the requirements of s.11(1)1 of O. Reg. 419/05, which requires that the emission rate used in the dispersion model be at least as high as the maximum emission rate that the source of contaminant is reasonably capable of for the relevant contaminant. These emission rates are further described in Appendix B – Emission Rate Calculations.

6.1 Dispersion Modelling Input Summary Table

A description of the way in which the approved dispersion model was performed is included as Table 3 – Dispersion Modelling Input Summary Table. This table meets both the requirements of s.26(1)11 and sections 8-17 of O. Reg. 419/05 and follows the format provided in the ESDM Procedure Document.

6.1.1 Dispersion Modelling Source Parameters

The source parameter data required for each source was identified according to the procedures provided in ADMGO. Furthermore, the dispersion modelling input parameters are summarized in Table 4 – Dispersion Modelling Source Summary Table.

The majority of sources from the Facility were modelled as individual point sources.

6.2 Land Use Zoning Designation Plan

The land use designation of the site and surrounding area is presented in Figure 2 – Land Use Zoning Designation Plan.

6.3 Coordinate System

The Universal Transverse Mercator (UTM) coordinate system, as per Section 5.2.2 of the ADMGO, was used to specify model object sources, buildings and receptors. All coordinates were defined in the North American Datum of 1983 (NAD83).

6.4 Meteorology and Surrounding Land Use

Sub paragraph 10 of s.26(1) of O. Reg. 419/05 requires a description of the local land use conditions if meteorological data, as described in paragraph 2 of s.13(l) of O. Reg. 419/05, was used. In this assessment, the AERMOD model was run using a MOECC pre-processed five year dispersion meteorological dataset (i.e. surface and profile files), last updated in 2015, in accordance with paragraph 1 of s.13(1) of O. Reg. 419/05. As the Facility is located in the Ottawa MOECC Region, the meteorological dataset for Ottawa was used. Furthermore, the land use surrounding the Facility is characterized as rural, as illustrated in Figure 8 – 3 km Satellite Image. As a result, MOECCs “Crops, Forest, Urban” meteorological dataset is used.

Meteorological anomalies were removed in accordance with the procedure outlined in ADMGO.

6.5 Terrain

Terrain data used in this assessment was obtained from MOECC (7.5 minute format) and is illustrated in Figure 9 – Terrain Elevations. DEM files used in this assessment are:

- 1433_3.DEM;
- 1433_4.DEM;
- 1434_3.DEM;
- 1434_4.DEM;
- 1435_3.DEM; and,
- 1435_4.DEM.

6.6 Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O .Reg. 419/05. Specifically, a nested receptor grid, centered around the outer edges of all the sources, was placed as follows:

a) 20 m spacing, within an area of 200 m by 200 m;

b) 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a);

c) 100 m spacing, within an area surrounding the area described in (b) with a boundary at 800 m by 800 m outside the boundary of the area described in (a);

d) 200 m spacing, within an area surrounding the area described in (c) with a boundary at 1,800 m by 1,800 m outside the boundary of the area described in (a); and

e) 500 m spacing, within an area surrounding the area described in (d) with a boundary at 4,800 m by 4,800 m outside the boundary of the area described in (a).

In addition to using the nested receptor grid, receptors were also placed every 10 m along the property line in sections of the property line that are within 200 m of an emission source and every 100 m in sections of the property line that are greater than 200 m from an emission source. Only receptors located outside of the property line were considered. The area of modeling coverage is illustrated on Figure 9 – Dispersion Modelling Receptors and POI Locations.

There is no child care facility, health care facility, senior's residence, long-term care facility or an educational facility located at the Facility. As such, a 'same structure contamination' assessment was not conducted.

6.7 Stack Height for Certain New Sources of Contaminants: Good Engineering Practice (GEP)

The Facility is subject to s.15 of O. Reg. 419/05 which requires facilities to consider the height of a new tall stack for stacks constructed after November 30th, 2005.

As per s.15 of O. Reg. 419/05, the height of the Kiln stack must be lower than the following:

- the actual height above ground level at which contaminants are discharged into the air from the source of contaminant; and
- the higher of the following heights:
  - Sixty-five metres.
  - A + (1.5 × B).

A is equal to the height above ground level of the structure referred to in paragraph 4 of subsection (1) of O. Reg. 419/05 (113.8 m for the Facility) and B is equal to the lesser of the following:

- the height above ground level of the structure referred to in paragraph 4 of subsection (1) O. Reg. 419/05 (113.8 m); and
- the greatest width presented to the wind by the structure referred to in paragraph 4 of subsection (1) of O. Reg. 419/05, measured perpendicularly to the direction of the wind (18 m).

This results in a stack height that must be less than 140.8 m above ground. Therefore, the designed stack height of 125 for the Kiln stack is not greater than GEP stack height.

6.8 Building Downwash

Building wake effects were considered in this assessment using the U.S. EPAs Building Profile Input Program (BPIP-PRIME), another pre-processor to AERMOD. The inputs into this pre-processor include the coordinates and heights of the buildings and stacks. The output data from BPIP is used in the AERMOD building wake effect calculations.

See Figure 7 – BPIP Plan for an illustration of the buildings which were considered in the BPIP exercise for this assessment. The BPIP input file is provided in Appendix F – Dispersion Modelling Files.

6.9 Averaging Periods and Conversions

Colacem wishes to have the Schedule 3 standards of O. Reg. 419/05 apply to this Facility in advance, as mentioned in Section 6.0. Many of these standards are based on 1-hour and 24-hour averaging times, which are averaging times easily provided by AERMOD. In cases where a standard has an averaging period that AERMOD is not designed to predict (e.g. 10-min), a conversion to the appropriate averaging period was completed using the MOECC recommended conversion factors, as documented in the ADMGO. For averaging periods greater than 24-hours (e.g., 30-day), the 24-hour predicted concentrations have been used to compare to these averaging periods, which is considered conservative.

6.10 Dispersion Modelling Options

The options used in the AERMOD dispersion model are summarized in Table V below.

Table V: Dispersion Modelling Options

Modelling Parameter	Description	Used in the Assessment?
DFAULT	Specifies that regulatory default options will be used	Yes
CONC	Specifies that concentration values will be calculated	Yes
AVERTIME	Time averaging periods calculated	1-hr and 24-hr

6.11 Dispersion Modelling Input and Output Files

Electronic copies of all input and output files are provided in Appendix F on compact disc (CD). For contaminants emitted only from the kiln, a unit modelling run was carried out for these contaminants. The remaining contaminants were modelled independently.

7.0 EMISSION SUMMARY TABLE

7.1 Emission Summary Table

A POI concentration for each significant contaminant emitted from the Facility was calculated based on the emission rates listed in Table 2 – Source Summary Table and the output from the dispersion model. The results are presented in Table 5 – Emission Summary Table. POI Locations are indicated on Figure 10 – Dispersion Modelling Receptors and POI locations.

The POI concentrations listed in Table 5 were compared against the MOECC POI Limits. At 71%, NOx has the highest concentration relative to its 1-hour limit of 400 ug/m^3 MOECC POI Limit.

7.2 Assessment of Contaminants with no MOECC POI Limits

Sub paragraph 14 subsection viii of s.26(1) O. Reg. 419/05 requires an indication of the likelihood, nature and location of any adverse effect if the contaminant is not listed in any of Schedules 1, 2 and 3.

Contaminants released by the Facility that are not found on the List of MOECC POI Limits are considered to be 'Contaminants with No MOECC POI Limits'. Where applicable, predicted POI concentrations for Contaminants with No MOECC POI Limits were screened against the corresponding Jurisdictional Screening Level limit (JSL) listed in the MOE publication *Jurisdictional Screening Level (JSL) List a Screening Tool for Ontario Regulation 419: Air Pollution – Local Air Quality,* dated February 2008, or the *de minimus* limit.

Predicted concentrations of all Contaminants with No MOECC POI Limits were found to be below the corresponding JSL or the *de minimus* limit. These contaminants are included in Appendix D, Table D2 – Negligible Contaminants. Of the 40 contaminants which carried forward into the dispersion modelling analysis, 27 contaminants were found to be less than 1% of their corresponding POI Limits. These contaminants are included in Appendix D, Table D2 – Negligible Contaminants.

In order to simplify the presentation of the results and to focus the report on the assessment of compliance, the contaminants have been categorized as presented in Table VI below.

Table VI: Categorization of Contaminants Assessed in the ESDM

CONTAMINANT CATEGORY	NUMBER OF CONTAMINANTS IN ESDM
CONTAMINANTS ASSESSED	
Number of Compounds Assessed	70
Number of Compounds Screened out using the Emission Threshold	30
Number of Compounds Considered in the Dispersion Modelling Analysis	40
COMPOUNDS ASSESSED WITH DISPERSION MODELLING	
Number of Compounds Considered in the Dispersion Modelling Analysis	40
Compounds Assessed below *de minimus*, JSL or less than 1% of MOECC POI Limit	29
Compounds Assessed greater than 1% but below MOECC POI Limits	10
Compounds for which a MGLCA Request was submitted	1

8.0 CONCLUSIONS

This ESDM Report was prepared in accordance with s.26 of O. Reg. 419/05. In addition, guidance in the ESDM Procedure Document was followed, as appropriate.

The Facility is subject to s.19 of O. Reg. 419/05 which allows for the use of models in the appendix to O. Reg. 346/90. However, the Facility wishes to demonstrate compliance with the Schedule 3 standards in advance using the MOECC-accepted regulatory dispersion model, AERMOD, therefore a *"Request Under s.20(4) to Have the Schedule 3 Standards Apply in Advance of the Date Required by O. Reg. 419/05*" form has been included with this ECA application.

All the emission rates listed in Table 2 – Source Summary Table correspond to the operating scenario which results in the maximum POI concentration from the site. For this reason and conservatisms discussed in s.4.5, the emission rates listed in Table 2 – Source Summary Table are not likely to be an underestimate of the actual emission rates. Colacem may wish to revisit these assumptions in the future if Facility operations change.

A POI concentration for each significant contaminant emitted from the Facility was calculated based on the calculated emission rates and the output from the dispersion model. The results are presented in Table 5 – Emission Summary Table.

The POI concentrations listed in the Emission Summary Table were compared against published MOECC publication *Summary of Standards and Guidelines to support Ontario Regulation 419: Air Pollution - Local Air Quality (including Schedule 6 of O. Reg. 419 on Upper Risk Thresholds)*, dated April 2012 (MOECC POI Limits). At 71%, nitrogen oxides has the highest predicted POI concentration relative to the corresponding MOECC POI Limit.

Contaminants released by the Facility that are not found on the List of MOECC POI Limits are considered to be 'Contaminants with No MOECC POI Limits'. Where applicable, predicted POI concentrations of Contaminants with No MOECC POI Limits were screened against the corresponding JSL limit listed in the MOE publication *Jurisdictional Screening Level (JSL) List a Screening Tool for Ontario Regulation 419: Air Pollution – Local Air Quality,* dated February 2008, or the *de minimus* limit.

A *"Supporting Information for a Maximum Ground Level Concentration Acceptability Request for Coumpounds with No Ministry POI Limit: Supplement to Application for Approval, EPA s.20.2"* was submitted for Portland Cement.

It is assumed that the conservative emission rates, when combined with the conservative operating conditions and conservative dispersion modelling assumptions, are not likely to under predict the concentrations at a POI. Therefore, this assessment demonstrates that the Facility can operate in compliance with s.20 of O. Reg. 419/05.

9.0 CLOSURE

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Camille Taylor, P.Eng.
Senior Air Quality Specialist

Sean Capstick, P.Eng
Principal

JDM/LGE/FSC/ng/ca

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TABLES

Table 1

Sources and Contaminants Identification Table

Source Information			Expected Contaminants	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Source/ Modelling ID	**Source Name**	**General Location**				
Raw Materials Receiving						
FUG1	Limestone Receiving	Raw Material Receiving	SPM, Crystalline Silica	Yes	Yes	N/A
FUG2	Bauxite Receiving	Raw Material Receiving	SPM	Yes	Yes	N/A
FUG3	Shale Receiving	Raw Material Receiving	SPM	Yes	Yes	N/A
FUG4	Iron Ore Receiving	Raw Material Receiving	SPM, Ferric Oxide	Yes	Yes	N/A
FUG5	Silica Receiving	Raw Material Receiving	SPM, Crystalline Silica	Yes	Yes	N/A
FUG6	Gypsum Receiving	Raw Material Receiving	SPM	Yes	Yes	N/A
E1	Bauxite Receiving Dust Collector	Raw Material Receiving	SPM	Yes	Yes	Only particulates were assessed. Aluminum oxide shares the same POI standard as SPM.
E2	Shale, Silica, Iron Ore Receiving Dust Collector	Raw Material Receiving	SPM, Ferric Oxide, Crystalline Silica (Silica)	Yes	Yes	N/A
E3	Gypsum Receiving Dust Collector	Raw Material Receiving	SPM	Yes	Yes	N/A
E4	Limestone Crusher Dust Collector	Raw Material Receiving	SPM, Crystalline Silica	Yes	Yes	N/A
Raw Materials Storage and Transfers						
NEG1	Limestone and Shale Storage	Raw Material Storage Building	None	No	No	No expectation of emission as sources are enclosed in a building.
NEG2	Gypsum Storage	Raw Material Storage Building	None	No	No	
E5	Bauxite Storage Bin Dust Collector	Raw Material Storage Building	SPM	Yes	Yes	Only particulates were assessed. Aluminum oxide shares the same POI standard as SPM.
E6	Iron Ore Hopper Dust Collector	Raw Material Storage Building	SPM, Ferric Oxide	Yes	Yes	N/A
E7	Silica Hopper Dust Collector	Raw Material Storage Building	SPM, Crystalline Silica	Yes	Yes	N/A
E8	Limestone Reclaimer Belt Dust Collector	Raw Material Storage Building	SPM, Crystalline Silica	Yes	Yes	N/A
E9	Limestone Reclaimer Belt Dust Collector	Raw Material Storage Building	SPM, Crystalline Silica	Yes	Yes	N/A
E10	Gypsum Reclaimer Belt Dust Collector	Raw Material Storage Building	SPM	Yes	Yes	N/A
E11	Limestone & Gypsum Belt to Cement Hopper Dust Collector	Raw Material Receiving	SPM, Crystalline Silica	Yes	Yes	N/A
E12	Constituents Belt to Cement Hopper Dust Collector	Raw Material Receiving	SPM, Crystalline Silica	Yes	Yes	N/A
Raw Mill						
E13	Raw Mill Feeding Dust Collector	Raw Mill	SPM, Ferric Oxide, Crystalline Silica	Yes	Yes	N/A
E14	Raw Meal Airslide Dust Collector	Raw Mill	SPM, Ferric Oxide, Crystalline Silica	Yes	Yes	N/A
E15	Raw Meal Silo Dust Collector	Raw Mill	SPM, Ferric Oxide, Crystalline Silica	Yes	Yes	N/A
E16	Raw Meal Silo Extraction Dust Collector	Raw Mill	SPM, Ferric Oxide, Crystalline Silica	Yes	Yes	N/A
E17	Air Lift Bin Dust Collector	Raw Mill	SPM, Ferric Oxide, Crystalline Silica	Yes	Yes	N/A
Kiln						
E18	Kiln Dust Collector	Pre-Heater	SPM, Carbon Monoxide, Nitrogen Oxides, Ammonia, Sulfur Oxides, Metals, Inorganics and Organics, and Dioxins and Furans	Yes	Yes	N/A
E27	Clinker Cooler Dust Collector	Clinker Cooler	SPM, Crystalline Silica	Yes	Yes	N/A
Petcoke Receiving and Grinding						
FUG7	Petcoke Receiving	Petcoke Outdoor Storage Area	SPM	Yes	Yes	N/A
FUG8	Petcoke Loading to Hopper	Petcoke Outdoor Storage Area	SPM	Yes	Yes	N/A
E19	Petcoke Receiving Dust Collector	Petcoke Outdoor Storage Area	SPM	Yes	Yes	N/A
E20	Petcoke Silos Loading Bucket Elevator Dust Collector	Petcoke Grinding	SPM	Yes	Yes	N/A
E21	Petcoke (Coarse) Silo Dust Collector - 1	Petcoke Grinding	SPM	Yes	Yes	N/A
E22	Petcoke (Coarse) Silo Dust Collector - 2	Petcoke Grinding	SPM	Yes	Yes	N/A
E23	Petcoke Grinder Dust Collector	Petcoke Grinding	SPM	Yes	Yes	N/A
E24	Petcoke (Pulverized) Silo Dust Collector - 1	Petcoke Grinding	SPM	Yes	Yes	N/A
E25	Petcoke (Pulverized) Silo Dust Collector - 2	Petcoke Grinding	SPM	Yes	Yes	N/A
Clinker Storage and Transfer						
E28	Clinker Receiving Dust Collector	Clinker Silo	SPM, Crystalline Silica	Yes	Yes	N/A
E29	Clinker Silo Dust Collector	Clinker Silo	SPM, Crystalline Silica	Yes	Yes	N/A
E30	Clinker Extraction for Bulk Loading Dust Collector	Clinker Silo	SPM, Crystalline Silica	Yes	Yes	N/A
E31	Clinker Bulk Loading Dust Collector	Clinker Silo	SPM, Crystalline Silica	Yes	Yes	N/A
E32	Clinker Extraction for Cement Hopper Dust Collector	Clinker Silo	SPM, Crystalline Silica	Yes	Yes	N/A

Table 1

Sources and Contaminants Identification Table

Source Information			Expected Contaminants	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Source/ Modelling ID	**Source Name**	**General Location**				
Cement Mill						
E33	Cement Clinker Hopper Dust Collector	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E34	Cement Limestone Hopper Dust Collector	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E35	Cement Gypsum Hopper Dust Collector	Cement Mill	SPM	Yes	Yes	N/A
E36	Cement 4° Constituent Hopper Dust Collector	Cement Mill	SPM	Yes	Yes	N/A
E37	Silica Fume Silo Dust Collector	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E38	Fly Ash Silo Dust Collector	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E39	Cement Mill Dust Collector - 1	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E40	Cement Mill Dust Collector - 2	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E41	Cement Mill Air Slide Dust Collector - 1	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
E42	Cement Mill Air Slide Dust Collector - 2	Cement Mill	SPM, Crystalline Silica	Yes	Yes	N/A
Finished Cement						
E43	Cement Silo Dust Collector - 1A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E44	Cement Silo Dust Collector - 2A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E45	Cement Silo Dust Collector - 1B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E46	Cement Silo Dust Collector - 2B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E47	Cement Silo Bulk Loading Dust Collector - 1A-A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E48	Cement Silo Bulk Loading Dust Collector - 1A-B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E49	Cement Silo Bulk Loading Dust Collector - 2A-A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E50	Cement Silo Bulk Loading Dust Collector - 2A-B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E51	Cement Silo Bulk Loading Dust Collector - 1B-A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E52	Cement Silo Bulk Loading Dust Collector - 1B-B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E53	Cement Silo Bulk Loading Dust Collector - 2B-A	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
E54	Cement Silo Bulk Loading Dust Collector - 2B-B	Finished Cement Silos	SPM, Crystalline Silica	Yes	Yes	N/A
Cement Packaging						
E55	Packing Plant Dust Collector - A	Packaging Plant	SPM, Crystalline Silica	Yes	Yes	N/A
E56	Packing Plant Dust Collector - B	Packaging Plant	SPM, Crystalline Silica	Yes	Yes	N/A
Alternative Fuels						
E26	Alternative Fuel Dust Collector	Alternative Fuel	SPM	Yes	Yes	N/A
Supporting Processes						
NEG4	Comfort Heating Equipment	Facility	Nitrogen Oxides	No	No	The comfort heating equipment can be considered negligible as per Section 7.2.2 of the ESDM Procedure Document as it will emit significantly less than 5% of the Facility's nitrogen oxides compared to the kiln.
NEG5	Maintenance Welding	Facility	SPM	No	No	Negligible as per Table B-3 of the ESDM Procedure Document (Maintenance Welding Stations).
RS	Paved Roads	Facility	SPM	Yes	No	As per section 7.4 of the ESDM Procedure guide the roads have not been modelled as the facility has a BMPP included in Appendix E of the ESDM.

Table 2
Source Summary Table

Stack ID	Source Description	Source Parameters							Emission Data						
		Stack Volumetric Flow Rate [Am³/s]	Stack Exit Gas Temperature [°C]	Stack Inner Diameter [m]	Stack Height Above Grade [m]	Stack Height Above Roof [m]	Stack Location [X Coordinate]	Stack Location [Y Coordinate]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
Raw Materials Receiving															
FUG1	Limestone Receiving	—	—	—	—	—	518709	5049928	SPM	N/A-1	5.42E-03	24	EC	Above Average	<1%
									PM10	N/A-2	2.56E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.88E-04	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.68E-04	24	EC	Above Average	1%
FUG2	Bauxite Receiving	—	—	—	—	—	518708	5049953	SPM	N/A-1	2.86E-05	24	EC	Above Average	<1%
									PM10	N/A-2	1.35E-05	24	EC	Above Average	<1%
									PM2.5	N/A-3	2.05E-06	24	EC	Above Average	<1%
FUG3	Shale Receiving	—	—	—	—	—	518709	5049928	SPM	N/A-1	5.11E-05	24	EC	Above Average	<1%
									PM10	N/A-2	2.41E-05	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.66E-06	24	EC	Above Average	<1%
FUG4	Iron Ore Receiving	—	—	—	—	—	518709	5049928	SPM	N/A-1	1.22E-05	24	EC	Above Average	<1%
									Ferric Oxide	1309-37-1	1.22E-05	24	EC	Above Average	<1%
									PM10	N/A-2	5.77E-06	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.74E-07	24	EC	Above Average	<1%
FUG5	Silica Receiving	—	—	—	—	—	518709	5049928	SPM	N/A-1	1.63E-04	24	EC	Above Average	<1%
									PM10	N/A-2	7.72E-05	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.17E-05	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	5.07E-06	24	EC	Above Average	<1%
FUG6	Gypsum Receiving	—	—	—	—	—	518699	5049900	SPM	N/A-1	1.21E-04	24	EC	Above Average	<1%
									PM10	N/A-2	5.73E-05	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.68E-06	24	EC	Above Average	<1%
E1	Bauxite Receiving Dust Collector	2.78	Ambient	0.50	15	N/A	518710	5049945	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
E2	Shale, Silica, Iron Ore Receiving Dust Collector	2.78	Ambient	0.50	15	N/A	518705	5049918	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	4.76E-04	24	EC	Above Average	3%
									Ferric Oxide	1309-37-1	1.37E-02	24	EC	Above Average	40%
E3	Gypsum Receiving Dust Collector	2.78	Ambient	0.50	15.00	N/A	518702	5049893	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
E4	Limestone Crusher Dust Collector	8.33	Ambient	0.85	20	N/A	518713	5049929	SPM	N/A-1	4.10E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.17E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.47E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.43E-03	24	EC	Above Average	10%
Raw Materials Storage and Transfers															Raw Material
E5	Bauxite Storage Bin Dust Collector	0.83	Ambient	0.30	5.00	N/A	518824	5050007	SPM	N/A-1	1.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	5.70E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.87E-03	24	EC	Above Average	<1%
E6	Iron Ore Hopper Dust Collector	1.39	Ambient	0.35	26	N/A	518834	5049980	SPM	N/A-1	1.79E-02	24	EC	Above Average	<1%
									PM10	N/A-2	9.50E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	6.45E-03	24	EC	Above Average	<1%
									Ferric Oxide	1309-37-1	1.79E-02	24	EC	Above Average	52%
E7	Silica Hopper Dust Collector	1.39	Ambient	0.35	26	N/A	518837	5049971	SPM	N/A-1	1.79E-02	24	EC	Above Average	<1%
									PM10	N/A-2	9.50E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	6.45E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	6.25E-04	24	EC	Above Average	4%
E8	Limestone Reclaimer Belt Dust Collector	0.83	Ambient	0.30	5	N/A	518835	5049976	SPM	N/A-1	1.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	5.70E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.87E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	3.75E-04	24	EC	Above Average	3%
E9	Limestone Reclaimer Belt Dust Collector	0.83	Ambient	0.30	5	N/A	518839	5049967	SPM	N/A-1	1.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	5.70E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.87E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	3.75E-04	24	EC	Above Average	3%
E10	Gypsum Reclaimer Belt Dust Collector	0.83	Ambient	0.30	5	N/A	518841	5049962	SPM	N/A-1	2.05E-03	24	EC	Above Average	<1%
									PM10	N/A-2	1.09E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.37E-04	24	EC	Above Average	<1%
E11	Limestone & Gypsum Belt to Cement Hopper Dust Collector	0.83	Ambient	0.30	5	N/A	518752	5049938	SPM	N/A-1	8.19E-03	24	EC	Above Average	<1%
									PM10	N/A-2	4.34E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	2.95E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	2.86E-04	24	EC	Above Average	2%
E12	Constituents Belt to Cement Hopper Dust Collector	0.83	Ambient	0.30	5	N/A	518755	5049932	SPM	N/A-1	2.05E-03	24	EC	Above Average	<1%
									PM10	N/A-2	1.09E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.37E-04	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	7.14E-05	24	EC	Above Average	<1%
Raw Mill															
E13	Raw Mill Feeding Dust Collector	4.17	Ambient	0.60	20	N/A	518887	5049824	SPM	N/A-1	5.38E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.85E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.94E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.87E-03	24	EC	Above Average	13%
									Ferric Oxide	1309-37-1	7.64E-04	24	EC	Above Average	2%

Table 2

Source Summary Table

Stack ID	Source Description	Source Parameters: Stack Volumetric Flow Rate [Am³/s]	Stack Exit Gas Temperature [°C]	Stack Inner Diameter [m]	Stack Height Above Grade [m]	Stack Height Above Roof [m]	Stack Location [X Coordinate]	Stack Location [Y Coordinate]	Emission Data: Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
E14	Raw Meal Airslide Dust Collector	1.39	60	0.35	15	N/A	518926	5049778	SPM	N/A-1	1.60E-02	24	EC	Above Average	<1%
									PM10	N/A-2	8.51E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	5.78E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	5.59E-04	24	EC	Above Average	4%
									Ferric Oxide	1309-37-1	2.28E-04	24	EC	Above Average	<1%
E15	Raw Meal Silo Dust Collector	2.78	60	0.50	65	N/A	518940	5049780	SPM	N/A-1	3.67E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.94E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.32E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.28E-03	24	EC	Above Average	9%
									Ferric Oxide	1309-37-1	5.21E-04	24	EC	Above Average	2%
E16	Raw Meal Silo Extraction Dust Collector	2.78	60	0.50	15	N/A	518934	5049773	SPM	N/A-1	3.67E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.94E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.32E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.28E-03	24	EC	Above Average	9%
									Ferric Oxide	1309-37-1	5.21E-04	24	EC	Above Average	2%
E17	Air Lift Bin Dust Collector	2.78	60	0.50	15	N/A	518922	5049762	SPM	N/A-1	3.67E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.94E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.32E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.28E-03	24	EC	Above Average	9%
									Ferric Oxide	1309-37-1	5.21E-04	24	EC	Above Average	2%
Kiln															
E18	Kiln Dust Collector	277.78	150	5.00	125	N/A	518903	5049756	SPM	N/A-1	3.85E+00	24	EC	Above Average	58%
									PM10	N/A-2	2.04E+00	24	EC	Above Average	60%
									PM2.5	N/A-3	1.39E+00	24	EC	Above Average	61%
									Carbon Monoxide	630-08-0	7.70E+01	½	EC	Above Average	100%
									Nitrogen Oxides	10102-44-0	2.31E+02	1, 24	EC	Above Average	100%
									Ammonia	7664-41-7	7.70E+00	24	EC	Above Average	100%
									Sulfur Dioxide	7446-09-5	3.85E+01	1, 24	EC	Above Average	100%
									Dioxins and Furans (TEQ)	N/A-4	1.54E-08	24	EC	Above Average	100%
									Silver	7440-22-4	9.61E-06	24	EF	Marginal	100%
									Arsenic	7440-38-2	1.89E-04	24	EF	Marginal	100%
									Barium	7440-39-3	5.51E-03	24	EF	Marginal	100%
									Beryllium	7440-41-7	1.04E-05	24	EF	Marginal	100%
									Calcium Oxide	1305-78-8	5.29E+00	24	EF	Marginal	100%
									Cadmium	7440-43-9	3.46E-05	24	EF	Marginal	100%
									Chloride	N/A-5	3.31E-02	24	EF	Marginal	100%
									Chromium	7440-47-3	1.21E-04	24	EF	Marginal	100%
									Copper	7440-50-8	8.35E-02	24	EF	Marginal	100%
									Hydrogen Fluoride	7664-39-3	1.49E-02	24	EF	Marginal	100%
									Iron*	15438-31-0	2.68E-01	24	EF	Marginal	100%
									Hydrogen Chloride	7647-01-0	7.72E-01	24	EF	Marginal	100%
									Mercury	7439-97-6	3.78E-04	24	EF	Marginal	100%
									Potassium	7440-09-7	2.83E-01	24	EF	Marginal	100%
									Manganese	7439-96-5	1.35E-02	24	EF	Marginal	100%
									Lead	7439-92-1	1.18E-03	24, 30-day	EF	Marginal	100%
									Sulfur trioxide	N/A-8	2.20E-01	24	EF	Marginal	100%
									Selenium	7782-49-2	2.36E-03	24	EF	Marginal	100%
									Thallium	7440-28-0	8.50E-05	24	EF	Marginal	100%
									Titanium	7440-32-6	5.83E-03	24	EF	Marginal	100%
									Zinc	7440-66-6	5.35E-03	24	EF	Marginal	100%
									C3 benzenes	N/A-10	4.09E-05	24	EF	Marginal	100%
									C4 benzenes	N/A-11	9.45E-05	24	EF	Marginal	100%
									C6 benzenes	N/A-12	1.45E-05	24	EF	Marginal	100%
									Acenaphthylene	208-96-8	1.89E-03	24	EF	Marginal	100%
									Acetone	67-64-1	5.83E-03	24	EF	Marginal	100%
									Benzaldehyde	100-52-7	3.78E-04	24	EF	Marginal	100%
									Benzene	71-43-2	4.88E-02	24, Annual	EF	Marginal	100%
									Benzo(a)anthracene	56-55-3	6.77E-07	24	EF	Marginal	100%
									Benzo(a)pyrene	50-32-8	2.05E-06	24, Annual	EF	Marginal	100%
									Benzo(b)fluoranthene	205-99-2	8.82E-06	24	EF	Marginal	100%
									Benzo(g,h,i)perylene	191-24-2	1.23E-06	24	EF	Marginal	100%
									Benzo(k)fluoranthene	207-08-9	2.36E-06	24	EF	Marginal	100%
									Benzoic acid	65-85-0	5.51E-02	24	EF	Marginal	100%
									Biphenyl	92-52-4	9.61E-05	24	EF	Marginal	100%
									Bis(2-ethylhexyl)phthalate	117-81-7	1.50E-03	24	EF	Marginal	100%
									Bromomethane	74-83-9	6.77E-04	24	EF	Marginal	100%
									Carbon disulfide	75-15-0	1.73E-03	24	EF	Marginal	100%
									Chlorobenzene	108-90-7	2.52E-04	10-min, 24	EF	Marginal	100%
									Chloromethane	74-87-3	5.98E-03	24	EF	Marginal	100%
									Chrysene	218-01-9	2.52E-06	24	EF	Marginal	100%
									Di-n-butylphthalate	84-74-2	6.46E-04	24	EF	Marginal	100%
									Dibenz(a,h)anthracene	53-70-3	9.92E-06	24	EF	Marginal	100%
									Ethylbenzene	100-41-4	2.99E-04	24	EF	Marginal	100%
									Fluoranthene	206-44-0	1.39E-04	24	EF	Marginal	100%
									Fluorene	86-73-7	2.99E-04	24	EF	Marginal	100%
									Formaldehyde	50-00-0	7.24E-03	24	EF	Marginal	100%
									Freon 113	76-13-1	7.87E-04	24	EF	Marginal	100%
									Indeno(1,2,3-cd)pyrene	193-39-5	1.37E-06	24	EF	Marginal	100%
									Methyl ethyl ketone	78-93-3	4.72E-04	24	EF	Marginal	100%

Table 2
Source Summary Table

Stack ID	Source Description	Source Parameters: Stack Volumetric Flow Rate [Am³/s]	Stack Exit Gas Temperature [°C]	Stack Inner Diameter [m]	Stack Height Above Grade [m]	Stack Height Above Roof [m]	Stack Location [X Coordinate]	Stack Location [Y Coordinate]	Emission Data: Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
									Methylene chloride	75-09-2	7.72E-03	24	EF	Marginal	100%
									Methylnaphthalene	90-12-0	6.61E-05	24	EF	Marginal	100%
									Naphthalene	91-20-3	3.46E-03	24	EF	Marginal	100%
									Phenanthrene	85-01-8	6.14E-03	24	EF	Marginal	100%
									Phenol	108-95-2	1.73E-03	24	EF	Marginal	100%
									Pyrene	129-00-0	6.93E-05	24	EF	Marginal	100%
									Styrene	100-42-5	2.36E-05	24	EF	Marginal	100%
									Toluene	108-88-3	2.99E-03	24	EF	Marginal	100%
									Xylenes	1330-20-7	2.05E-03	10-min, 24	EF	Marginal	100%
E27	Clinker Cooler Dust Collector	2.78	150	0.50	10	N/A	518948	5049665	SPM	N/A-1	2.89E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.53E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.04E-02	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.89E-02	24	EC	Above Average	2%
									Crystalline Silica	14808-60-7	7.65E-05	24	EC	Above Average	<1%
Petcoke Receiving and Grinding															
FUG7	Petcoke Receiving	—	—	—	—	—	518756	5049810	SPM	N/A-1	7.43E-03	24	EC	Above Average	<1%
									PM10	N/A-2	3.51E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	5.32E-04	24	EC	Above Average	<1%
FUG8	Petcoke Loading to Hopper	—	—	—	—	—	518844	5049634	SPM	N/A-1	1.24E-04	24	EC	Above Average	<1%
									PM10	N/A-2	5.87E-05	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.89E-06	24	EC	Above Average	<1%
E19	Petcoke Receiving Dust Collector	2.78	Ambient	0.50	10	N/A	518846	5049630	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
E20	Petcoke Silos Loading Bucket Elevator Dust Collector	0.83	Ambient	0.30	10	N/A	518922	5049656	SPM	N/A-1	4.10E-03	24	EC	Above Average	<1%
									PM10	N/A-2	2.17E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.47E-03	24	EC	Above Average	<1%
E21	Petcoke (Coarse) Silo Dust Collector - 1	0.83	Ambient	0.30	35	N/A	518933	5049663	SPM	N/A-1	4.10E-03	24	EC	Above Average	<1%
									PM10	N/A-2	2.17E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.47E-03	24	EC	Above Average	<1%
E22	Petcoke (Coarse) Silo Dust Collector - 2	0.83	Ambient	0.30	35	N/A	518928	5049661	SPM	N/A-1	4.10E-03	24	EC	Above Average	<1%
									PM10	N/A-2	2.17E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.47E-03	24	EC	Above Average	<1%
E23	Petcoke Grinder Dust Collector	16.67	70	1.25	35	N/A	518921	5049691	SPM	N/A-1	1.42E-01	24	EC	Above Average	2%
									PM10	N/A-2	7.55E-02	24	EC	Above Average	2%
									PM2.5	N/A-3	5.13E-02	24	EC	Above Average	2%
E24	Petcoke (Pulverized) Silo Dust Collector - 1	0.83	70	0.30	35	N/A	518939	5049654	SPM	N/A-1	1.07E-02	24	EC	Above Average	<1%
									PM10	N/A-2	5.66E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.85E-03	24	EC	Above Average	<1%
E25	Petcoke (Pulverized) Silo Dust Collector - 2	0.83	70	0.30	35	N/A	518931	5049654	SPM	N/A-1	1.07E-02	24	EC	Above Average	<1%
									PM10	N/A-2	5.66E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	3.85E-03	24	EC	Above Average	<1%
Clinker Storage and Transfer															
E28	Clinker Receiving Dust Collector	8.33	50	0.85	10	N/A	518982	5049672	SPM	N/A-1	3.78E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.00E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.36E-02	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	3.78E-02	24	EC	Above Average	2%
									Crystalline Silica	14808-60-7	1.00E-04	24	EC	Above Average	<1%
E29	Clinker Silo Dust Collector	5.56	100	0.70	75	N/A	518984	5049574	SPM	N/A-1	6.55E-02	24	EC	Above Average	<1%
									PM10	N/A-2	3.47E-02	24	EC	Above Average	1%
									PM2.5	N/A-3	2.36E-02	24	EC	Above Average	1%
									Portland Cement	65997-15-1	6.55E-02	24	EC	Above Average	4%
									Crystalline Silica	14808-60-7	1.74E-04	24	EC	Above Average	1%
E30	Clinker Extraction for Bulk Loading Dust Collector	1.39	50	0.35	10	N/A	518996	5049545	SPM	N/A-1	6.30E-03	24	EC	Above Average	<1%
									PM10	N/A-2	3.34E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	2.27E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	6.30E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.67E-05	24	EC	Above Average	<1%
E31	Clinker Bulk Loading Dust Collector	4.17	50	0.60	27	N/A	518999	5049514	SPM	N/A-1	1.89E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.00E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	6.81E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	1.89E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	5.01E-05	24	EC	Above Average	<1%
E32	Clinker Extraction for Cement Hopper Dust Collector	2.78	50	0.50	10	N/A	518959	5049559	SPM	N/A-1	2.52E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.34E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	9.08E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.52E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	6.68E-05	24	EC	Above Average	<1%
Cement Mill															
E33	Cement Clinker Hopper Dust Collector	2.78	50	0.50	36	N/A	518913	5049542	SPM	N/A-1	2.52E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.34E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	9.08E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.52E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	6.68E-05	24	EC	Above Average	<1%

Table 2
Source Summary Table

		Source Parameters							Emission Data						
Stack ID	Source Description	Stack Volumetric Flow Rate [Am³/s]	Stack Exit Gas Temperature [°C]	Stack Inner Diameter [m]	Stack Height Above Grade [m]	Stack Height Above Roof [m]	Stack Location [X Coordinate]	Stack Location [Y Coordinate]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
E34	Cement Limestone Hopper Dust Collector	1.39	Ambient	0.35	36	N/A	518905	5049539	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	4.76E-04	24	EC	Above Average	3%
E35	Cement Gypsum Hopper Dust Collector	1.39	Ambient	0.35	36	N/A	518901	5049538	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
E36	Cement 4° Constituent Hopper Dust Collector	1.39	Ambient	0.35	36	N/A	518893	5049535	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	1.37E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	3.62E-05	24	EC	Above Average	<1%
E37	Silica Fume Silo Dust Collector	1.39	Ambient	0.35	36	N/A	518912	5049552	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	3.62E-05	24	EC	Above Average	<1%
E38	Fly Ash Silo Dust Collector	1.39	Ambient	0.35	36	N/A	518903	5049549	SPM	N/A-1	1.37E-02	24	EC	Above Average	<1%
									PM10	N/A-2	7.24E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.92E-03	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	7.24E-04	24	EC	Above Average	5%
E39	Cement Mill Dust Collector - 1	72.22	90	2.50	40	N/A	518909	5049530	SPM	N/A-1	5.83E-01	24	EC	Above Average	9%
									PM10	N/A-2	3.09E-01	24	EC	Above Average	9%
									PM2.5	N/A-3	2.10E-01	24	EC	Above Average	9%
									Portland Cement	65997-15-1	5.83E-01	24	EC	Above Average	33%
									Crystalline Silica	14808-60-7	9.27E-04	24	EC	Above Average	6%
E40	Cement Mill Dust Collector - 2	72.22	90	2.50	40	N/A	518905	5049528	SPM	N/A-1	5.83E-01	24	EC	Above Average	9%
									PM10	N/A-2	3.09E-01	24	EC	Above Average	9%
									PM2.5	N/A-3	2.10E-01	24	EC	Above Average	9%
									Portland Cement	65997-15-1	5.83E-01	24	EC	Above Average	33%
									Crystalline Silica	14808-60-7	9.27E-04	24	EC	Above Average	6%
E41	Cement Mill Air Slide Dust Collector - 1	1.39	70	0.35	15	N/A	518917	5049472	SPM	N/A-1	1.19E-02	24	EC	Above Average	<1%
									PM10	N/A-2	6.29E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.27E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	1.19E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.89E-05	24	EC	Above Average	<1%
E42	Cement Mill Air Slide Dust Collector - 2	1.39	70	0.35	15	N/A	518913	5049470	SPM	N/A-1	1.19E-02	24	EC	Above Average	<1%
									PM10	N/A-2	6.29E-03	24	EC	Above Average	<1%
									PM2.5	N/A-3	4.27E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	1.19E-02	24	EC	Above Average	<1%
									Crystalline Silica	14808-60-7	1.89E-05	24	EC	Above Average	<1%
Finished Cement															
E43	Cement Silo Dust Collector - 1A	2.78	60	0.50	62	N/A	518944	5049472	SPM	N/A-1	2.45E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.30E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.80E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.45E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.89E-05	24	EC	Above Average	<1%
E44	Cement Silo Dust Collector - 2A	2.78	60	0.50	62	N/A	518913	5049461	SPM	N/A-1	2.45E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.30E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.80E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.45E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.89E-05	24	EC	Above Average	<1%
E45	Cement Silo Dust Collector - 1B	2.78	60	0.50	62	N/A	518955	5049441	SPM	N/A-1	2.45E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.30E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.80E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.45E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.89E-05	24	EC	Above Average	<1%
E46	Cement Silo Dust Collector - 2B	2.78	60	0.50	62	N/A	518925	5049430	SPM	N/A-1	2.45E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.30E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	8.80E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.45E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.89E-05	24	EC	Above Average	<1%
E47	Cement Silo Bulk Loading Dust Collector - 1A-A	2.22	40	0.45	15	N/A	518948	5049471	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%

Table 2
Source Summary Table

Stack ID	Source Description	Source Parameters							Emission Data						
		Stack Volumetric Flow Rate [Am³/s]	Stack Exit Gas Temperature [°C]	Stack Inner Diameter [m]	Stack Height Above Grade [m]	Stack Height Above Roof [m]	Stack Location [X Coordinate]	Stack Location [Y Coordinate]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]	Emission Estimating Technique	Emissions Data Quality	Percentage of Overall Emissions [%]
E48	Cement Silo Bulk Loading Dust Collector - 1A-B	2.22	40	0.45	15	N/A	518952	5049468	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E49	Cement Silo Bulk Loading Dust Collector - 2A-A	2.22	40	0.45	15	N/A	518918	5049460	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E50	Cement Silo Bulk Loading Dust Collector - 2A-B	2.22	40	0.45	15	N/A	518921	5049457	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E51	Cement Silo Bulk Loading Dust Collector - 1B-A	2.22	40	0.45	15	N/A	518959	5049441	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E52	Cement Silo Bulk Loading Dust Collector - 1B-B	2.22	40	0.45	15	N/A	518963	5049437	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E53	Cement Silo Bulk Loading Dust Collector - 2B-A	2.22	40	0.45	15	N/A	518929	5049430	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
E54	Cement Silo Bulk Loading Dust Collector - 2B-B	2.22	40	0.45	15	N/A	518933	5049426	SPM	N/A-1	2.08E-02	24	EC	Above Average	<1%
									PM10	N/A-2	1.10E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	7.49E-03	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	2.08E-02	24	EC	Above Average	1%
									Crystalline Silica	14808-60-7	3.31E-05	24	EC	Above Average	<1%
Cement Packaging															
E55	Packing Plant Dust Collector - A	8.33	40	0.85	20	N/A	518933	5049382	SPM	N/A-1	3.90E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.07E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.40E-02	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	3.90E-02	24	EC	Above Average	2%
									Crystalline Silica	14808-60-7	6.20E-05	24	EC	Above Average	<1%
E56	Packing Plant Dust Collector - B	8.33	40	0.85	20	N/A	518935	5049377	SPM	N/A-1	3.90E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.07E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.40E-02	24	EC	Above Average	<1%
									Portland Cement	65997-15-1	3.90E-02	24	EC	Above Average	2%
									Crystalline Silica	14808-60-7	6.20E-05	24	EC	Above Average	<1%
Alternative Fuels															
E26	Alternative Fuel Dust Collector	2.78	Ambient	0.50	20	N/A	518950	5049662	SPM	N/A-1	4.10E-02	24	EC	Above Average	<1%
									PM10	N/A-2	2.17E-02	24	EC	Above Average	<1%
									PM2.5	N/A-3	1.47E-02	24	EC	Above Average	<1%
Supporting Processes															
RS	Paved Roads	N/A	N/A	N/A	N/A	N/A	N/A	N/A	SPM	N/A-1	3.74E-01	24	EC	Above Average	6%
									PM10	N/A-2	7.17E-02	25	EC	Above Average	2%
									PM2.5	N/A-3	1.74E-02	26	EC	Above Average	<1%

Notes: * Metallic iron

Table 3
Dispersion Modelling Input Summary Table

Relevant Section of the Regulation	Section Title	Summary of How the Approved Dispersion Model Was Used	Location of Supporting Documentation in ESDM Report
Section 8	Negligible Sources of Contaminants	Sources and contaminants that were considered negligible were explicitly identified, and therefore were not modelled in accordance with s.8 of O.Reg.419/05.	Section 3.0, Table 1
Section 9	Same Structure Contamination	Not applicable as the Facility is the only tenant occupying the building, and does not have a child care facility, health care facility, senior's residence, long-term care facility or an education facility located at the on site.	N/A
Section 10	Operating Conditions	When applicable, all equipment was assumed to be operating at the maximum production rates, simultaneously.	Section 4.0, Table 4
Section 11	Source of Contaminant Emission Rates	The emission rate for each significant contaminant emitted from a significant source was estimated, the methodology for the calculation is documented in Table 2 - Source Summary Table.	Section 4.0, Table 2
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The Operating Conditions were estimated in accordance with s.10(1) 1 and s.11(1) 1 of O.Reg.419/05 and are therefore considered to result in the highest POI concentration that the Facility is capable of for each contaminant emitted.	Section 4.0
Section 13	Meteorological Conditions	MOE's Regional Crops Dataset for Ottawa Region was used.	Section 6.0
Section 14	Area of Modelling Coverage (receptor locations)	Model coverage set to match MOE guidelines.	Section 6.0, Figure 9
Section 15	Stack Height for Certain New Sources of Contaminant	The Kiln stack satisfies the criteria of s.15 of O. Reg. 419/05 as the Kiln stack is less than the maximum allowable stack height of 140.8 m.	Section 6.0
Section 16	Terrain Data	MOE DEM files used: 1433_3, 1433_4, 1434_3, 1434_4, 1435_3 and 1435_4.	Section 6.0
Section 17	Averaging Periods	Maximum 1-hour and 24-hour emission rates were used in the AERMOD model to produce 1-hour and 24-hour modelled POI concentrations. For contaminants with 10-min, monthly and annual averaged POI Limits, the 1- hour or 24-hour modelled concentrations were converted to 10-min, 0..5 hour, monthly or annual concentrations using the conversion factors in the ADMGO.	Section 4.0

Table 4
Dispersion Modelling Summary Table

Modelling ID	Source ID(s)	Source Type	Modelling Source Data: Release Height [m]	Initial Lateral Dimension [m]	Initial Vertical Dimension [m]	Centroid X-Coordinate [m]	Centroid Y-Coordinate [m]	Emission Data: Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]
Raw Materials Receiving											
V1	FUG1, FUG3, FUG4, FUG5	Volume	15	5.8	4.7	518709.4	5049927.7	SPM	N/A-1	5.64E-03	24
								PM10	N/A-2	2.67E-03	24
								PM2.5	N/A-3	4.04E-04	24
								Ferric Oxide	1309-37-1	1.22E-05	24
								Crystalline Silica	14808-60-7	1.74E-04	24
V2	FUG2	Volume	15	2.2	4.7	518707.8	5049952.7	SPM	N/A-1	2.86E-05	24
								PM10	N/A-2	1.35E-05	24
								PM2.5	N/A-3	2.05E-06	24
V3	FUG6	Volume	15	2.2	4.7	518698.5	5049900.1	SPM	N/A-1	1.21E-04	24
								PM10	N/A-2	5.73E-05	24
								PM2.5	N/A-3	8.68E-06	24
V4	FUG7	Volume	1.5	1.3	1.4	518755.7	5049809.8	SPM	N/A-1	7.43E-03	24
								PM10	N/A-2	3.51E-03	24
								PM2.5	N/A-3	5.32E-04	24
V5	FUG8	Volume	0	1.3	1.4	518843.5	5049633.9	SPM	N/A-1	1.24E-04	24
								PM10	N/A-2	5.87E-05	24
								PM2.5	N/A-3	8.89E-06	24

Modelling ID	Source ID(s)	Source Type	Modelling Source Data: Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Gas Exit Temperature [K]	Stack Inner Diameter [m]	Source X-Coordinate [m]	Source Y-Coordinate [m]	Emission Data: Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]
Raw Materials Receiving												
E1	E1	Point	15	14.15	Ambient	0.5	518710	5049945	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
E2	E2	Point	15	14.15	Ambient	0.5	518705	5049918	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
									Crystalline Silica	14808-60-7	4.76E-04	24
									Ferric Oxide	1309-37-1	1.37E-02	24
E3	E3	Point	15	14.15	Ambient	0.5	518702	5049893	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
E4	E4	Point	20	14.69	Ambient	0.85	518713	5049929	SPM	N/A-1	4.10E-02	24
									PM10	N/A-2	2.17E-02	24
									PM2.5	N/A-3	1.47E-02	24
									Crystalline Silica	14808-60-7	1.43E-03	24
Raw Materials Storage and Transfers												
E5	E5	Point	5	11.79	Ambient	0.3	518824	5050007	SPM	N/A-1	1.08E-02	24
									PM10	N/A-2	5.70E-03	24
									PM2.5	N/A-3	3.87E-03	24
E6	E6	Point	26	14.44	Ambient	0.35	518834	5049980	SPM	N/A-1	1.79E-02	24
									PM10	N/A-2	9.50E-03	24
									PM2.5	N/A-3	6.45E-03	24
									Ferric Oxide	1309-37-1	1.79E-02	24
E7	E7	Point	26	14.44	Ambient	0.35	518837	5049971	SPM	N/A-1	1.79E-02	24
									PM10	N/A-2	9.50E-03	24
									PM2.5	N/A-3	6.45E-03	24
									Crystalline Silica	14808-60-7	6.25E-04	24
E8	E8	Point	5	11.79	Ambient	0.3	518835	5049976	SPM	N/A-1	1.08E-02	24
									PM10	N/A-2	5.70E-03	24
									PM2.5	N/A-3	3.87E-03	24
									Crystalline Silica	14808-60-7	3.75E-04	24

Table 4
Dispersion Modelling Summary Table

		Modelling Source Data							Emission Data			
Modelling ID	**Source ID(s)**	**Source Type**	**Stack Height Above Grade [m]**	**Stack Gas Exit Velocity [m/s]**	**Stack Gas Exit Temperature [K]**	**Stack Inner Diameter [m]**	**Source X-Coordinate [m]**	**Source Y-Coordinate [m]**	**Contaminant**	**CAS No.**	**Maximum Emission Rate [g/s]**	**Averaging Period [hours]**
E9	E9	Point	5	11.79	Ambient	0.3	518839	5049967	SPM	N/A-1	1.08E-02	24
									PM10	N/A-2	5.70E-03	24
									PM2.5	N/A-3	3.87E-03	24
									Crystalline Silica	14808-60-7	3.75E-04	24
E10	E10	Point	5	11.79	Ambient	0.3	518841	5049962	SPM	N/A-1	2.05E-03	24
									PM10	N/A-2	1.09E-03	24
									PM2.5	N/A-3	7.37E-04	24
E11	E11	Point	5	11.79	Ambient	0.3	518752	5049938	SPM	N/A-1	8.19E-03	24
									PM10	N/A-2	4.34E-03	24
									PM2.5	N/A-3	2.95E-03	24
									Crystalline Silica	14808-60-7	2.86E-04	24
E12	E12	Point	5	11.79	Ambient	0.3	518755	5049932	SPM	N/A-1	2.05E-03	24
									PM10	N/A-2	1.09E-03	24
									PM2.5	N/A-3	7.37E-04	24
									Crystalline Silica	14808-60-7	7.14E-05	24
Raw Mill												
E13	E13	Point	20	14.74	Ambient	0.6	518887	5049824	SPM	N/A-1	5.38E-02	24
									PM10	N/A-2	2.85E-02	24
									PM2.5	N/A-3	1.94E-02	24
									Crystalline Silica	14808-60-7	1.87E-03	24
									Ferric Oxide	1309-37-1	7.64E-04	24
E14	E14	Point	15	14.44	333.15	0.35	518926	5049778	SPM	N/A-1	1.60E-02	24
									PM10	N/A-2	8.51E-03	24
									PM2.5	N/A-3	5.78E-03	24
									Crystalline Silica	14808-60-7	5.59E-04	24
									Ferric Oxide	1309-37-1	2.28E-04	24
E15	E15	Point	65	14.15	333.15	0.5	518940	5049780	SPM	N/A-1	3.67E-02	24
									PM10	N/A-2	1.94E-02	24
									PM2.5	N/A-3	1.32E-02	24
									Crystalline Silica	14808-60-7	1.28E-03	24
									Ferric Oxide	1309-37-1	5.21E-04	24
E16	E16	Point	15	14.15	333.15	0.5	518934	5049773	SPM	N/A-1	3.67E-02	24
									PM10	N/A-2	1.94E-02	24
									PM2.5	N/A-3	1.32E-02	24
									Crystalline Silica	14808-60-7	1.28E-03	24
									Ferric Oxide	1309-37-1	5.21E-04	24
E17	E17	Point	15	14.15	333.15	0.5	518922	5049762	SPM	N/A-1	3.67E-02	24
									PM10	N/A-2	1.94E-02	24
									PM2.5	N/A-3	1.32E-02	24
									Crystalline Silica	14808-60-7	1.28E-03	24
									Ferric Oxide	1309-37-1	5.21E-04	24

Table 4
Dispersion Modelling Summary Table

			Modelling Source Data						Emission Data			
Modelling ID	**Source ID(s)**	**Source Type**	**Stack Height Above Grade [m]**	**Stack Gas Exit Velocity [m/s]**	**Stack Gas Exit Temperature [K]**	**Stack Inner Diameter [m]**	**Source X-Coordinate [m]**	**Source Y-Coordinate [m]**	**Contaminant**	**CAS No.**	**Maximum Emission Rate [g/s]**	**Averaging Period [hours]**
Kiln												
E18	E18	Point	125	14.15	423.15	5	518903	5049756	SPM	N/A-1	3.85E+00	24
									PM10	N/A-2	2.04E+00	24
									PM2.5	N/A-3	1.39E+00	24
									Carbon Monoxide	630-08-0	7.70E+01	½
									Nitrogen Oxides	10102-44-0	2.31E+02	1, 24
									Ammonia	7664-41-7	7.70E+00	24
									Sulfur Dioxide	7446-09-5	3.85E+01	1, 24
									Dioxins and Furans (TEQ)	N/A-4	1.54E-08	24
									Arsenic	7440-38-2	1.89E-04	24
									Barium	7440-39-3	5.51E-03	24
									Beryllium	7440-41-7	1.04E-05	24
									Calcium Oxide	1305-78-8	5.29E+00	24
									Cadmium	7440-43-9	3.46E-05	24
									Chloride	N/A-5	3.31E-02	24
									Chromium	7440-47-3	1.21E-04	24
									Copper	7440-50-8	8.35E-02	24
									Hydrogen Fluoride	7664-39-3	1.49E-02	24
									Iron*	15438-31-0	2.68E-01	24
									Hydrogen Chloride	7647-01-0	7.72E-01	24
									Mercury	7439-97-6	3.78E-04	24
									Potassium	7440-09-7	2.83E-01	24
									Manganese	7439-96-5	1.35E-02	24
									Lead	7439-92-1	1.18E-03	24, 30-day
									Sulfur trioxide	N/A-8	2.20E-01	24
									Selenium	7782-49-2	2.36E-03	24
									Thallium	7440-28-0	8.50E-05	24
									C3 benzenes	N/A-10	4.09E-05	24
									C4 benzenes	N/A-11	9.45E-05	24
									C6 benzenes	N/A-12	1.45E-05	24
									Acenaphthylene	208-96-8	1.89E-03	24
									Benzaldehyde	100-52-7	3.78E-04	24
									Benzene	71-43-2	4.88E-02	24, Annual
									Benzo(a)pyrene	50-32-8	2.05E-06	24, Annual
									Fluorene	86-73-7	2.99E-04	24
									Naphthalene	91-20-3	3.46E-03	24
									Phenanthrene	85-01-8	6.14E-03	24
									Pyrene	129-00-0	6.93E-05	24
E27	E27	Point	10	14.15	423.15	0.5	518948	5049665	SPM	N/A-1	2.89E-02	24
									PM10	N/A-2	1.53E-02	24
									PM2.5	N/A-3	1.04E-02	24
									Portland Cement	65997-15-1	2.89E-02	24
									Crystalline Silica	14808-60-7	7.65E-05	24

Made By: KL
Checked By: JDM

Table 4
Dispersion Modelling Summary Table

Modelling ID	Source ID(s)	Source Type	Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Gas Exit Temperature [K]	Stack Inner Diameter [m]	Source X-Coordinate [m]	Source Y-Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]
			Modelling Source Data						Emission Data			
Petcoke Receiving and Grinding												
E19	E19	Point	10	14.15	Ambient	0.5	518846	5049630	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
E20	E20	Point	10	11.79	Ambient	0.3	518922	5049656	SPM	N/A-1	4.10E-03	24
									PM10	N/A-2	2.17E-03	24
									PM2.5	N/A-3	1.47E-03	24
E21	E21	Point	35	11.79	Ambient	0.3	518933	5049663	SPM	N/A-1	4.10E-03	24
									PM10	N/A-2	2.17E-03	24
									PM2.5	N/A-3	1.47E-03	24
E22	E22	Point	35	11.79	Ambient	0.3	518928	5049661	SPM	N/A-1	4.10E-03	24
									PM10	N/A-2	2.17E-03	24
									PM2.5	N/A-3	1.47E-03	24
E23	E23	Point	35	13.58	343.15	1.25	518921	5049691	SPM	N/A-1	1.42E-01	24
									PM10	N/A-2	7.55E-02	24
									PM2.5	N/A-3	5.13E-02	24
E24	E24	Point	35	11.79	343.15	0.3	518939	5049654	SPM	N/A-1	1.07E-02	24
									PM10	N/A-2	5.66E-03	24
									PM2.5	N/A-3	3.85E-03	24
E25	E25	Point	35	11.79	343.15	0.3	518931	5049654	SPM	N/A-1	1.07E-02	24
									PM10	N/A-2	5.66E-03	24
									PM2.5	N/A-3	3.85E-03	24
Clinker Storage and Transfer												
E28	E28	Point	10	14.69	323.15	0.85	518982	5049672	SPM	N/A-1	3.78E-02	24
									PM10	N/A-2	2.00E-02	24
									PM2.5	N/A-3	1.36E-02	24
									Portland Cement	65997-15-1	3.78E-02	24
									Crystalline Silica	14808-60-7	1.00E-04	24
E29	E29	Point	75	14.44	373.15	0.7	518984	5049574	SPM	N/A-1	6.55E-02	24
									PM10	N/A-2	3.47E-02	24
									PM2.5	N/A-3	2.36E-02	24
									Portland Cement	65997-15-1	6.55E-02	24
									Crystalline Silica	14808-60-7	1.74E-04	24
E30	E30	Point	10	14.44	323.15	0.35	518996	5049545	SPM	N/A-1	6.30E-03	24
									PM10	N/A-2	3.34E-03	24
									PM2.5	N/A-3	2.27E-03	24
									Portland Cement	65997-15-1	6.30E-03	24
									Crystalline Silica	14808-60-7	1.67E-05	24
E31	E31	Point	27	14.74	323.15	0.6	518999	5049514	SPM	N/A-1	1.89E-02	24
									PM10	N/A-2	1.00E-02	24
									PM2.5	N/A-3	6.81E-03	24
									Portland Cement	65997-15-1	1.89E-02	24
									Crystalline Silica	14808-60-7	5.01E-05	24
E32	E32	Point	10	14.15	323.15	0.5	518959	5049559	SPM	N/A-1	2.52E-02	24
									PM10	N/A-2	1.34E-02	24
									PM2.5	N/A-3	9.08E-03	24
									Portland Cement	65997-15-1	2.52E-02	24
									Crystalline Silica	14808-60-7	6.68E-05	24

Table 4
Dispersion Modelling Summary Table

			Modelling Source Data						Emission Data			
Modelling ID	**Source ID(s)**	**Source Type**	**Stack Height Above Grade [m]**	**Stack Gas Exit Velocity [m/s]**	**Stack Gas Exit Temperature [K]**	**Stack Inner Diameter [m]**	**Source X-Coordinate [m]**	**Source Y-Coordinate [m]**	**Contaminant**	**CAS No.**	**Maximum Emission Rate [g/s]**	**Averaging Period [hours]**
Cement Mill												
E33	E33	Point	36	14.15	323.15	0.5	518913	5049542	SPM	N/A-1	2.52E-02	24
									PM10	N/A-2	1.34E-02	24
									PM2.5	N/A-3	9.08E-03	24
									Portland Cement	65997-15-1	2.52E-02	24
									Crystalline Silica	14808-60-7	6.68E-05	24
E34	E34	Point	36	14.44	Ambient	0.35	518905	5049539	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
									Crystalline Silica	14808-60-7	4.76E-04	24
E35	E35	Point	36	14.44	Ambient	0.35	518901	5049538	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
E36	E36	Point	36	14.44	Ambient	0.35	518893	5049535	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
									Portland Cement	65997-15-1	1.37E-02	24
									Crystalline Silica	14808-60-7	3.62E-05	24
E37	E37	Point	36	14.44	Ambient	0.35	518912	5049552	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
									Crystalline Silica	14808-60-7	3.62E-05	24
E38	E38	Point	36	14.44	Ambient	0.35	518903	5049549	SPM	N/A-1	1.37E-02	24
									PM10	N/A-2	7.24E-03	24
									PM2.5	N/A-3	4.92E-03	24
									Crystalline Silica	14808-60-7	7.24E-04	24
E39	E39	Point	40	14.71	363.15	2.5	518909	5049530	SPM	N/A-1	5.83E-01	24
									PM10	N/A-2	3.09E-01	24
									PM2.5	N/A-3	2.10E-01	24
									Portland Cement	65997-15-1	5.83E-01	24
									Crystalline Silica	14808-60-7	9.27E-04	24
E40	E40	Point	40	14.71	363.15	2.5	518905	5049528	SPM	N/A-1	5.83E-01	24
									PM10	N/A-2	3.09E-01	24
									PM2.5	N/A-3	2.10E-01	24
									Portland Cement	65997-15-1	5.83E-01	24
									Crystalline Silica	14808-60-7	9.27E-04	24
E41	E41	Point	15	14.44	343.15	0.35	518917	5049472	SPM	N/A-1	1.19E-02	24
									PM10	N/A-2	6.29E-03	24
									PM2.5	N/A-3	4.27E-03	24
									Portland Cement	65997-15-1	1.19E-02	24
									Crystalline Silica	14808-60-7	1.89E-05	24
E42	E42	Point	15	14.44	343.15	0.35	518913	5049470	SPM	N/A-1	1.19E-02	24
									PM10	N/A-2	6.29E-03	24
									PM2.5	N/A-3	4.27E-03	24
									Portland Cement	65997-15-1	1.19E-02	24
									Crystalline Silica	14808-60-7	1.89E-05	24

Table 4
Dispersion Modelling Summary Table

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emission Data			
			Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Gas Exit Temperature [K]	Stack Inner Diameter [m]	Source X-Coordinate [m]	Source Y-Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]
Finished Cement												
E43	E43	Point	62	14.15	333.15	0.5	518944	5049472	SPM	N/A-1	2.45E-02	24
									PM10	N/A-2	1.30E-02	24
									PM2.5	N/A-3	8.80E-03	24
									Portland Cement	65997-15-1	2.45E-02	24
									Crystalline Silica	14808-60-7	3.89E-05	24
E44	E44	Point	62	14.15	333.15	0.5	518913	5049461	SPM	N/A-1	2.45E-02	24
									PM10	N/A-2	1.30E-02	24
									PM2.5	N/A-3	8.80E-03	24
									Portland Cement	65997-15-1	2.45E-02	24
									Crystalline Silica	14808-60-7	3.89E-05	24
E45	E45	Point	62	14.15	333.15	0.5	518955	5049441	SPM	N/A-1	2.45E-02	24
									PM10	N/A-2	1.30E-02	24
									PM2.5	N/A-3	8.80E-03	24
									Portland Cement	65997-15-1	2.45E-02	24
									Crystalline Silica	14808-60-7	3.89E-05	24
E46	E46	Point	62	14.15	333.15	0.5	518925	5049430	SPM	N/A-1	2.45E-02	24
									PM10	N/A-2	1.30E-02	24
									PM2.5	N/A-3	8.80E-03	24
									Portland Cement	65997-15-1	2.45E-02	24
									Crystalline Silica	14808-60-7	3.89E-05	24
E47	E47	Point	15	13.97	313.15	0.45	518948	5049471	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E48	E48	Point	15	13.97	313.15	0.45	518952	5049468	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E49	E49	Point	15	13.97	313.15	0.45	518918	5049460	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E50	E50	Point	15	13.97	313.15	0.45	518921	5049457	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E51	E51	Point	15	13.97	313.15	0.45	518959	5049441	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E52	E52	Point	15	13.97	313.15	0.45	518963	5049437	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
E53	E53	Point	15	13.97	313.15	0.45	518929	5049430	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24

Table 4
Dispersion Modelling Summary Table

Modelling ID	Source ID(s)	Source Type	Stack Height Above Grade [m]	Stack Gas Exit Velocity [m/s]	Stack Gas Exit Temperature [K]	Stack Inner Diameter [m]	Source X-Coordinate [m]	Source Y-Coordinate [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	Averaging Period [hours]
			Modelling Source Data						Emission Data			
E54	E54	Point	15	13.97	313.15	0.45	518933	5049426	SPM	N/A-1	2.08E-02	24
									PM10	N/A-2	1.10E-02	24
									PM2.5	N/A-3	7.49E-03	24
									Portland Cement	65997-15-1	2.08E-02	24
									Crystalline Silica	14808-60-7	3.31E-05	24
Cement Packaging												
E55	E55	Point	20	14.69	313.15	0.85	518933	5049382	SPM	N/A-1	3.90E-02	24
									PM10	N/A-2	2.07E-02	24
									PM2.5	N/A-3	1.40E-02	24
									Portland Cement	65997-15-1	3.90E-02	24
									Crystalline Silica	14808-60-7	6.20E-05	24
E56	E56	Point	20	14.69	313.15	0.85	518935	5049377	SPM	N/A-1	3.90E-02	24
									PM10	N/A-2	2.07E-02	24
									PM2.5	N/A-3	1.40E-02	24
									Portland Cement	65997-15-1	3.90E-02	24
									Crystalline Silica	14808-60-7	6.20E-05	24
Alternative Fuels												
E26	E26	Point	20	14.15	Ambient	0.5	518950.362	5049662.285	SPM	N/A-1	4.10E-02	24
									PM10	N/A-2	2.17E-02	24
									PM2.5	N/A-3	1.47E-02	24

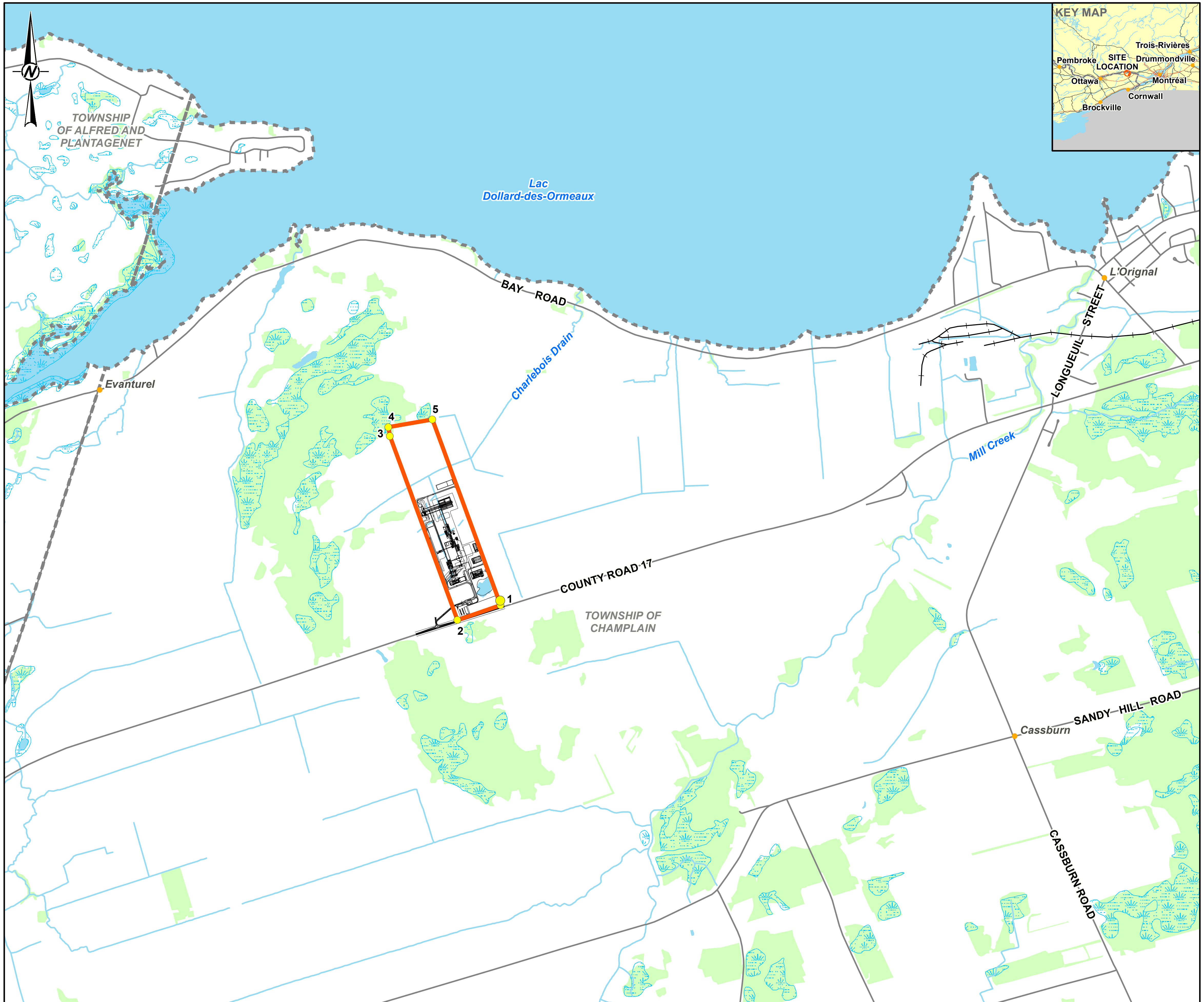
Notes: * Metallic iron

Table 5
Emission Summary Table

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Maximum POI Concentration [$\mu g/m^3$]	Averaging Period [hours]	MOECC POI Limit [$\mu g/m^3$]	MOECC Screening Level [$\mu g/m^3$]	Limiting Effect	Regulation Schedule No.	Percentage of MOECC Limit [%]
SPM	N/A-1	6.62E+00	AERMOD	5.44E+01	24	120	—	Visibility	Schedule 3	45%
PM10	N/A-2	3.38E+00	AERMOD	2.59E+01	24	—	50	—	AAQC	52%
PM2.5	N/A-3	2.26E+00	AERMOD	1.66E+01	24	—	25	—	AAQC	66%
Crystalline Silica	14808-60-7	1.43E-02	AERMOD	5.60E-01	24	5	—	Health	Guideline	11%
Ferric Oxide	1309-37-1	3.41E-02	AERMOD	4.33E+00	24	25	—	Soiling	Schedule 3	17%
Carbon Monoxide	630-08-0	7.70E+01	AERMOD	1.16E+02	½	6000	—	Health	Schedule 3	2%
Nitrogen Oxides	10102-44-0	2.31E+02	AERMOD	4.69E+01	24	200	—	Health	Schedule 3	23%
Nitrogen Oxides	10102-44-0	2.31E+02	AERMOD	2.86E+02	1	400	—	Health	Schedule 3	71%
Ammonia	7664-41-7	7.70E+00	AERMOD	1.56E+00	24	100	—	Health	Schedule 3	2%
Sulfur Dioxide	7446-09-5	3.85E+01	AERMOD	7.82E+00	24	275	—	Health & Vegetation	Schedule 3	3%
Sulfur Dioxide	7446-09-5	3.85E+01	AERMOD	4.76E+01	1	690	—	Health & Vegetation	Schedule 3	7%
Portland cement	65997-15-1	1.75E+00	AERMOD	4.40E+01	24	—	20	Health	JSL	MGLCA Request Submitted[1]
Dioxins and Furans (TEQ)	N/A-4	1.54E-08	AERMOD	3.13E-09	24	0.0000001	—	Health	Schedule 3	3%
Calcium Oxide	1305-78-8	5.29E+00	AERMOD	1.08E+00	24	10	—	Corrosion	Schedule 3	11%
Iron*	15438-31-0	2.68E-01	AERMOD	5.44E-02	24	4	—	Soiling	Schedule 3	1%

Notes:
* Metallic iron
A *"Supporting Information for a Maximum Ground Level Concentration Acceptability (MGLCA) Request for Compounds with No Ministry POI Limit : Supplement to Application for Approval, EPA s.20.2."* was submitted.

FIGURES



LEGEND

- LAYOUT
- ROAD
- WATERCOURSE
- WATERCOURSE, INTERMITTENT
- WATERBODY
- WETLAND
- WOODED AREA
- MUNICIPAL BOUNDARY
- SITE BOUNDARY OF PROPOSED PROJECT

PROPERTY BOUNDARY COORDINATES

	X	Y
1	519304.53	5049205.28
2	518970.73	5049089.26
3	518447.62	5050513.67
4	518435.70	5050583.97
5	518776.39	5050643.40

0 1,000 2,000
1:30,000 METRES

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
SITE LOCATION PLAN

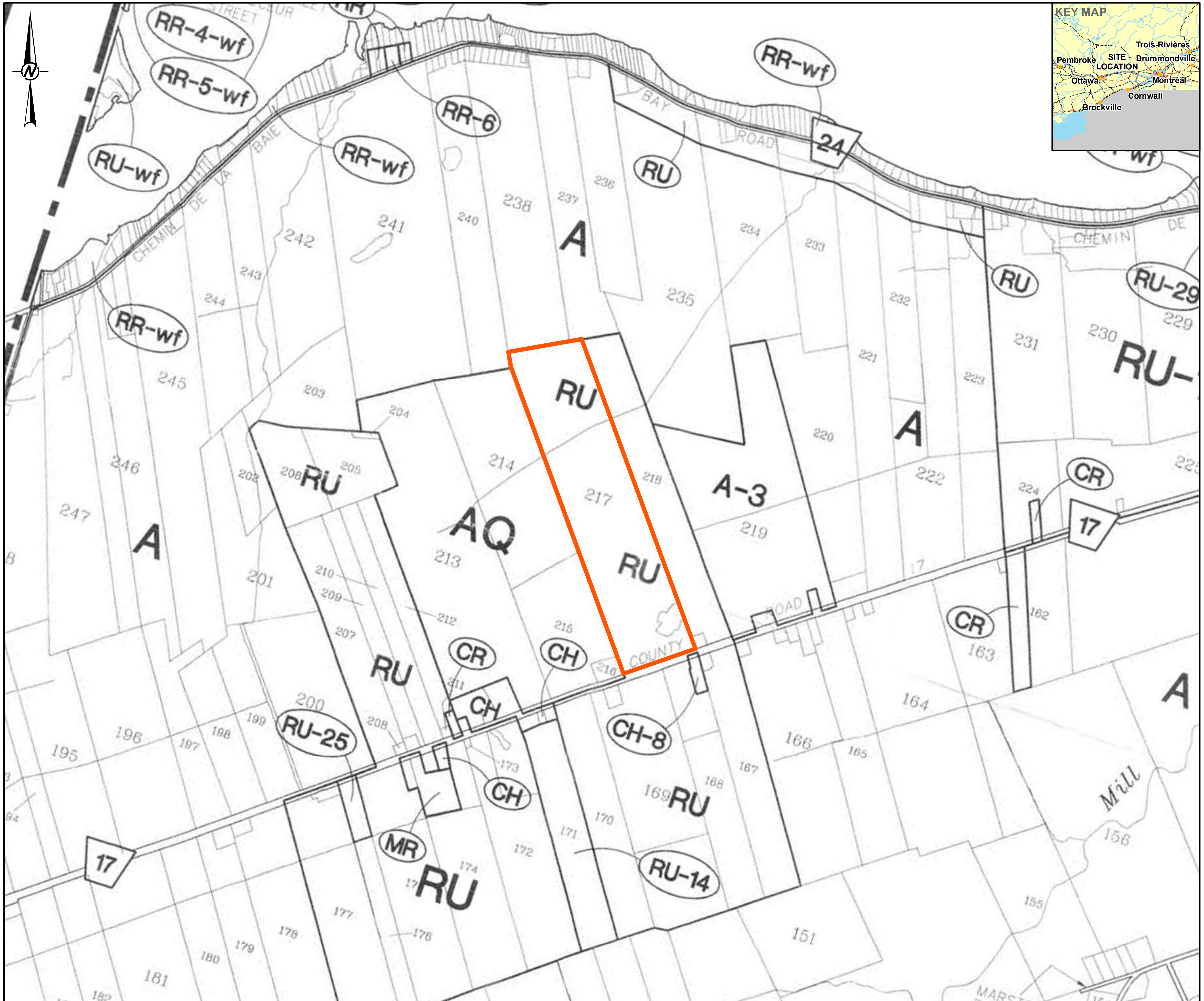
CONSULTANT
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	1

S:\Clients\Colacem_Canada\L_Orignal_Cement_Plant\99_PROJ\1529718_EIS\40_PROD\0007_Air\1529718-0007-RN-0001.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0



LEGEND

	SITE BOUNDARY OF PROPOSED PROJECT	
A	Agriculture	
AQ	Minetal Aggregate - Quarry	
CH	Commercial Highway	
CR	Commercial Rural	
MR	Industrial Rural	
RR	Residential Rural	
RU	Rural	

0 500 1,000
1:18,000 METRES

REFERENCE(S)
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MNR LIO, OBTAINED 2015
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ZONING - ZONING BY-LAW NO. 2000-75, TOWNSHIP OF CHAMPLAIN, WARD OF LONGUEUIL, SCHEDULE A
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

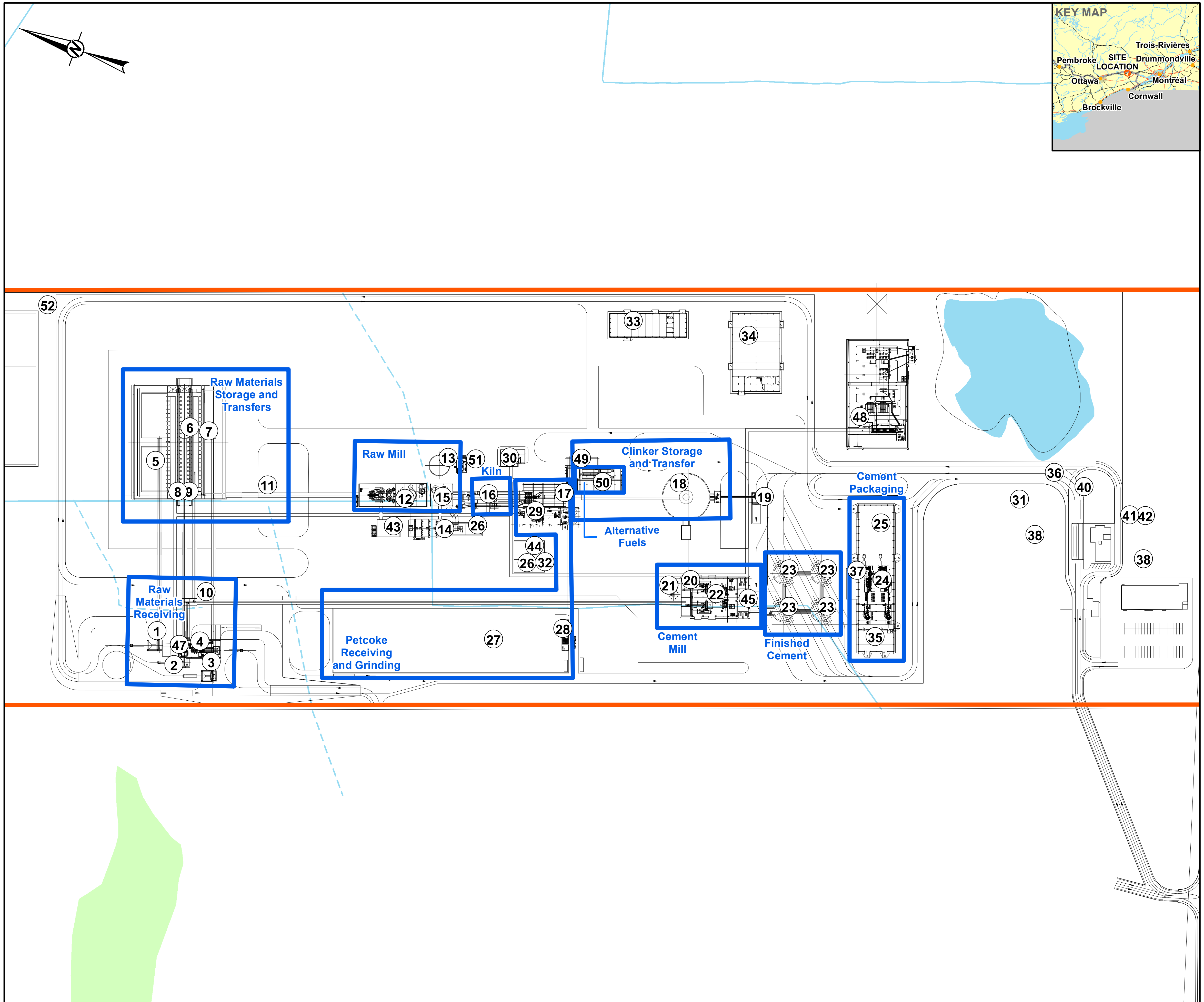
TITLE
LAND USE ZONING DESIGNATION PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	1	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm



LEGEND

- ① COLACEM ID
- LAYOUT
- WATERCOURSE
- WATERBODY
- WOODED AREA
- PROCESS AREA
- SITE BOUNDARY OF PROPOSED PROJECT

Colacem ID	Building/Structure Name	Colacem ID	Building/Structure Name
1	Hopper Bauxite and Conveying	27	Pet Coke Storage (Open Storage)
2	Hopper Schist, Silica, Iron and Conveying	28	Pet Coke Hopper
3	Hopper Gypsum and Conveying	29	Pet Coke Grinding Building
4	Limestone Crusher and Conveyor	30	Central Control Room
5	Raw Material Storage Building (Bauxite)	31	Director's Office
6	Raw Material Storage Building (Limestone and Schist)	32	Industrial Water Closed Circle
7	Raw Material Storage Building (Gypsum)	33	Mechanical and Electrical Workshop
8	Raw Material Storage Building (Iron Ore)	34	Storage Warehouse
9	Raw Material Storage Building (Silica)	35	Empty Bags Storage
10	Conveyor Limestone, Gypsum and Additives to Cement Hoppers	36	Vehicle Scale
11	Conveyor Bauxite, Limestone, Schist and Additives to Raw Mill	37	Electrical Room Packing
12	Raw Mill	38	Car Park
13	Homogenization Silo		
14	Waste Gas Treatment System for Kiln and Mill	40	Guardroom
15	Preheater	41	Canteen
16	Kiln Building	42	Changing Room
17	Cooler Building	43	Kiln Inlet & Raw Elec Room
18	Clinker Silo	44	Kiln Outlet, Cooler and Petcoke Mill Electrical Room
19	Clinker Bulk Loading Structure	45	Electrical Room for Cement Mill
20	Hopper Clinker and Additives of Cement Mill		
21	Silica and fly ash silo	47	Limestone Crusher
22	Cement Mill	48	Electrical Substation
23	Cement Packing Silos	49	Hopper Reception Clinker
24	Cement Packing	50	Alternative Fuels Building
25	Pallets Storage	51	Denox SNCR
26	Air Compressor Station	52	Stormwater Basin

0 100 200

1:3,300 METRES

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
FACILITY LAYOUT

CONSULTANT

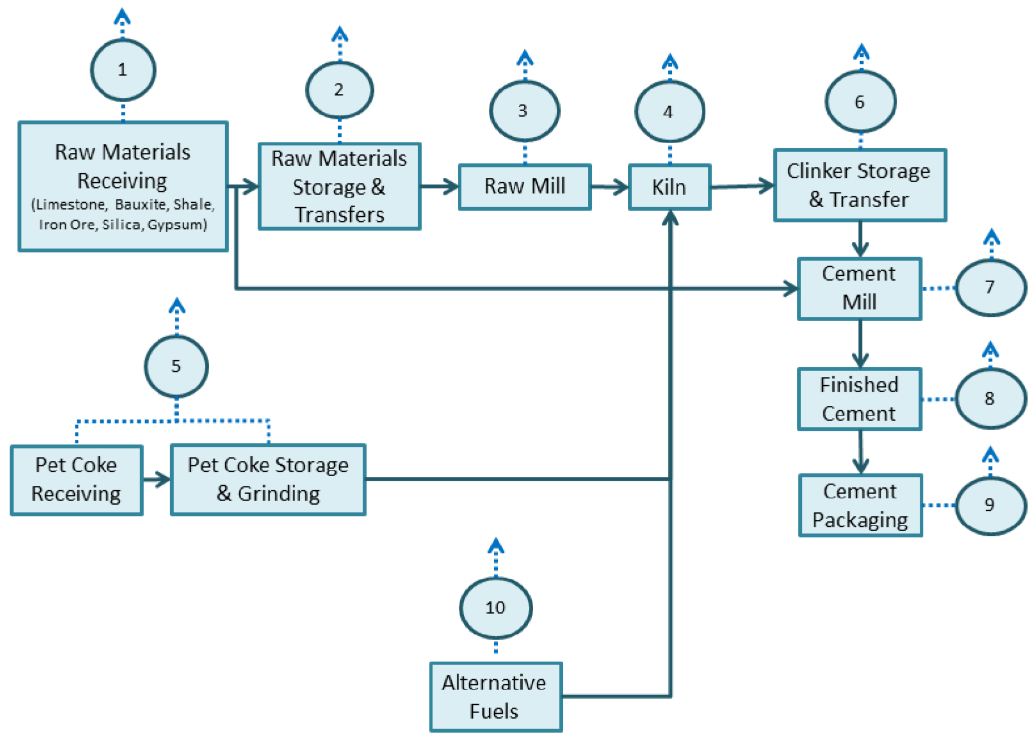
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

S:\Clients\Colacem_Canada\L_Orignal_Cement_Plant\99_PROJ\1529718_EIS\40_PROD\0007_Air\1529718-0007-RN-0004.mxd



LEGEND

Material Flow

Emissions Release through Process Area (see table)

Process Area No.	Process Area Name	Source IDs
1	Raw Materials Receiving	E1-E4, FUG1-FUG6
2	Raw Materials Storage and Transfers	E5-E12
3	Raw Mill	E13-E17
4	Kiln	E18, E27
5	Petcoke Receiving and Grinding	E19-E25, FUG7-FUG8
6	Clinker Storage & Transfer	E28-E32
7	Cement Mill	E33-E42
8	Finished Cement	E43-E54
9	Cement Packaging	E55-E56

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
PROCESS FLOW DIAGRAM

CONSULTANT

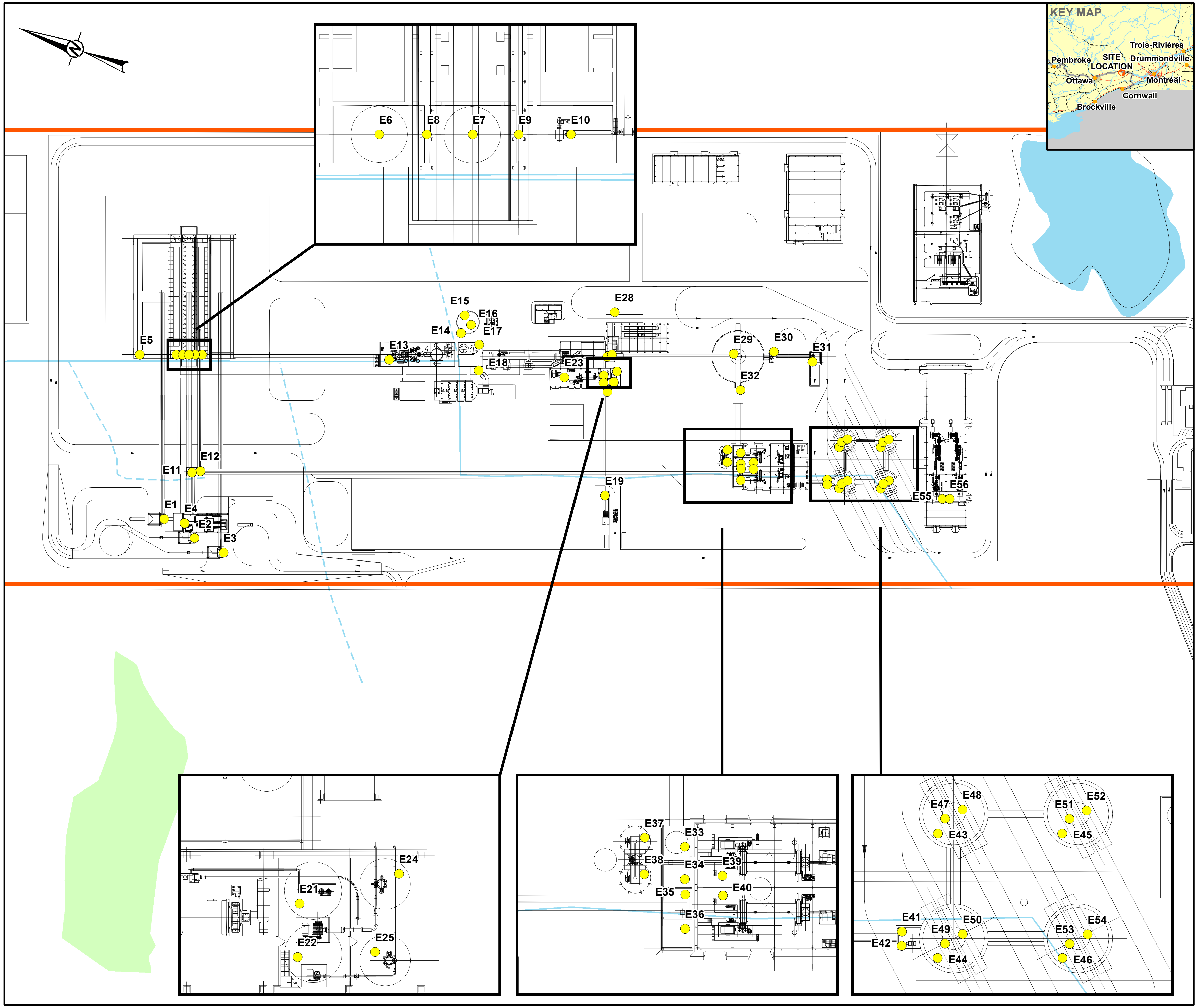
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	FIGURE
1529718	-	1	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm 0



LEGEND

- EMISSION POINT
- LAYOUT
- WATERBODY
- WOODED AREA
- SITE BOUNDARY OF PROPOSED PROJECT

Emission Point Source ID	Emission Point Source Name	Emission Point Source ID	Emission Point Source Name
E1	Bauxite Receiving Dust Collector	E31	Clinker Bulk Loading Dust Collector
E2	Shale, Silica, Iron Ore Receiving Dust Collector	E32	Clinker Extraction for Cement Hopper Dust Collector
E3	Gypsum Receiving Dust Collector	E33	Cement Clinker Hopper Dust Collector
E4	Limestone Crusher Dust Collector	E34	Cement Limestone Hopper Dust Collector
E5	Bauxite Storage Bin Dust Collector	E35	Cement Gypsum Hopper Dust Collector
E6	Iron Ore Hopper Dust Collector	E36	Cement 4° Constituent Hopper Dust Collector
E7	Silica Hopper Dust Collector	E37	Silica Fume Silo Dust Collector
E8	Limestone Reclaimer Belt Dust Collector	E38	Fly Ash Silo Dust Collector
E9	Limestone Reclaimer Belt Dust Collector	E39	Cement Mill Dust Collector - 1
E10	Gypsum Reclaimer Belt Dust Collector	E40	Cement Mill Dust Collector - 2
E11	Limestone & Gypsum Belt to Cement Hopper Dust Collector	E41	Cement Mill Air Slide Dust Collector - 1
E12	Constituents Belt to Cement Hopper Dust Collector	E42	Cement Mill Air Slide Dust Collector - 2
E13	Raw Mill Feeding Dust Collector	E43	Cement Silo Dust Collector - 1A
E14	Raw Meal Airslide Dust Collector	E44	Cement Silo Dust Collector - 2A
E15	Raw Meal Silo Dust Collector	E45	Cement Silo Dust Collector - 1B
E16	Raw Meal Silo Extraction Dust Collector	E46	Cement Silo Dust Collector - 2B
E17	Air Lift Bin Dust Collector	E47	Cement Silo Bulk Loading Dust Collector - 1A-A
E18	Kiln Dust Collector	E48	Cement Silo Bulk Loading Dust Collector - 1A-B
E19	Pet Coke Receiving Dust Collector	E49	Cement Silo Bulk Loading Dust Collector - 2A-A
E20	Pet Coke Silos Loading Bucket Elevator Dust Collector	E50	Cement Silo Bulk Loading Dust Collector - 2A-B
E21	Pet Coke (Coarse) Silo Dust Collector - 1	E51	Cement Silo Bulk Loading Dust Collector - 1B-A
E22	Pet Coke (Coarse) Silo Dust Collector - 2	E52	Cement Silo Bulk Loading Dust Collector - 1B-B
E23	Pet Coke Grinder Dust Collector	E53	Cement Silo Bulk Loading Dust Collector - 2B-A
E24	Pet Coke (Pulverized) Silo Dust Collector - 1	E54	Cement Silo Bulk Loading Dust Collector - 2B-B
E25	Pet Coke (Pulverized) Silo Dust Collector - 2	E55	Packing Plant Dust Collector - A
E26	Alternative Fuel Dust Collector	E56	Packing Plant Dust Collector - B
E27	Clinker Cooler Dust Collector		
E28	Clinker Receiving Dust Collector		
E29	Clinker Silo Dust Collector		
E30	Clinker Extraction for Bulk Loading Dust Collector		

NOTE(S)

THE INSETS IN THE FIGURE ARE NOT DRAWN TO SCALE.

0 100 200

1:3,000 METRES

REFERENCE(S)

MNR LIO, OBTAINED 2015
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

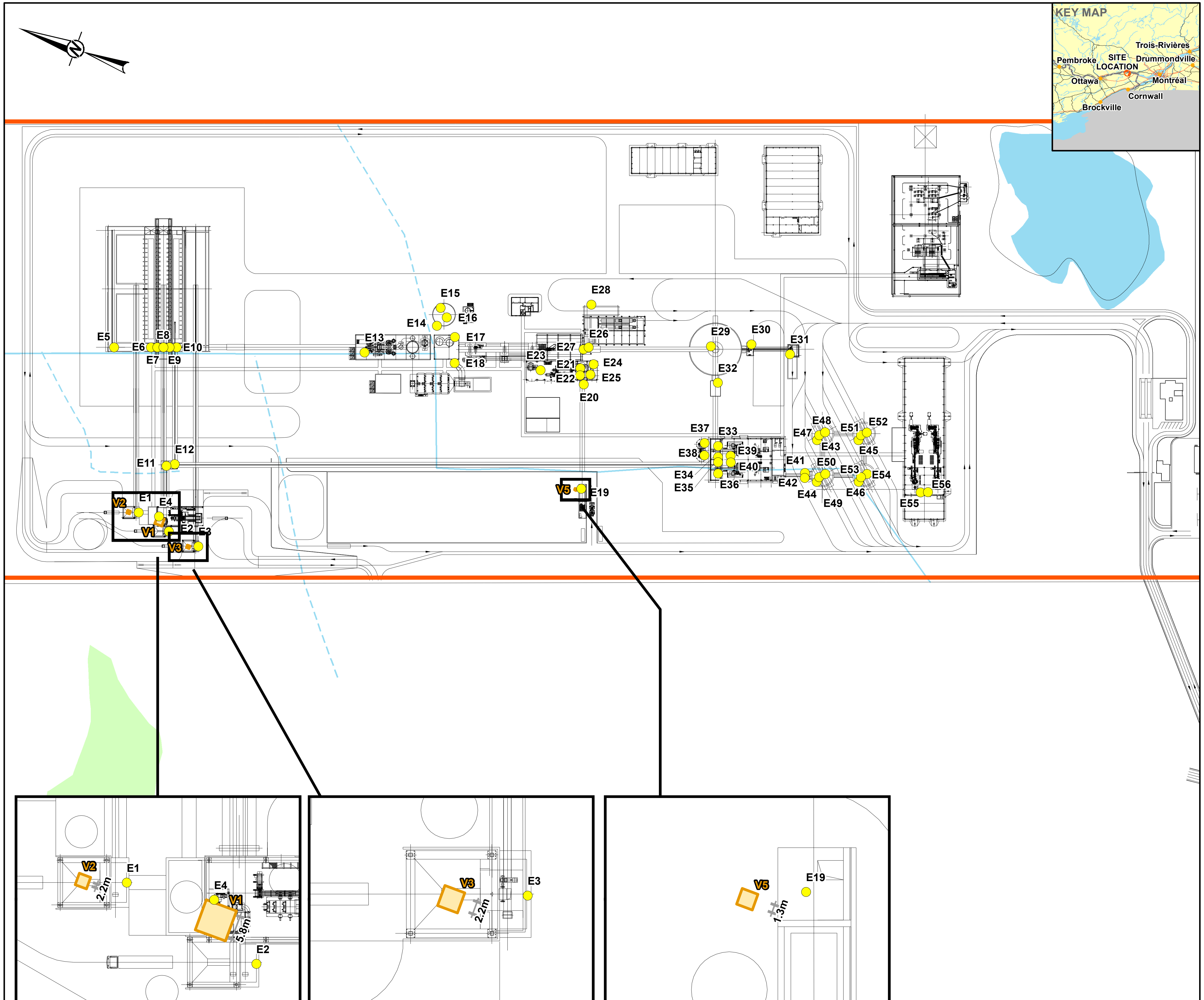
TITLE
EMISSION POINT SOURCE LAYOUT

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	5



LEGEND

- POINT SOURCE
- LAYOUT
- WATERBODY
- WOODED AREA
- VOLUME SOURCE
- SITE BOUNDARY OF PROPOSED PROJECT

VOLUME SOURCE PARAMETERS

Modelling ID	Source ID(s)	Release Height [m]	Initial Lateral Dimension [m]	Initial Vertical Dimension [m]	Centroid X-Coordinate [m]	Centroid Y-Coordinate [m]
V1	FUG1, FUG3, FUG4, FUG5	15	5.8	4.7	518709.4	5049927.7
V2	FUG2	15	2.2	4.7	518707.8	5049952.7
V3	FUG6	15	2.2	4.7	518698.5	5049900.1
V4	FUG7	1.5	1.3	1.4	518755.7	5049809.8
V5	FUG8	0	1.3	1.4	518843.5	5049633.9

NOTE(S)
THE INSETS IN THE FIGURE ARE NOT DRAWN TO SCALE.

0 100 200
1:3,000 METRES

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

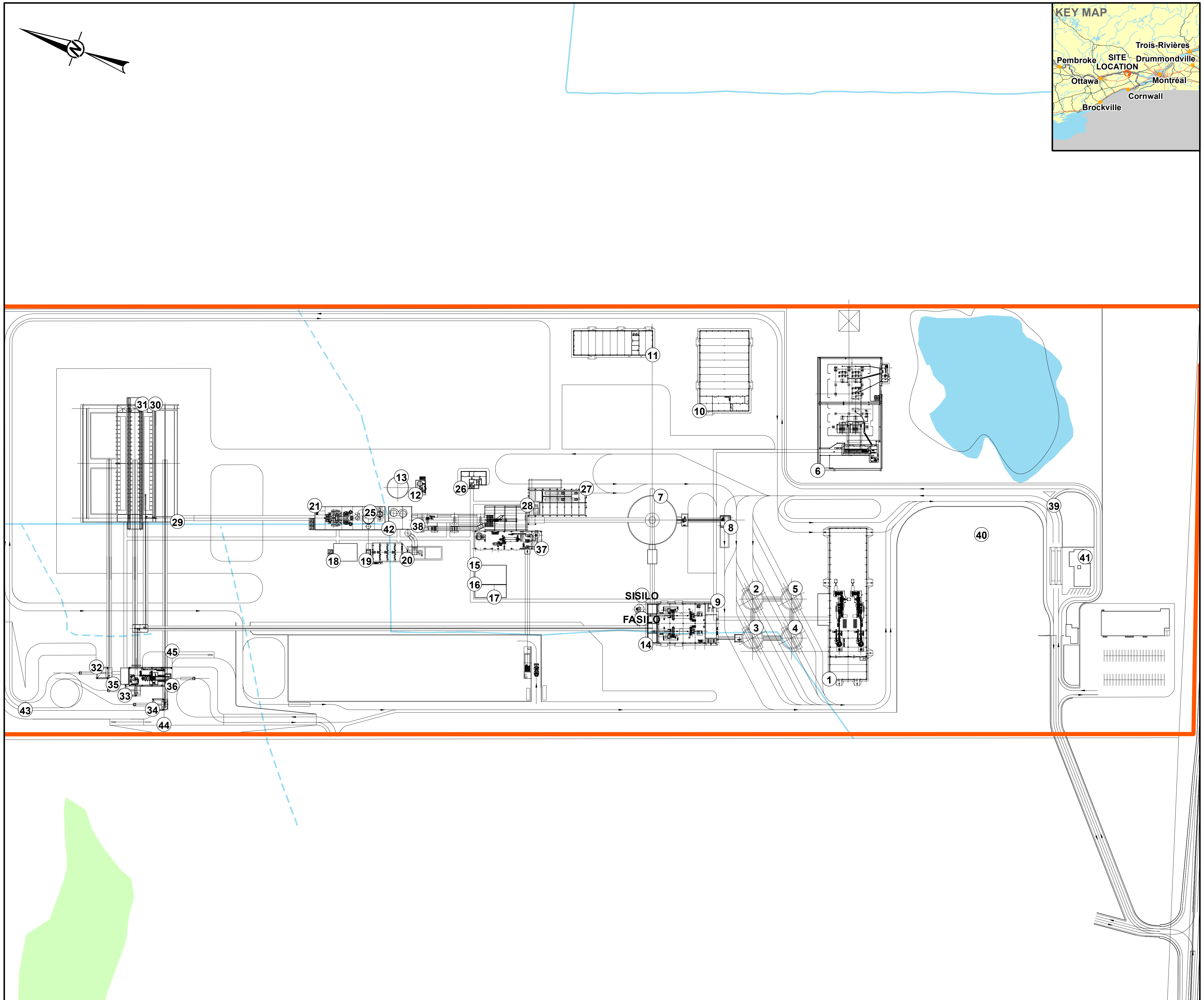
TITLE
DISPERSION MODELLING PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	6



LEGEND

- ① BUILDING ID
- LAYOUT
- ROAD
- SITE BOUNDARY OF PROPOSED PROJECT

Building/Structure Name	Building ID	Colacem ID	Height
Cement Packing	1	24	15.6
Cement Packing Silo 1	2	23	62
Cement Packing Silo 2	3	23	62
Cement Packing Silo 3	4	23	62
Cement Packing Silo 4	5	23	62
Electrical Substation	6	48	5
Clinker Silo	7	18	74.5
Clinker Bulk Loading Structure	8	19	24.7
Cement Mill	9	22	38.2
Storage Warehouse	10	34	10
Mechanical and Electrical Workshop	11	33	10
Denox SNCR	12	51	5
Homogenization Silo	13	13	65
Hopper Clinker and Additives of Cement Mill	14	20	35.5
Kiln Outlet, Cooler and Petcoke Mill Electrical Room	15	44	5
Air Compressor Station	16	26	5
Industrial Water Closed Circle	17	32	5
Kiln Inlet & Raw Elec Room	18	43	5
Waste Gas Treatment System for Kiln and Mill	19	14	5
Air Compressor Station	20	26	5
Raw Mill	21	12	31
Raw Mill	25	12	31
Central Control Room	26	30	15
Alternative Fuels Building	27	50	22.6
Cooler Building	28	17	20.8
Raw Material Storage Building - Tier 1	29	5 to 9	10.3
Raw Material Storage Building - Tier 2	30	5 to 9	20.1
Raw Material Storage Building - Tier 3	31	5 to 9	32.1
Hopper Bauxite and Conveying	32	1	20.1
Hopper Schist, Silica, Iron and Conveying	33	2	20.1
Hopper Gypsum and Conveying	34	3	20.1
Limestone Crusher	35	47	5
Limestone Crusher and Conveyor	36	4	20.1
Pet Coke Grinding Building	37	29	33.9
Kiln Building	38	16	20.8
Guardroom	39	40	2
Director's Office	40	31	10
Canteen	41	41	7
Preheater	42	15	113.8
Fly Ash Silo	FASILO	N/A-4	36
Silica Fumes Silo	SISILO	N/A-5	36
Raw Materials Road Structure 1	44	N/A-6	10
Raw Materials Road Structure 2	43	N/A-7	10
Raw Materials Road Structure 3	45	N/A-8	4

0 100 200
1:3,200 METRES

REFERENCE(S)
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
BPIP PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	7

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

LEGEND

- SITE BOUNDARY OF PROPOSED PROJECT
- 3 KM SITE BOUNDARY BUFER

0 1 2

1:30,000 KILOMETRES

REFERENCE(S)

MNR LIO, OBTAINED 2015
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IMAGERY: BING MAPS © 2015 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
3-KM SATELLITE IMAGE

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	1	8

LEGEND

ROAD

CONTOUR

WATERBODY

SITE BOUNDARY OF PROPOSED PROJECT

ELEVATION (METRES)

342

31

0 2 4

1:80,000 KILOMETRES

REFERENCE(S)

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DEM - NATURAL RESOURCES CANADA, CANADIAN DIGITAL ELEVATION MODEL (CDEM), OBTAINED 09/22/15
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
TERRAIN ELEVATIONS

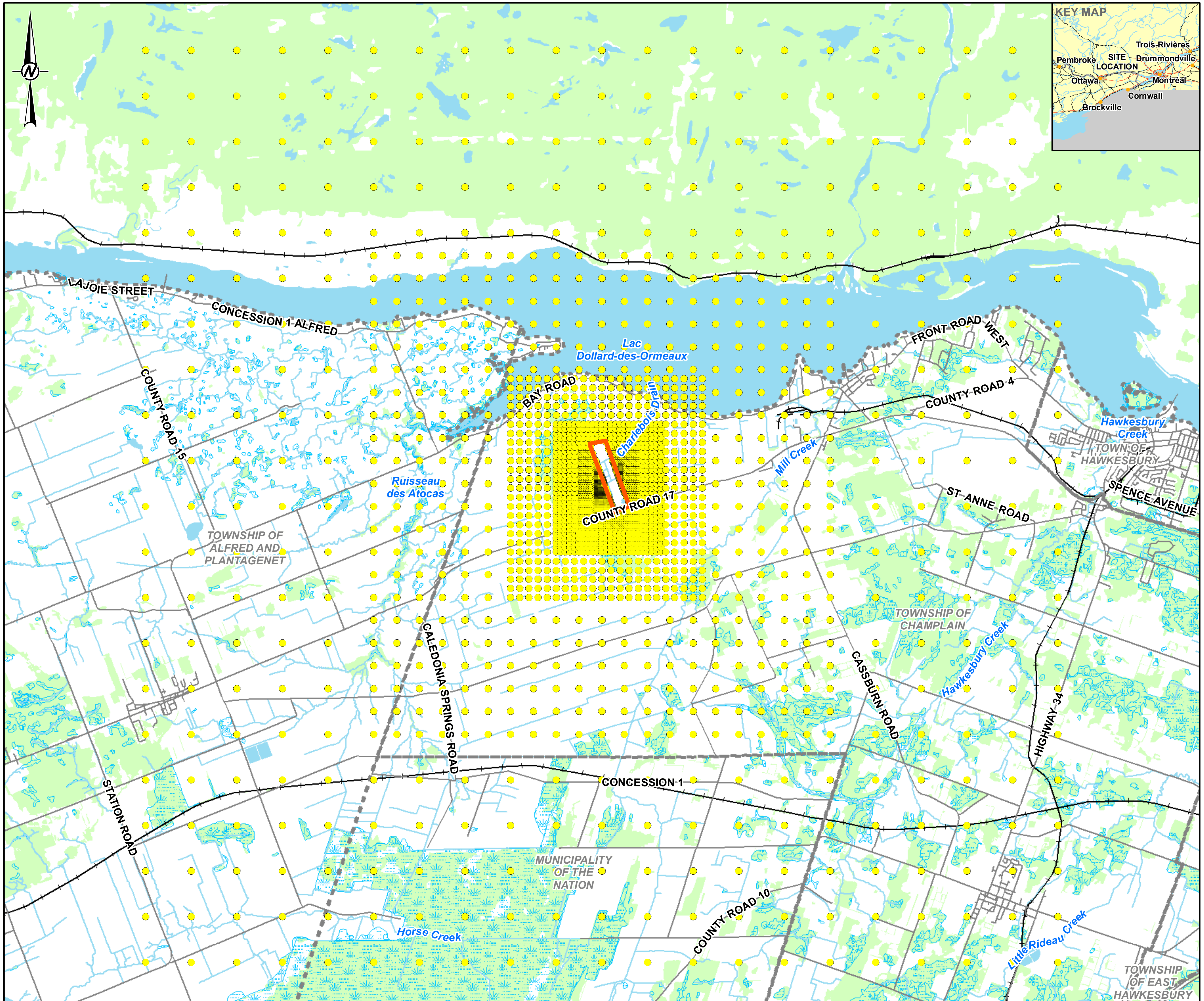
CONSULTANT
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	1	9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm



LEGEND

- RECEPTOR
- ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- WETLAND
- WOODED AREA
- MUNICIPAL BOUNDARY
- SITE BOUNDARY OF PROPOSED PROJECT

0 3 6

1:85,000 KILOMETRES

REFERENCE(S)

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IMAGERY: ESRI WORLD IMAGERY WMS, CNES/AIRBUS DS, 2.5M, 1/15/2007
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
RECEPTOR GRID

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

PROJECT NO.	CONTROL	REV.	MAP
1529718	-	2	10

APPENDIX A

Modification Log

APPENDIX A
Modification Log

The following table presents a sample of what a typical modification log would include for an ESDM Report update.

The ECA defines a "*Modification*" to be "any construction, alteration, extension or replacement of any plant, structure, equipment, apparatus, mechanism or thing, or alteration of a process rate of production at the Facility that may discharge or alter the rate or manner of discharge of a Compound of Concern to the air". This Modification Log may contain ESDM Report changes that do not fit this definition. Only those changes which meet this definition are required to be documented in the Written Summary required by Conditions 4.3 and 5.1 of the ECA.

ESDM Report Version	Description of Change	Emission Summary and Dispersion Modelling Report Changes	Does this Modification Meet the Definition of a "*Modification*" as defined by the ECA (i.e. must be included in the Annual Written Summary)
1.1	Addition of PM10, PM2.5 and Portland Cement to the ESDM	Table 2, Table 4, Table 5, Emission rate calculations (Appendix B), Assessment of Negligibility (Appendix D), and Modelling files (Appendix F)	N/A
1.1	Update of k factor for fugitive emissions from material handling	Emission rate calculations (Appendix B)	N/A
1.1	Inclusion of assessment of emissions of fugitive dust from paved roads	Emission rate calculations (Appendix B), Table 1, Table 2	N/A
1.1	Update of figures with revised building base plan	Figures 1,3,5,6 and 7 and Figure E1	N/A

Note:

N/A – Not applicable, revised during the MOECC ESDM technical review in response to an information request.

APPENDIX B

Emission Rate Calculations

Dust Collectors - Dust Emissions - E1 to E56

Description and Methodology

The facility has dust collectors throughout the Facility to perform various operations related to raw material receiving, material storage and transfers, raw mill, Petcoke receiving and grinding, cement costituents and cement receiving, clinker silo, cement mill, finished cement silos, cement packaging and alternative fuels. For each dust collector, data such as outlet loading concentration is provided in Appendix C. Figure 3 presents the locations of the dust collector stacks.

The emissions from each dust collector were estimated based on the maximum volumetric flow rate multiplied by the designed particulate mass outlet loading concentration. The daily emission rates were calculated based on each unit's maximum daily operating hours. Emissions of PM10 and PM2.5 were estimated based on Table B.2-3 from US EPA AP-42, Appendix B.2 - Generalized Particle Size Distributions. The data quality has been assumed to be Above Average.

Particle Size Distribution

Particle Size [µm]	Cumulative % Particle Distribution	Fabric Filter Collection Efficiencies
SPM	—	99.5%
PM10	53%	99.5%
PM2.5	18%	99.0%

Reference: US EPA AP-42 Appendix B.2 - GENERALIZED PARTICLE SIZE DISTRIBUTIONS
Cumulative % Particle Distribution: Category 5
Fabric Filter Collection Efficiencies: Table B.2-3

Notes:
- SPM collection efficiency was conservatively assumed to equal the control efficiency of PM10
- SPM inlet emission rate was estimated using the SPM outlet concentration provided by Colacem and the assumed SPM collection efficiency
- PM10 and PM2.5 inlet emission rates were estimated using SPM inlet emission rates and the cumulative % particle distribution
- PM10 and PM2.5 outlet emission rates were estimated using the fabric filter collection efficiencies and their inlet emission rates

Sample Calculations

SPM Emission Rate

Outlet SPM Emission Rate = Flow Rate [Nm³/hr] x Output Concentration [mg/Nm³] x Conversion Factors

$$= \frac{9{,}832\ \text{Nm}^3}{\text{hr}} \times \frac{15\ \text{mg}}{\text{Nm}^3} \times \frac{1\ \text{g}}{1000\ \text{mg}} \times \frac{1\ \text{hr}}{3600\ \text{s}} \times \frac{8\ \text{hr/day operation}}{24\ \text{hr/day}}$$

$$= \frac{1.37\text{E-}02\ \text{g}}{\text{s}}$$

PM10 and PM2.5 Emission Rate

Inlet SPM Emission Rate = Outlet SPM Emission Rate [g/s] / (100% - Assumed Fabric Filter Collection Efficiency [%])

$$= \frac{1.37\text{E-}02\ \text{g}}{\text{s}} \Big/ (100\% - 99.5\%)$$

$$= \frac{2.73\ \text{g}}{\text{s}}$$

Inlet PM10 Emission Rate = Inlet SPM Emission Rate [g/s] x Cumulative % Particle Distribution of PM10

$$= \frac{2.73\ \text{g}}{\text{s}} \times 53\%$$

$$= \frac{1.45\ \text{g}}{\text{s}}$$

Outlet PM10 Emission Rate = Inlet PM10 Emission Rate [g/s] x (100% - Fabric Filter Collection Efficiency [%])

$$= \frac{1.45\ \text{g}}{\text{s}} \times (100\% - 99.5\%)$$

$$= \frac{0.0072\ \text{g}}{\text{s}}$$

Inlet PM2.5 Emission Rate = Inlet SPM Emission Rate [g/s] x Cumulative % Particle Distribution of PM2.5

$$= \frac{1.45\ \text{g}}{\text{s}} \times 18\%$$

$$= \frac{0.26\ \text{g}}{\text{s}}$$

Outlet PM2.5 Emission Rate = Inlet PM2.5 Emission Rate [g/s] x (100% - Fabric Filter Collection Efficiency [%])

$$= \frac{0.26\ \text{g}}{\text{s}} \times (100\% - 99.0\%)$$

$$= \frac{0.0026\ \text{g}}{\text{s}}$$

Conversion Factors

1 g =	1000 mg
1 hr =	3600 s
1 day =	24 hr
deg K =	273.15 + deg C

Assumed Flow Rate Conditions

Ambient Temp =	25 C
Ambient Temp =	298 K
Normalized Temp=	20 C
Normalized Temp=	293 K

*corrected only for temperature

Emissions Summary

Stack/ Modelling ID	Stack/Source Name	Actual Flow Rate [Am³/hr]	Exhaust Temperature [°C]	Normalized Flow Rate [Nm³/hr]	Outlet Concentration [mg/Nm³]	Daily Operating Hours [hours/day]	Daily Emission Rate [g/s]		
							SPM	PM_{10}	$PM_{2.5}$
							N/A-1	N/A-2	N/A-3
E1	Bauxite Receiving Dust Collector	10,000	Ambient	9,832	15	8	1.37E-02	7.24E-03	4.92E-03
E2	Shale, Silica, Iron Ore Receiving Dust Collector	10,000	Ambient	9,832	15	8	1.37E-02	7.24E-03	4.92E-03
E3	Gypsum Receiving Dust Collector	10,000	Ambient	9,832	15	8	1.37E-02	7.24E-03	4.92E-03
E4	Limestone Crusher Dust Collector	30,000	Ambient	29,497	15	8	4.10E-02	2.17E-02	1.47E-02
E5	Bauxite Storage Bin Dust Collector	3,000	Ambient	2,950	15	21	1.08E-02	5.70E-03	3.87E-03
E6	Iron Ore Hopper Dust Collector	5,000	Ambient	4,916	15	21	1.79E-02	9.50E-03	6.45E-03
E7	Silica Hopper Dust Collector	5,000	Ambient	4,916	15	21	1.79E-02	9.50E-03	6.45E-03
E8	Limestone Reclaimer Belt Dust Collector	3,000	Ambient	2,950	15	21	1.08E-02	5.70E-03	3.87E-03
E9	Limestone Reclaimer Belt Dust Collector	3,000	Ambient	2,950	15	21	1.08E-02	5.70E-03	3.87E-03
E10	Gypsum Reclaimer Belt Dust Collector	3,000	Ambient	2,950	15	4	2.05E-03	1.09E-03	7.37E-04
E11	Limestone & Gypsum Belt to Cement Hopper Dust Collector	3,000	Ambient	2,950	15	16	8.19E-03	4.34E-03	2.95E-03
E12	Constituents Belt to Cement Hopper Dust Collector	3,000	Ambient	2,950	15	4	2.05E-03	1.09E-03	7.37E-04
E13	Raw Mill Feeding Dust Collector	15,000	Ambient	14,748	15	21	5.38E-02	2.85E-02	1.94E-02
E14	Raw Meal Airslide Dust Collector	5,000	60	4,402	15	21	1.60E-02	8.51E-03	5.78E-03
E15	Raw Meal Silo Dust Collector	10,000	60	8,803	15	24	3.67E-02	1.94E-02	1.32E-02
E16	Raw Meal Silo Extraction Dust Collector	10,000	60	8,803	15	24	3.67E-02	1.94E-02	1.32E-02
E17	Air Lift Bin Dust Collector	10,000	60	8,803	15	24	3.67E-02	1.94E-02	1.32E-02
E18	Kiln Dust Collector	1,000,000	150	693,026	20	24	3.85E+00	2.04E+00	1.39E+00
E19	Petcoke Receiving Dust Collector	10,000	Ambient	9,832	15	8	1.37E-02	7.24E-03	4.92E-03
E20	Petcoke Silos Loading Bucket Elevator Dust Collector	3,000	Ambient	2,950	15	8	4.10E-03	2.17E-03	1.47E-03
E21	Petcoke (Coarse) Silo Dust Collector - 1	3,000	Ambient	2,950	15	8	4.10E-03	2.17E-03	1.47E-03
E22	Petcoke (Coarse) Silo Dust Collector - 2	3,000	Ambient	2,950	15	8	4.10E-03	2.17E-03	1.47E-03
E23	Petcoke Grinder Dust Collector	60,000	70	51,280	15	16	1.42E-01	7.55E-02	5.13E-02
E24	Petcoke (Pulverized) Silo Dust Collector - 1	3,000	70	2,564	15	24	1.07E-02	5.66E-03	3.85E-03
E25	Petcoke (Pulverized) Silo Dust Collector - 2	3,000	70	2,564	15	24	1.07E-02	5.66E-03	3.85E-03
E26	Alternative Fuel Dust Collector	10,000	Ambient	9,832	15	24	4.10E-02	2.17E-02	1.47E-02
E27	Clinker Cooler Dust Collector	10,000	150	6,930	15	24	2.89E-02	1.53E-02	1.04E-02
E28	Clinker Receiving Dust Collector	30,000	50	27,228	15	8	3.78E-02	2.00E-02	1.36E-02
E29	Clinker Silo Dust Collector	20,000	100	15,718	15	24	6.55E-02	3.47E-02	2.36E-02
E30	Clinker Extraction for Bulk Loading Dust Collector	5,000	50	4,538	15	8	6.30E-03	3.34E-03	2.27E-03
E31	Clinker Bulk Loading Dust Collector	15,000	50	13,614	15	8	1.89E-02	1.00E-02	6.81E-03
E32	Clinker Extraction for Cement Hopper Dust Collector	10,000	50	9,076	15	16	2.52E-02	1.34E-02	9.08E-03
E33	Cement Clinker Hopper Dust Collector	10,000	50	9,076	15	16	2.52E-02	1.34E-02	9.08E-03
E34	Cement Limestone Hopper Dust Collector	5,000	Ambient	4,916	15	16	1.37E-02	7.24E-03	4.92E-03
E35	Cement Gypsum Hopper Dust Collector	5,000	Ambient	4,916	15	16	1.37E-02	7.24E-03	4.92E-03
E36	Cement 4° Constituent Hopper Dust Collector	5,000	Ambient	4,916	15	16	1.37E-02	7.24E-03	4.92E-03
E37	Silica Fume Silo Dust Collector	5,000	Ambient	4,916	15	16	1.37E-02	7.24E-03	4.92E-03
E38	Fly Ash Silo Dust Collector	5,000	Ambient	4,916	15	16	1.37E-02	7.24E-03	4.92E-03
E39	Cement Mill Dust Collector - 1	260,000	90	209,970	15	16	5.83E-01	3.09E-01	2.10E-01
E40	Cement Mill Dust Collector - 2	260,000	90	209,970	15	16	5.83E-01	3.09E-01	2.10E-01
E41	Cement Mill Air Slide Dust Collector - 1	5,000	70	4,273	15	16	1.19E-02	6.29E-03	4.27E-03
E42	Cement Mill Air Slide Dust Collector - 2	5,000	70	4,273	15	16	1.19E-02	6.29E-03	4.27E-03
E43	Cement Silo Dust Collector - 1A	10,000	60	8,803	15	16	2.45E-02	1.30E-02	8.80E-03
E44	Cement Silo Dust Collector - 2A	10,000	60	8,803	15	16	2.45E-02	1.30E-02	8.80E-03
E45	Cement Silo Dust Collector - 1B	10,000	60	8,803	15	16	2.45E-02	1.30E-02	8.80E-03
E46	Cement Silo Dust Collector - 2B	10,000	60	8,803	15	16	2.45E-02	1.30E-02	8.80E-03
E47	Cement Silo Bulk Loading Dust Collector - 1A-A	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E48	Cement Silo Bulk Loading Dust Collector - 1A-B	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E49	Cement Silo Bulk Loading Dust Collector - 2A-A	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E50	Cement Silo Bulk Loading Dust Collector - 2A-B	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E51	Cement Silo Bulk Loading Dust Collector - 1B-A	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E52	Cement Silo Bulk Loading Dust Collector - 1B-B	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E53	Cement Silo Bulk Loading Dust Collector - 2B-A	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E54	Cement Silo Bulk Loading Dust Collector - 2B-B	8,000	40	7,493	15	16	2.08E-02	1.10E-02	7.49E-03
E55	Packing Plant Dust Collector - A	30,000	40	28,097	15	8	3.90E-02	2.07E-02	1.40E-02
E56	Packing Plant Dust Collector - B	30,000	40	28,097	15	8	3.90E-02	2.07E-02	1.40E-02

Dust Collectors - Non-Dust Emissions - E1 to E56

Methodology

The emissions from each dust collector were estimated based on the maximum volumetric flow rate multiplied by the designed particulate mass outlet loading concentration. The daily emission rates were calculated based on each unit's maximum daily operating hours. This is summarized in E1-E56 - Dust sheet. Based on the composition of the materials at the Facility, the emission rates of crystalline silica and ferric oxide were also estimated. For each source, the percent composition of the contaminant was provided as well as the source of the information. The percent composition of the contaminant was multiplied by the emission rate of PM10 (as estimated in source sheet E1-E56 - Dust.

Parameters

Percent of Crystalline Silica in PM10 =	6.6%	AWMA - PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate-Producing Sources in California (Richards et al., 2012)
Percent Fe_2O_3 in Iron Ore =	100%	Assumed concentration
Percent of Iron in Raw Materials =	1.42%	Average of iron ore mass percentage in all raw materials received at Facility
Crystalline Silica in Clinker =	0.5%	Typical MSDSs
Portland Cement in Clinker =	100%	Typical MSDSs
Crystalline Silica in Silica Fume =	0.5%	Typical MSDS
Crystalline Silica in Fly Ash =	10%	Typical MSDS
Crystalline Silica in Portland Cement =	0.3%	Typical MSDS
Portland Cement in Portland Cement =	100.0%	Typical MSDS
Raw Mill Silica Sand Concentration =	3%	Typical MSDS

Emissions Summary

Stack/ Modelling ID	Stack/Source Name	Percent Composition (by Weight) [%]			Emission Rate [g/s]				
		Crystalline Silica	Ferric Oxide	Portland Cement	SPM	PM10	Crystalline Silica	Ferric Oxide	Portland Cement
		14808-60-7	1309-37-1	65997-15-1	N/A-1	N/A-2	14808-60-7	1309-37-1	65997-15-1
E1	Bauxite Receiving Dust Collector	—	—	—	1.37E-02	7.24E-03	—	—	—
E2	Shale, Silica, Iron Ore Receiving Dust Collector	6.6%	100%	—	1.37E-02	7.24E-03	4.76E-04	1.37E-02	—
E3	Gypsum Receiving Dust Collector	—	—	—	1.37E-02	7.24E-03	—	—	—
E4	Limestone Crusher Dust Collector	6.6%	—	—	4.10E-02	2.17E-02	1.43E-03	—	—
E5	Bauxite Storage Bin Dust Collector	—	—	—	1.08E-02	5.70E-03	—	—	—
E6	Iron Ore Hopper Dust Collector	—	100%	—	1.79E-02	9.50E-03	—	1.79E-02	—
E7	Silica Hopper Dust Collector	6.6%	—	—	1.79E-02	9.50E-03	6.25E-04	—	—
E8	Limestone Reclaimer Belt Dust Collector	6.6%	—	—	1.08E-02	5.70E-03	3.75E-04	—	—
E9	Limestone Reclaimer Belt Dust Collector	6.6%	—	—	1.08E-02	5.70E-03	3.75E-04	—	—
E10	Gypsum Reclaimer Belt Dust Collector	—	—	—	2.05E-03	1.09E-03	—	—	—
E11	Limestone & Gypsum Belt to Cement Hopper Dust Collector	6.6%	—	—	8.19E-03	4.34E-03	2.86E-04	—	—
E12	Constituents Belt to Cement Hopper Dust Collector	6.6%	—	—	2.05E-03	1.09E-03	7.14E-05	—	—
E13	Raw Mill Feeding Dust Collector	6.6%	1.42%	—	5.38E-02	2.85E-02	1.87E-03	7.64E-04	—
E14	Raw Meal Airslide Dust Collector	6.6%	1.42%	—	1.60E-02	8.51E-03	5.59E-04	2.28E-04	—
E15	Raw Meal Silo Dust Collector	6.6%	1.42%	—	3.67E-02	1.94E-02	1.28E-03	5.21E-04	—
E16	Raw Meal Silo Extraction Dust Collector	6.6%	1.42%	—	3.67E-02	1.94E-02	1.28E-03	5.21E-04	—
E17	Air Lift Bin Dust Collector	6.6%	1.42%	—	3.67E-02	1.94E-02	1.28E-03	5.21E-04	—
E19	Petcoke Receiving Dust Collector	—	—	—	1.37E-02	7.24E-03	—	—	—

Stack/ Modelling ID	Stack/Source Name	Percent Composition (by Weight) [%]			Emission Rate [g/s]				
		Crystalline Silica	Ferric Oxide	Portland Cement	SPM	PM10	Crystalline Silica	Ferric Oxide	Portland Cement
		14808-60-7	1309-37-1	65997-15-1	N/A-1	N/A-2	14808-60-7	1309-37-1	65997-15-1
E20	Petcoke Silos Loading Bucket Elevator Dust Collector	—	—	—	4.10E-03	2.17E-03	—	—	—
E21	Petcoke (Coarse) Silo Dust Collector - 1	—	—	—	4.10E-03	2.17E-03	—	—	—
E22	Petcoke (Coarse) Silo Dust Collector - 2	—	—	—	4.10E-03	2.17E-03	—	—	—
E23	Petcoke Grinder Dust Collector	—	—	—	1.42E-01	7.55E-02	—	—	—
E24	Petcoke (Pulverized) Silo Dust Collector - 1	—	—	—	1.07E-02	5.66E-03	—	—	—
E25	Petcoke (Pulverized) Silo Dust Collector - 2	—	—	—	1.07E-02	5.66E-03	—	—	—
E26	Alternative Fuel Dust Collector	—	—	—	4.10E-02	2.17E-02	—	—	—
E27	Clinker Cooler Dust Collector	0.5%	—	100%	2.89E-02	1.53E-02	7.65E-05	—	2.89E-02
E28	Clinker Receiving Dust Collector	0.5%	—	100%	3.78E-02	2.00E-02	1.00E-04	—	3.78E-02
E29	Clinker Silo Dust Collector	0.5%	—	100%	6.55E-02	3.47E-02	1.74E-04	—	6.55E-02
E30	Clinker Extraction for Bulk Loading Dust Collector	0.5%	—	100%	6.30E-03	3.34E-03	1.67E-05	—	6.30E-03
E31	Clinker Bulk Loading Dust Collector	0.5%	—	100%	1.89E-02	1.00E-02	5.01E-05	—	1.89E-02
E32	Clinker Extraction for Cement Hopper Dust Collector	0.5%	—	100%	2.52E-02	1.34E-02	6.68E-05	—	2.52E-02
E33	Cement Clinker Hopper Dust Collector	0.5%	—	100%	2.52E-02	1.34E-02	6.68E-05	—	2.52E-02
E34	Cement Limestone Hopper Dust Collector	6.6%	—	—	1.37E-02	7.24E-03	4.76E-04	—	—
E35	Cement Gypsum Hopper Dust Collector	—	—	—	1.37E-02	7.24E-03	—	—	—
E36	Cement 4° Constituent Hopper Dust Collector	0.5%	—	100%	1.37E-02	7.24E-03	3.62E-05	—	1.37E-02
E37	Silica Fume Silo Dust Collector	0.5%	—	—	1.37E-02	7.24E-03	3.62E-05	—	—
E38	Fly Ash Silo Dust Collector	10%	—	—	1.37E-02	7.24E-03	7.24E-04	—	—
E39	Cement Mill Dust Collector - 1	0.3%	—	100.0%	5.83E-01	3.09E-01	9.27E-04	—	5.83E-01
E40	Cement Mill Dust Collector - 2	0.3%	—	100.0%	5.83E-01	3.09E-01	9.27E-04	—	5.83E-01
E41	Cement Mill Air Slide Dust Collector - 1	0.3%	—	100.0%	1.19E-02	6.29E-03	1.89E-05	—	1.19E-02
E42	Cement Mill Air Slide Dust Collector - 2	0.3%	—	100.0%	1.19E-02	6.29E-03	1.89E-05	—	1.19E-02
E43	Cement Silo Dust Collector - 1A	0.3%	—	100.0%	2.45E-02	1.30E-02	3.89E-05	—	2.45E-02
E44	Cement Silo Dust Collector - 2A	0.3%	—	100.0%	2.45E-02	1.30E-02	3.89E-05	—	2.45E-02
E45	Cement Silo Dust Collector - 1B	0.3%	—	100.0%	2.45E-02	1.30E-02	3.89E-05	—	2.45E-02
E46	Cement Silo Dust Collector - 2B	0.3%	—	100.0%	2.45E-02	1.30E-02	3.89E-05	—	2.45E-02
E47	Cement Silo Bulk Loading Dust Collector - 1A-A	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E48	Cement Silo Bulk Loading Dust Collector - 1A-B	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E49	Cement Silo Bulk Loading Dust Collector - 2A-A	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E50	Cement Silo Bulk Loading Dust Collector - 2A-B	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E51	Cement Silo Bulk Loading Dust Collector - 1B-A	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E52	Cement Silo Bulk Loading Dust Collector - 1B-B	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E53	Cement Silo Bulk Loading Dust Collector - 2B-A	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E54	Cement Silo Bulk Loading Dust Collector - 2B-B	0.3%	—	100.0%	2.08E-02	1.10E-02	3.31E-05	—	2.08E-02
E55	Packing Plant Dust Collector - A	0.3%	—	100.0%	3.90E-02	2.07E-02	6.20E-05	—	3.90E-02
E56	Packing Plant Dust Collector - B	0.3%	—	100.0%	3.90E-02	2.07E-02	6.20E-05	—	3.90E-02

Kiln - Dust, Carbon Monoxide, Nitrogen Oxides, Ammonia, Sulphur Dioxide, Dioxins & Furans Emissions - E18

Description and Methodology

The exhaust gas from the kiln is equipped with a waste gas treatment system that contains a state-of-the-art hybrid filter. The hybrid filter incorporates both baghouse filtering and an electrostatic precipitator technology into the same housing. The system is able to capture greater 99.99% of all particles sizes. Details of the pollution control system has been provided in Appendix C.

The kiln is proposed to operate 24 hours per day, 7 days per week and up to 11 months per year. The kiln has a daily production rate of 3,000 tons of clinker per day.

Particulate matter (SPM), carbon monoxide (CO), nitrogen oxides (NOx), ammonia (NH3) and sulfur dioxide (SOx) emissions from the waste gas treatment system were estimated based on the maximum outlet loading concentration and the maximum volumetric flow rate (capacity) provided by Colacem. The outlet loading concentrations are considered to be conservative as the waste gas treatment system is equipped with a state-of-the-art hybrid filter. Emissions of PM10 and PM2.5 were estimated based on Table B.2-3 from US EPA AP-42, Appendix B.2 - Generalized Particle Size Distributions. The emissions of Dioxins and Furans were estimated using the in-stack limits from the Canada Wide Status Report, October 2004. In the absence of real source testing data, other relevant trace contaminant emissions have been estimated based on the U.S. EPA's emission factors from Chapter 11.6 Portland Cement Manufacturing, Table 11.6-9: Summary of Noncriteria Pollutant Emission Factors for Portland Cement Kilns. These contaminants are calculated on the Kiln - Non-Dust source sheet.

The data quality has been assumed to be Above Average.

Sample Calculation

NOx Emission Rate = Capacity [Nm³/hr] x Output Concentration [mg/Nm³] x Conversion Factors

$$\text{NOx Emission Rate} = \frac{692{,}780\ \text{Nm}^3}{\text{hr}} \times \frac{1{,}200\ \text{mg}}{\text{Nm}^3} \times \frac{1\ \text{g}}{1000\ \text{mg}} \times \frac{1\ \text{hr}}{3600\ \text{s}}$$

$$\text{NOx Emission Rate} = \frac{2.31\text{E+02}\ \text{g}}{\text{s}}$$

Conversion Factors

1 g =	1000	mg
1 hr =	3600	s
1 day =	24	hr
1 pg =	1.00E-09	mg
deg K =	273.15	+ deg C

Dioxins and Furans In Stack Limit Assumption

Emission Source	In Stack Limit*
Cement Kilns	80

*In-stack expressed in units of pg/m³

Reference: Dioxins and Furans CWS Status Report, October 2004
http://www.ccme.ca/files/Resources/air/dioxins_furans/d_f_2004_sector_status_rpt_e.pdf

Assumed Flow Rate Conditions*

Normalized Temp=	20	C
Normalized Temp=	293	K

*corrected only for temperature

Particle Size Distribution

Particle Size [µm]	Cumulative % Particle Distribution	Fabric Filter Collection Efficiencies
SPM	—	99.5%
PM10	53%	99.5%
PM2.5	18%	99.0%

Reference: Cumulative % Particle Distribution — US EPA AP-42 Appendix B.2 - GENERALIZED PARTICLE SIZE DISTRIBUTIONS, Category 5
Fabric Filter Collection Efficiencies: Table B.2-3

Notes:
- SPM collection efficiency was conservatively assumed to equal the control efficiency of PM10
- SPM inlet emission rate was estimated using the SPM outlet concentration provided by Colacem and the assumed SPM collection efficiency
- PM10 and PM2.5 inlet emission rates were estimated using SPM inlet emission rates and the cumulative % particle distribution
- PM10 and PM2.5 outlet emission rates were estimated using the fabric filter collection efficiencies and their inlet emission rates

Emissions Summary

Stack/Modelling ID	Stack/Source Name	Actual Flow Rate [Am³/hr]	Stack Temperature [°C]	Normalized Flow Rate [Nm³/hr]	Contaminant	CAS	Outlet Concentration [mg/Nm³]	Daily Emission Rate [g/s]
E18	Kiln Dust Collector	1,000,000	150	692,780	SPM	N/A-1	20	3.85E+00
					PM_{10}	N/A-2	—	2.04E+00
					$PM_{2.5}$	N/A-3	—	1.39E+00
					Carbon Monoxide	630-08-0	400	7.70E+01
					Nitrogen Oxides	10102–44–0	1,200	2.31E+02
					Ammonia	7664-41-7	40	7.70E+00
					Sulfur Dioxide	7446-09-5	200	3.85E+01
					Dioxins and Furans (TEQ)	N/A-4	8.00E-08	1.54E-08

Kiln - Inorganics (including Metals) and Organics - E18

Parameters

Daily Throughput = 3,000 ton/day

Methodology

Emissions of organics and inorganics (including metals) were estimated using the method described in the US EPA AP-42 Chapter 11.6 Portland Cement Manufacturing (1/95), Table 11.6-9.
If an emission factor was available for both Fabric Filter (FF) and Electrostatic Percipitator (ESP), the lower value was used since the kiln has a hybrid filter (FF and ESP).

The emitted ions identified in the table have been assumed to be emitted from the kiln as a particulate. Therefore they have not been included in Table 2 - Source Summary Table.

Sample Calculation

Emission Rate [g/s] = Daily Throughput [ton/day] x Emission Factor [lb/ton] x Conversion Factors

Copper Emission Rate [g/s] = $\frac{3{,}000 \text{ ton}}{\text{day}} \times \frac{5.30\text{E-03 lb}}{\text{ton}} \times \frac{454 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$

Copper Emission Rate [g/s] = $\frac{8.35\text{E-02 g}}{\text{s}}$

Conversion Factors

1 lb =	454	g
1 hr =	3600	s
1 day =	24	hr

Emissions Summary

Source	Contaminant Type	Contaminant	CAS	Emission Factor [lb/ton]	Daily Emission Rate [g/s]	US EPA Data Quality	Comment
E18	Inorganics	Silver	7440-22-4	6.10E-07	9.61E-06	D	—
		Aluminum	7429-90-5	1.30E-02	2.05E-01	E	Assumed to be part of SPM emitted from the kiln
		Arsenic	7440-38-2	1.20E-05	1.89E-04	D	—
		Barium	7440-39-3	3.50E-04	5.51E-03	D	—
		Beryllium	7440-41-7	6.60E-07	1.04E-05	D	—
		Calcium Oxide	1305-78-8	2.40E-01	5.29E+00	E	Calcium emission factor
		Cadmium	7440-43-9	2.20E-06	3.46E-05	D	—
		Chloride	N/A-5	2.10E-03	3.31E-02	D	
		Chromium	7440-47-3	7.70E-06	1.21E-04	E	—
		Copper	7440-50-8	5.30E-03	8.35E-02	E	—
		Hydrogen Fluoride	7664-39-3	9.00E-04	1.49E-02	E	Fluoride emission factor
		Iron	15438-31-0	1.70E-02	2.68E-01	E	Metallic Iron
		Hydrogen Chloride	7647-01-0	4.90E-02	7.72E-01	E	—
		Mercury	7439-97-6	2.40E-05	3.78E-04	D	—
		Potassium	7440-09-7	1.80E-02	2.83E-01	D	—
		Manganese	7439-96-5	8.60E-04	1.35E-02	E	—
		Ammonia	7664-41-7	1.00E-02		E	Calculated with site EF
		Ammonium	N/A-6	1.10E-01	1.73E+00	D	Assumed to be part of SPM emitted from the kiln
		Nitrate	N/A-7	4.60E-03	7.24E-02	E	Assumed to be part of SPM emitted from the kiln
		Sodium	7440-23-5	3.80E-02	5.98E-01	D	Assumed to be part of SPM emitted from the kiln
		Lead	7439-92-1	7.50E-05	1.18E-03	D	—
		Sulfur trioxide	N/A-8	1.40E-02	2.20E-01	D	
		Sulfate	N/A-9	7.20E-03	1.13E-01	D	Assumed to be part of SPM emitted from the kiln
		Selenium	7782-49-2	1.50E-04	2.36E-03	E	—
		Thallium	7440-28-0	5.40E-06	8.50E-05	D	—
		Titanium	7440-32-6	3.70E-04	5.83E-03	E	—
		Zinc	7440-66-6	3.40E-04	5.35E-03	D	—
	Organics	C3 benzenes	N/A-10	2.60E-06	4.09E-05	E	—
		C4 benzenes	N/A-11	6.00E-06	9.45E-05	E	—
		C6 benzenes	N/A-12	9.20E-07	1.45E-05	E	—
		Acenaphthylene	208-96-8	1.20E-04	1.89E-03	E	—
		Acetone	67-64-1	3.70E-04	5.83E-03	D	—
		Benzaldehyde	100-52-7	2.40E-05	3.78E-04	E	—
		Benzene	71-43-2	3.10E-03	4.88E-02	D	—
		Benzo(a)anthracene	56-55-3	4.30E-08	6.77E-07	E	—
		Benzo(a)pyrene	50-32-8	1.30E-07	2.05E-06	E	—
		Benzo(b)fluoranthene	205-99-2	5.60E-07	8.82E-06	E	—
		Benzo(g,h,i)perylene	191-24-2	7.80E-08	1.23E-06	E	—
		Benzo(k)fluoranthene	207-08-9	1.50E-07	2.36E-06	E	—
		Benzoic acid	65-85-0	3.50E-03	5.51E-02	D	—
		Biphenyl	92-52-4	6.10E-06	9.61E-05	E	—
		Bis(2-ethylhexyl)phthalate	117-81-7	9.50E-05	1.50E-03	D	—
		Bromomethane	74-83-9	4.30E-05	6.77E-04	E	—
		Carbon disulfide	75-15-0	1.10E-04	1.73E-03	D	—
		Chlorobenzene	108-90-7	1.60E-05	2.52E-04	D	—
		Chloromethane	74-87-3	3.80E-04	5.98E-03	E	—
		Chrysene	218-01-9	1.60E-07	2.52E-06	E	—
		Di-n-butylphthalate	84-74-2	4.10E-05	6.46E-04	D	—
		Dibenz(a,h)anthracene	53-70-3	6.30E-07	9.92E-06	E	—
		Ethylbenzene	100-41-4	1.90E-05	2.99E-04	D	—
		Fluoranthene	206-44-0	8.80E-06	1.39E-04	E	—
		Fluorene	86-73-7	1.90E-05	2.99E-04	E	—
		Formaldehyde	50-00-0	4.60E-04	7.24E-03	E	—
		Freon 113	76-13-1	5.00E-05	7.87E-04	E	—
		Indeno(1,2,3-cd)pyrene	193-39-5	8.70E-08	1.37E-06	E	—
		Methyl ethyl ketone	78-93-3	3.00E-05	4.72E-04	E	—
		Methylene chloride	75-09-2	4.90E-04	7.72E-03	E	—
		Methylnaphthalene	90-12-0	4.20E-06	6.61E-05	E	—
		Naphthalene	91-20-3	2.20E-04	3.46E-03	D	—
		Phenanthrene	85-01-8	3.90E-04	6.14E-03	E	—
		Phenol	108-95-2	1.10E-04	1.73E-03	D	—
		Pyrene	129-00-0	4.40E-06	6.93E-05	E	—
		Styrene	100-42-5	1.50E-06	2.36E-05	E	—
		Toluene	108-88-3	1.90E-04	2.99E-03	D	—
		Xylenes	1330-20-7	1.30E-04	2.05E-03	D	—

*Calcium has been assessed as Calcium Oxide
** Fluoride has been assessed as Hydrogen Fluoride
*** Metallic iron
The ions identified in the table above have been assumed to be emitted from the kiln as a particulate. Therefore they have not been included in Table 2 - Source Summary Table.

Raw Materials Fugitive Emissions - FUG1 - FUG8

Description and Methodology

The following facility operations have the potential to emit fugitive dust:
- the facility receives various raw materials at the Raw Material Receiving area;
- the facility receives Petcoke at the Petcoke Receiving area; and
- the Petcoke is stored in a below-grade storage area and loaded onto the Petcoke hopper.

All raw material transfers are completed in covered buildings that are equipped with dust collectors (see E1 to E4) and the potential fugitive emissions are conservatively assessed as part of FUG1 - FUG6. Petcoke receiving takes place outside while Petcoke loading onto hopper takes place below grade. These fugitive sources are conservatively assessed as part of FUG7 and FUG8, respectively. These emissions were estimated using the drops equation presented in U.S. EPA Chapter 13.2.4 Aggregate Handling and Storage Piles. With the exception of Petcoke receiving, all materials received at the facility will either be controlled by dust collectors, covered sheds/structures, carried out inside of buildings or in below-grade structures. A control factor of 75% has been applied accordingly.

The emission rate for crystalline silica released from material receiving (silica sand and limestone) were estimated using the percentage of emissions provided in AWMA's article for crystalline silica compared to PM10, which was calculated to be 6.6%. The crystalline silica emissions were calculated by multiplying the estimated emission rate of PM10 by 6.6%. The AWMA article has been provided in Appendix C.

For the purpose of this assessment, worst case material receiving was assumed to occur in November. However, Bauxite is received at its maximum amount in October. The project monthly throughputs can be found in Appendix C. It has been conservatively assumed that all materials will be received simultaneously.

The data quality was assumed to be Above Average.

Specifications and Operating Rate

Fugitive ID	Source Name	Moisture Content (M) [%]	Mean Wind Speed (U) [m/s]	Maximum Monthly Throughput [ton/month]	Maximum Daily Throughput [ton/day]
FUG1	Limestone Receiving	1	1.0	117,739	5352
FUG2	Bauxite Receiving	14	1.0	25,032	1138
FUG3	Shale Receiving	4	1.0	7,729	351
FUG4	Iron Ore Receiving	4.3	1.0	2,045	93
FUG5	Silica Receiving	2.5	1.0	12,789	581
FUG6	Gypsum Receiving	2	1.0	6,955	316
FUG7	Petcoke Receiving	8	8.0	49,565	2253
FUG8	Petcoke Loading to Hopper	8	1.0	49,565	2253

Notes:
1. Trucks bring bauxite and petcoke only two months per year.
2. Moisture Content provided by Colacem on July 20, 2015 (Air and Noise IR).

Parameters

Annual Outdoor Wind Speed =	12.9 km/hr 8.0 mph	Reference: Environment Canada, 1981 to 2010 Canadian Climate Normals station data - OTTAWA MACDONALD-CARTIER INT'L A
Enclosed/Below Grade Wind Speed =	1.0 mph	
Operating Rate =	24 hr/day 22 days/month	
Percentage of crystalline silica in PM10 =	6.6%	Reference: AWMA - PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate-Producing Sources in California (Richards et al., 2012)
Percent Fe_2O_3 in Iron Ore =	100%	Assumed concentration
Assumed Emission Control =	75%	Reference: Enclosed or Below Grade

Conversion Factors

1 g =	1000	mg
1 hr =	3600	s
1 lb =	454	g

Made By: KL
Checked By: JDM

Methodology

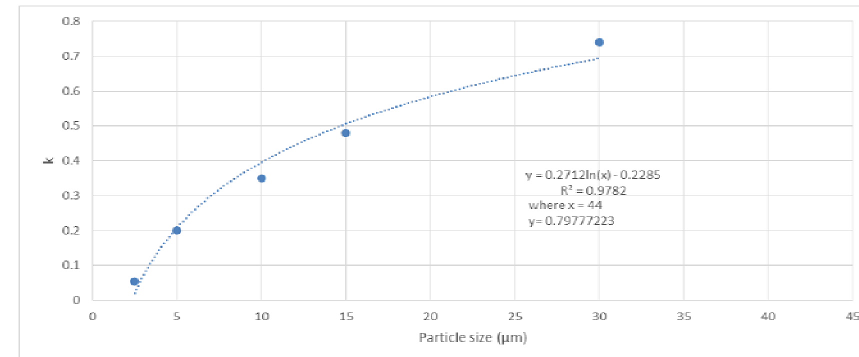
Reference US EPA AP-42, Chapter 13.2.4 Aggregate Handling and Storage Piles

$$EF = k \times 0.0032 \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where:
- EF = Emission Factor (lb/ton)
- k = Particle sized multiplier (dimesionless)
- U = Mean wind speed (mph)
- M = Material moisture content (%)

Aerodynamic Particle Size Multiplier (*k*)			
PM44	**PM30**	**PM10**	**PM2.5**
0.8	0.74	0.35	0.053

Where k for PM<44 μm was extrapolated using the logarithmic regression for the particle size versus particle size multiplier (k).



Sample Calculations - FUG1

Emission Factor [lb/ton]

$$\text{SPM Emission Factor} = 0.8 \times 0.0032 \times \frac{\left(\frac{1.0}{5}\right)^{1.3}}{\left(\frac{1}{2}\right)^{1.4}}$$

$$\text{SPM Emission Factor} = 8.34\text{E-}04 \ \frac{lb}{ton}$$

Emission Rate [g/s]

SPM Emission Rate = Emission Factor [lb/ton] x Movement Rate [ton/hr] x Conversion Factors

$$\text{SPM Emission Rate} = 8.34\text{E-}04 \ \frac{lb}{ton} \times 5352 \ \frac{ton}{day} \times 454 \ \frac{g}{lb} \times \frac{1 \ day}{24 \ hr} \times \frac{1 \ hr}{3600 \ s} \times (100\% - 75\%)$$

$$\text{SPM Emission Rate} = 5.86\text{E-}03 \ \frac{g}{s}$$

Emissions Summary

Stack ID	Source Name	Moisture Content (M) [%]	Mean Wind Speed (U) [m/s]	Maximum Daily Throughput [ton/day]	SPM Emission Factor [lb/ton]	Emission Control Efficiency [%]	Daily Emission Rate [g/s]				
							SPM	**PM_{10}**	**$PM_{2.5}$**	**Crystalline Silica**	**Ferric Oxide**
							N/A-1	**N/A-2**	**N/A-3**	**14808-60-7**	**1309-37-1**
FUG1	Limestone Receiving	1	1.0	5352	7.71E-04	75%	5.42E-03	2.56E-03	3.88E-04	1.68E-04	—
FUG2	Bauxite Receiving	14	1.0	1138	1.92E-05		2.86E-05	1.35E-05	2.05E-06	—	—
FUG3	Shale Receiving	4	1.0	351	1.11E-04		5.11E-05	2.41E-05	3.66E-06	—	—
FUG4	Iron Ore Receiving	4.3	1.0	93	1.00E-04		1.22E-05	5.77E-06	8.74E-07	—	1.22E-05
FUG5	Silica Receiving	2.5	1.0	581	2.14E-04		1.63E-04	7.72E-05	1.17E-05	5.07E-06	—
FUG6	Gypsum Receiving	2	1.0	316	2.92E-04		1.21E-04	5.73E-05	8.68E-06	—	—
FUG7	Petcoke Receiving	8	8.0	2253	6.28E-04	0%	7.43E-03	3.51E-03	5.32E-04	—	—
FUG8	Petcoke Loading to Hopper	8	1.0	2253	4.20E-05	75%	1.24E-04	5.87E-05	8.89E-06	—	—

Paved Road Dust Emissions

Description and Methodology

All roads at the facility will be paved. It has been assumed that any potential dust emissions will be mitigated; therefore a control efficiency of 80% has been applied to emissions from paved roads. Emissions of particulate matter (SPM, PM10 and PM2.5) were estimated using the method described in the US EPA AP-42 Chapter 13.2.1 Paved Roads (11/06) using the equation for an industrial site.

Type of Vehicle	Truck Capacity [ton]	Empty Truck Weight [ton]	Maximum Truck Weight [ton]	Mean Truck Weight [ton]
On-Highway	39	21	60	41
Off-Highway	65	44	109	77

Notes:
On-Highway: On-highway truck paramters were used for truck with higher mean weight
Off-Highway: http://www.perlini-equipment.com/index.php?option=com_content&view=article&id=74&Itemid=102

Paved Roads Control Efficiency = 80%

Methodology

PM emissions due to vehicle traffic on paved roads are estimated using the method described in the US EPA AP-42 Chapter 13.2.1 Paved Roads (11/06) as per the following equation:

$$E = k\,(sL)^{0.91}(W)^{1.02}$$

Where:
E = Emission Factor [g/VKT]
k = Particle size multiplier
sL = Road Surface Silt Loading [g/m²]
W = Average Vehicle Weight [tons]

Table 13.2.1-1: Particle Size Multipliers for Paved Road Equation

Constant	PM2.5	PM10	PM30
k [g/VKT]	0.15	0.62	3.23

Note: SPM = PM30

Mean Road Surface Silt Loading (sL) 2 g/m²

Conversion Factors

1 hr = 3600 s
1 day = 24 hr

Emission Factors

Contaminant	CAS	Particle Size Multiplier [g/VKT]	Road Surface Silt Loading [g/m²]	Control Efficiency	On-Highway Vehicle: Average Vehicle Weight [tons]	On-Highway Vehicle: Emission Factor [g/VKT]	Off-Highway Vehicle: Average Vehicle Weight [tons]	Off-Highway Vehicle: Emission Factor [g/VKT]	Total Emissions (g/s)
SPM	N/A-1	3.23	2	80%	41	265	77	506	3.74E-01
PM10	N/A-2	0.62	2	80%	41	51	77	97	7.17E-02
PM2.5	N/A-3	0.15	2	80%	41	12	77	24	1.74E-02

Sample Calculation - Daily SPM Emission Rate for RS-11

The following parameters were used to calculate Emission rates of SPM:

k = 3.23 g/VKT
sL = 2 g/m²
W = 77 tons

SPM Emission Factor

$$EF = \frac{3.23\ g}{VKT}\left(\frac{2\ g}{m^2}\right)^{0.91}\left(77\ tons\right)^{1.02}$$

$$EF = \frac{506\ g}{VKT}$$

SPM Emission Rate (Daily)

$$ER_{PM} = \frac{506\ g}{VKT}\times\frac{7\ VKT}{day}\times\frac{1\ day}{24\ hour}\times\frac{1\ hr}{3600\ s}\times 20\%\ ^*$$

$$ER_{PM} = \frac{8.72E-03\ g}{s}$$

*The factor of 0.20 represents an emissions reduction factor of 80% due to the implementation of the Facility's dust control practices.

Paved Road Dust Emissions Calculations

Table C4-1: Road Lengths of Segments

Segment ID	Segment #	IDs	# of Model Segments [Count]	Model Spacing	Road Length [km]
RS-1	1	CT, SF, AF, RM, PC	8	16.7	0.13
RS-2	2	CT, SF, AF, RM, PC	7	22.0	0.15
RS-3	3	CT, SF, AF, RM, PC	7	16.7	0.12
RS-4	4	PC, RM	61	16.7	1.02
RS-5	5	CT	23	11.3	0.26
RS-6	6	PC	76	11.3	0.86
RS-7	7	RM	22	11.3	0.25
RS-8	8	AF	3	11.3	0.03
RS-9	9	SF	29	11.3	0.33
RS-10	10	CT, SF, AF, PC	18	16.7	0.30
RS-11	11	LS	8	11.3	0.09

Table C4-2: Truck Throughputs

Truck Activities	Code	Truck Trips/Month	Days/Month	Hours/Day	Trips/Day	Trips/hour
Limestone	LS	1,811.4	22	8	82.3	10.3
Petcoke	PC		3	24	0.0	0.0
Iron	RM	58.4	22	8	2.7	0.3
Bauxite	RM		3	24	0.0	0.0
Shale	RM	220.8	22	8	10.0	1.3
Gypsum	RM	198.7	3	24	66.2	2.8
Silica	RM	365.4	22	8	16.6	2.1
Silica fume and fly ash	SF	119.1	22	8	5.4	0.7
Cement Truck	CT	3,476.3	22	8	158.0	19.8
LS cement	LSC	94.4	22	8	4.3	0.5

Notes: Limestone is based on maximum throughput and 65-ton trucks.
Alternative FUels and Limestone Cement were not considered.
Assumed Pet Coke represents worst-case scenario.

Table C4-3: VKT/hour

Activity Code	LS	PC	RM	AF	SF	CT	Trips/hour/segment	Road Length [km]	VKT/hour
Segment/# Trips-hr	10.3	0.0	6.4	0.0	0.7	19.8			
RS-1	No	Yes x 2	Yes x 2	Yes x 2	Yes x 2	Yes x 2	54	0.13	7
RS-2	No	Yes x 2	Yes x 2	Yes x 2	Yes x 2	Yes x 2	54	0.15	8
RS-3	No	Yes x 1	Yes x 2	Yes x 2	Yes x 2	Yes x 2	54	0.12	6
RS-4	No	Yes x 1	Yes x 2	No	No	No	13	1.02	13
RS-5	No	No	No	No	No	Yes x 1	20	0.26	5
RS-6	No	Yes x 1	No	No	No	No	0	0.86	0
RS-7	No	No	Yes x 2	No	No	No	13	0.25	3
RS-8	No	No	No	Yes x 1	Yes x 1	No	0.68	0.03	0
RS-9	No	No	No	No	Yes x 1	Yes x 1	20	0.33	7
RS-10	No	Yes x 1	No	No	Yes x 1	Yes x 1	20	0.30	6
RS-11	Yes x 1	No	No	No	No	No	10	0.09	1

Note: any trucks travelling in both directions (i.e., Yes x 2) take the same route for both directions of travel.

Table C4-4: VKT/day

Activity Code	LS	PC	RM	AF	SF	CT	Trips/day/segment	Road Length [km]	VKT/day
Segment/# Trips-hr	82.3	0.0	95.5	0.0	5.4	158.0			
RS-1	No	Yes x 2	Yes x 2	Yes x 2	Yes x 2	Yes x 2	518	0.1336	69.20
RS-2	No	Yes x 2	Yes x 2	Yes x 2	Yes x 2	Yes x 2	518	0.154	79.76
RS-3	No	Yes x 1	Yes x 2	Yes x 2	Yes x 2	Yes x 2	518	0.1169	60.55
RS-4	No	Yes x 1	Yes x 2	No	No	No	191	1.0187	194.65
RS-5	No	No	No	No	No	Yes x 1	158	0.2599	41.07
RS-6	No	Yes x 1	No	No	No	No	0	0.8588	0.00
RS-7	No	No	Yes x 2	No	No	No	191	0.2486	47.50
RS-8	No	No	No	Yes x 1	Yes x 1	No	5	0.0339	0.18
RS-9	No	No	No	No	Yes x 1	Yes x 1	163	0.3277	53.55
RS-10	No	Yes x 1	No	No	Yes x 1	Yes x 1	163	0.3006	49.13
RS-11	Yes x 1	No	No	No	No	No	82	0.0904	7.44

Table C4-6: Emissions Summary - Daily Road Dust and Tailpipe

Paved Roads Control Efficiency = 80%

Activity Code	VKT/day	Road Dust [g/s]		
		SPM	PM10	PM2.5
		265	51	12
RS-1	69	4.24E-02	8.14E-03	1.97E-03
RS-2	80	4.89E-02	9.38E-03	2.27E-03
RS-3	61	3.71E-02	7.12E-03	1.72E-03
RS-4	195	1.1927E-01	2.29E-02	5.54E-03
RS-5	41	2.52E-02	4.83E-03	1.17E-03
RS-6	0	0.00E+00	0.00E+00	0.00E+00
RS-7	47.5	2.91E-02	5.59E-03	1.35E-03
RS-8	0	1.12E-04	2.16E-05	5.22E-06
RS-9	54	3.28E-02	6.30E-03	1.52E-03
RS-10	49	3.01E-02	5.78E-03	1.40E-03
		3.65E-01	**7.00E-02**	**1.69E-02**
Limestone Trucks		506	97	24
RS-11	7	8.72E-03	1.67E-03	4.05E-04

Conversion Factors

1 hr = 3600 s
1 day = 24 hr

APPENDIX C

Supporting Information

Waste Gas Treatment System for the Kiln and Mill

The waste gas treatment system for kiln and mill is a gas conditioning and filtering system.

The process gas coming from the preheater and the excess air coming from the cooler mixed together go to the conditioning and filtering system if the raw mill is not running. If raw mill is running, a big portion of the preheater gas goes to raw mill for raw material draying, after that goes to filtering system where is cleaned together with the excess air from cooler.

The conditioning system is done by a conditioning tower where the temperature of gas at the system outlet is controlled sprying water at the conditioning tower inlet, using a automatic control system on water flow rate.

The filtering system is done by an hibrid filter, a combination of an electrostatic precipitator sections installed before a bag filter sections both in the same casing.

The Hybrid filter is an emission control technology that removes fine particles from exhaust gases.

Electrostatic precipitators are inadequate for fine-particle capture, and fabric filters have high pressure drop and short lifetime because of filter blinding. Although people have been trying to combine the two mechanisms, technical challenges remain such as protection of the bags from electrically induced damage and suppression of particle reentrainment.

The Hybrid filter integrates electrostatic precipitation (ESP) and filter bag technologies into the same housing. The unique synergy between these two technologies suppresses particle reentrainment and thus creates a compact, durable, cost-effective, and highly efficient particulate matter collection system that is superior to either technology by itself.

Benefits

- Superior collection efficiency (>99.99%) for all particle sizes.
- A long, effective bag life, as the bags are well protected and cleaned without normal dust reentrainment.
- System size reduction (less than the normal number of ESP components and 65%–75% fewer bags than a conventional fabric filter) as it operates at a high filtration velocity.
- Low energy consumption during continuous operation.
- Easy to implement and retrofit, as there is little reliance on external control parameters.

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John R. Richards [a] , Todd T. Brozell [a] , Charles Rea [b] , Geoff Boraston [c] & John Hayden [d]

[a] Air Control Techniques P.C. , Cary , NC , USA

[b] California Construction and Industrial Minerals Association , Sacramento , CA , USA

[c] Granite Construction, Inc. , Watsonville , CA , USA

[d] National Stone, Sand, & Gravel Association , Alexandria , VA , USA

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John R. Richards and Todd T. Brozell
Air Control Techniques, P.C., Cary, NC

Charles Rea
California Construction and Industrial Minerals Association, Sacramento, CA

Geoff Boraston
Granite Construction, Inc., Watsonville, CA

John Hayden
National Stone, Sand, & Gravel Association, Alexandria, VA

ABSTRACT

The California Construction and Industrial Minerals Association and the National Stone, Sand, & Gravel Association have sponsored tests at three sand and gravel plants in California to compile crystalline silica emission factors for particulate matter (PM) of aerodynamic diameter of 4 μm or less (PM_4) and ambient concentration data. This information is needed by industrial facilities to evaluate compliance with the Chronic Reference Exposure Level (REL) for ambient crystalline silica adopted in 2005 by the California Office of Environmental Health Hazard Assessment. The REL applies to PM_4 respirable PM. Air Control Techniques, P.C. sampled for PM_4 crystalline silica using a conventional sampler for PM of aerodynamic diameter of 2.5 μm or less ($PM_{2.5}$), which met the requirements of 40 *Code of Federal Regulations* Part 50, Appendix L. The sample flow rate was adjusted to modify the 50% cut size to 4 μm instead of 2.5 μm. The filter was also changed to allow for crystalline silica analyses using National Institute for Occupational Safety and Health (NIOSH) Method 7500. The particle size-capture efficiency curve for the modified Appendix L instrument closely matched the performance curve of NIOSH Method 0600 for PM_4 crystalline silica and provided a minimum detection limit well below the levels attainable with NIOSH Method 0600. The results of the tests indicate that PM_4 crystalline silica emissions range from 0.000006 to 0.000110 lb/t for screening operations, tertiary crushers, and conveyor transfer points. The PM_4 crystalline silica emission factors were proportional to the crystalline silica content of the material handled in the process equipment. Measured ambient concentrations ranged from 0 (below detectable limit) to 2.8 μg/m^3. All values measured above 2 μg/m^3 were at locations upwind of the facilities being tested. The ambient PM_4 crystalline silica concentrations measured during this study were below the California REL of 3 μg/m^3. The measured ambient concentrations in the PM_4 size range are consistent with previously published ambient crystalline silica data applicable to the $PM_{2.5}$ and PM of aerodynamic diameter of 10 μm or less (PM_{10}) size ranges.

> **IMPLICATIONS**
>
> Mineral processing facilities need PM_4 crystalline silica emission factor data to evaluate compliance with the 3 μg/m^3 Chronic REL for PM_4 ambient crystalline silica adopted in 2005 by the California Office of Environmental Health Hazard Assessment. Emission tests at three sand and gravel plants have provided PM_4 crystalline silica data for screens, crushers, and conveyors. Mineral processing facilities can use the emission factor data to evaluate compliance with the stringent ambient PM_4 crystalline silica limit.

INTRODUCTION

Crystalline Silica Emission Factors of Particulate Matter of Aerodynamic Diameter of 4 μm or Less

There are no previously published data concerning particulate matter (PM) of aerodynamic diameter of 4 μm or less (PM_4) crystalline silica emissions from aggregate producing plants or other mineral industry sources. The PM_4 crystalline silica emission factors can be estimated based on published data concerning emission factors for PM of aerodynamic diameter of 10 μm (PM_{10}) or 2.5 μm ($PM_{2.5}$) or less for aggregate producing plants.[1–9] The U.S. Environmental Protection Agency (EPA) AP42 Section 11.19-2 emission factors for tertiary crushers, screens, and conveyor transfer points indicate that the $PM_{2.5}$ emissions range from 0.000013 to 0.000100 lb/t of stone. The AP42 Section 11.19-2 PM_{10} emission factors for these three types of processing equipment range from 0.000046 to 0.00074 lb/t.

These emission factors provide a starting point for evaluating possible PM_4 crystalline silica emission factors. It is reasonable to expect the PM_4 total emission factors to be between the $PM_{2.5}$ and PM_{10} emission factors. The PM_4

crystalline silica emission factors will depend on the crystalline silica content of the PM_4 total PM.

Ambient Crystalline Silica Concentrations

No PM_4 ambient concentration or emission factor data have been published. All previous crystalline silica ambient concentration data applied to the $PM_{2.5}$, PM_{10}, and/or PM of 15-μm or less (PM_{15}) size ranges.

One of the first studies of ambient crystalline silica concentrations was conducted by Davis et al.[10] This study focused on urban areas. Ambient crystalline silica concentrations were measured in 22 urban areas using dichotomous samplers that separate ambient PM into the 0- to 2.5-μm range ("fine PM") and the 2.5- to 15-μm range (termed here as "coarse/supercoarse PM"). Davis et al. measured mean 24-hr average ambient crystalline silica concentrations ranging from 0.9 to 8 $\mu g/M^3$ in the coarse/supercoarse size range. Crystalline silica was 1–9% of the coarse/supercoarse PM and 0–2.6% of the fine (<2.5 μm) PM.

EPA[11] used the data of Davis et al. to derive estimates of the annual average crystalline silica levels in urban areas. The city-specific crystalline silica content values were multiplied by annual average PM_{10} concentrations in these areas to estimate the annual average PM_{10} crystalline silica levels. EPA also calculated an annual average of 1.9 $\mu g/m^3$ with a range of 0.8–5 $\mu g/m^3$ in the PM_{10} size range. The crystalline silica content in the $PM_{2.5}$ size range was consistently less than 1 $\mu g/m^3$ because of the low crystalline silica content of the $PM_{2.5}$ PM and the low total concentration of $PM_{2.5}$ PM.

In 2000, the National Stone, Sand, & Gravel Association (NSSGA) sponsored upwind-downwind studies of ambient crystalline silica concentrations at four stone crushing plants processing high-quartz-content rock.[12] Air Control Techniques, P.C. used Rupprecht & Patashnick Co, Inc. Federal Reference Method (FRM)-2000 samplers that fully met the stringent design and operating specifications of 40 *Code of Federal Regulations* (CFR) Part 50, Appendix L.[13] The measured 8-hr working-shift PM_{10} crystalline silica concentrations at the collocated downwind PM_{10} samplers ranged from 1 to 10.9 $\mu g/m^3$. These values are similar to the range of mean 24-hr concentration values of 0.9–8 $\mu g/m^3$ for 24-hr concentrations measured by Davis et al. in the coarse/supercoarse size range. The measured upwind and downwind concentrations were similar. The crystalline silica levels of 5.07–6.24% by weight of the PM_{10} were similar to the 4.9 ± 2.3% levels in coarse/supercoarse PM reported by Davis et al.

Various other studies have provided limited data for urban, rural, and industrial areas. Puledda[14] measured PM_{10} crystalline silica levels in Rome, Italy of 0.11–2.27 $\mu g/m^3$. These levels were 1.7–3.4% of the measured PM_{10}. Norton and Gunter[15] measured PM_{10} crystalline silica levels averaging 10% in Moscow, ID. They also extracted PM from PM_{10} samples from numerous areas throughout Idaho and estimated crystalline silica levels to be between 7 and 16% of PM_{10} in various urban and rural areas in Idaho. Various other studies described by EPA[11] at urban, rural, and industrial areas indicated 24-hr average crystalline silica levels and crystalline silica contents in PM_{10} that were similar to those in Davis et al.,[10] Air Control Techniques, P.C.,[12] Puledda,[14] and Norton and Gunter.[15] These other studies include Schipper,[16] Goldsmith,[17] Chow et al.,[18] Chow,[19] and Chow.[20] Only the study of Shakari and Holmen[21] reported crystalline silica levels and PM_{10} crystalline silica contents outside of the range of the various papers summarized above. There are insufficient data in Shakari and Holmen to identify the possible reasons for the differences between their data and other studies.

On the basis of the available ambient crystalline silica data, the study participants concluded that there was a need for a monitoring technique having a minimum detectable limit of 0.3 $\mu g/m^3$. This is at or below the concentrations anticipated in this project. This minimum detectable concentration is also 10% of the California Relative Exposure Limit. An evaluation of National Institute for Occupational Safety and Health (NIOSH) Method 0600 used for in-plant industrial hygiene tests indicated that this method was not sufficiently precise at the necessary detection limit. Accordingly, the California Construction and Industrial Minerals Association (CalCIMA) and NSSGA sponsored the development of a more accurate and precise PM_4 crystalline silica monitoring method for this project. Information concerning the development of the PM_4 crystalline silica monitoring method on the basis of the validated $PM_{2.5}$ test method is described in the project report.[22]

TEST LOCATIONS AND PROCEDURES

PM_4 Crystalline Silica Measurement Test Locations

Study participants selected facilities for testing on the basis of (1) the representativeness of a vibrating screen, tertiary crusher, and conveyor transfer point of other California plants; (2) the representativeness of the crystalline silica content of the minerals processed; (3) the accessibility of the equipment for testing; (4) the capability to isolate the process unit tested from adjacent process units; and (5) the geographical location. The plants included the Service Rock Products, Inc. plant in Barstow; the Vulcan Materials, Inc. Carroll Canyon plant near San Diego; and the Teichert Aggregates, Inc. Vernalis plant near Tracy. These plants had crystalline silica levels ranging from 16.5 to 35.3% by weight in the minerals being processed.

PM_{10} data were compiled to provide a comparison of measured PM_4 crystalline silica emissions with measured PM_{10} emissions. The scope of the programs at each of these three facilities included PM_{10} emission factor tests on the crushers, vibrating screens, and conveyor transfer points.

The specific sources tested at Barstow included (1) a 16- by 5-ft flat vibrating screening operation, (2) a shorthead crusher, and (3) a conveyor transfer point. The equipment tested at Carroll Canyon included (1) a 16- by 8-ft flat vibrating screen, (2) a set of two cone crushers, and (3) a conveyor transfer point. The sources tested at Vernalis included (1) a 20- by 8-ft triple deck sloped vibrating screen, (2) a set of two cone crushers, and (3) a conveyor transfer point. Water sprays controlled all of the units with the exception of the Carroll Canyon cone crushers. A fabric filter supplemented wet suppression control at the Carroll Canyon cone crushers.

PM_4 Crystalline Silica Measurement Procedures

The PM_4 crystalline silica emission concentrations were measured using TECO Model 2000 FRMs modified to have a 50% cut point of 4 μm rather than 2.5 μm. This monitoring method was developed for CalCIMA and NSSGA by Air Control Techniques, P.C. in accordance with a protocol submitted to the California Air Resources Board in July 2005. The authors consider this method to be an extension of the $PM_{2.5}$ ambient monitoring procedures specified by EPA in 40 CFR Part 50, Appendix L because of the use of identical sampling equipment, sampling procedures, and quality assurance procedures.

The main adjustment necessary to an Appendix L qualifying instrument is a change in the 50% cut size of this instrument from $PM_{2.5}$ to PM_4. The 50% cut size was adjusted by reducing the sample airflow rate into the TECO sharp cut cyclone to 11.1 L/min from the 16.67 L/min used for $PM_{2.5}$ monitoring. The adequacy of the cut size was confirmed using National Institute for Standards and Technology (NIST) traceable microspheres.

A calculated sampling time of 1–3 hr was required to meet the minimum detection limits of NIOSH 7500 for crystalline silica during tests on the process equipment. These sampling time estimates were based on (1) the NIOSH Method 7500 detection limit of 5 μg, (2) the TECO FRM 2000 sample gas flow rate of 11.1 L/min that was used to collect PM_4, and (3) the estimated crystalline silica content of the stone material being processed. Crystalline silica was detected in all but one filter sample, which confirmed the adequacy of the 1- to 3-hr sampling periods used in the study. The filter samples were weighted at R.J. Lee Group, Inc. using a microbalance and analyzed for crystalline silica using NIOSH Method 7500.

The fugitive PM_{10} PM emissions from the process equipment sources tested in Barstow were measured using a TECO tapered element oscillating microbalance (TEOM) in accordance with EPA Reference Method IO-3. For the tests at Carroll Canyon and Vernalis, the fugitive PM_{10} PM emissions were measured using TECO Model 2000 FRMs modified for PM_{10}.

Sampling arrays designed based on EPA Method 5D (40 CFR Part 60, Appendix A) captured process equipment PM_4 crystalline silica emissions. The mass fluxes

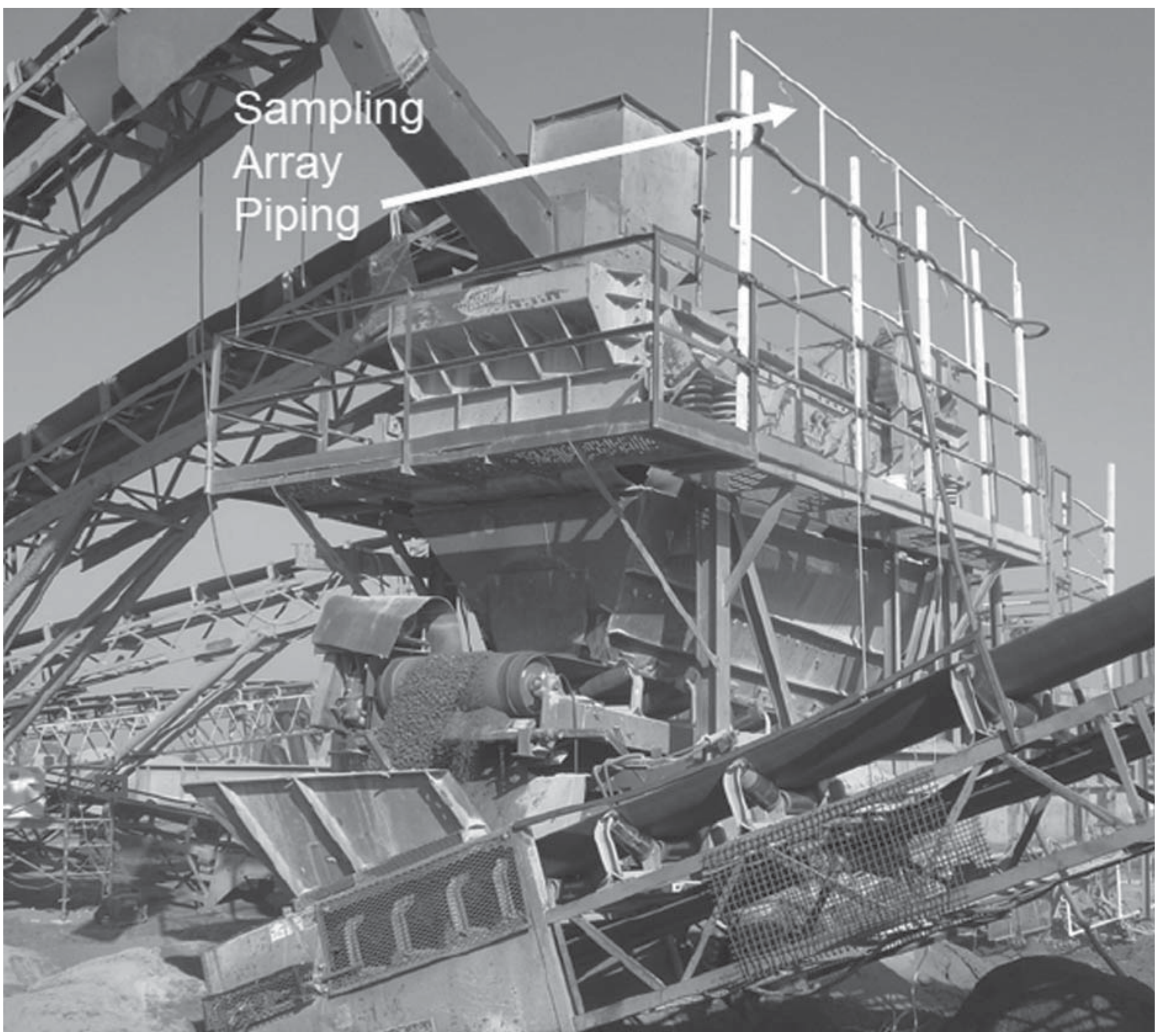

Figure 1. Side view of the sampling array on the downwind side of the vibrating sizing screen at the Barstow plant.

Figure 2. South-side view of sampling array on downwind side of the conveyor transfer point at the Barstow plant.

of PM_4 and PM_{10} fugitive PM through the arrays were calculated by multiplying the total area of the array by the ambient wind speed and the measured PM_4 and PM_{10} concentrations.

The arrays for the vibrating screens, tertiary crushers, and conveyor transfer points were mounted within 5 ft of the locations of PM entrainment by ambient air. Because of this close spacing of the arrays to the source, the "plume" did not have time to substantially disperse in the horizontal or vertical direction. Accordingly, the dispersing PM was captured from the sources even as the ambient winds shifted direction within an angle of approximately 90°.

Each sampling array had more than 100 sampling points. This substantially exceeds the 30 sampling points specified in EPA Method 5D for testing open-top sources. The area monitored by the sampling array exceeded the area subject to dispersion of the PM on the downwind side of the process unit being tested. Each array consisted of manifolds having equally spaced nozzles for air sampling. The gas transport velocities through all sampling tubes and ductwork were above a minimum of 3200 ft/min to prevent any gravitational settling of dust. The sampling manifolds and ductwork were visually inspected after each test run. Following each set of emission tests, the sampling array piping and flex ducts were disassembled and checked for solids deposits. No deposits were present in any sections of the sampling system. Wind speed data and wind direction data demonstrated that each test run was consistent with study requirements.

Each of the array sampling manifolds was ducted together to yield a single sample gas stream. This gas stream flowed through a round duct 12 in. in diameter with sampling ports for a TECO FRM 2000 (modified for PM_4) sampling head and a PM_{10} sampling head. This duct size was the minimum necessary to accommodate the relatively large inlet heads for the TECO FRM 2000 and the TEOM. The gas velocity through the portion of the duct with the sampling ports for the monitoring instruments was less than 10 mph to be consistent with typical ambient wind velocities.

The actual sample gas flow rates through the sampling arrays provided near-isokinetic sampling velocities in the nozzles of the sampling arrays. The nozzles provided isokinetic sampling velocities equal to or lower than 110% at an average ambient wind speed of 5 mph. At isokinetic sampling rates below 100%, there is a slight bias to higher-than-true PM_4 concentrations because of the inertia of the PM_4 particles; however, this isokinetic effect is small for PM_4 particles because of their extremely low mass. Figures 1–3 show the sampling array arrangements.

The ambient airflow rate through each array was calculated based on the area of the array and the measured ambient wind speed. The tests were conducted only when the ambient winds were moving across the process being tested and through the downwind array. The adequacy of fugitive dust capture by the array was documented on a continuous basis using visible wind direction indicators and on an intermittent basis using a nephelometer continuous PM concentration analyzer inside and outside of the array.

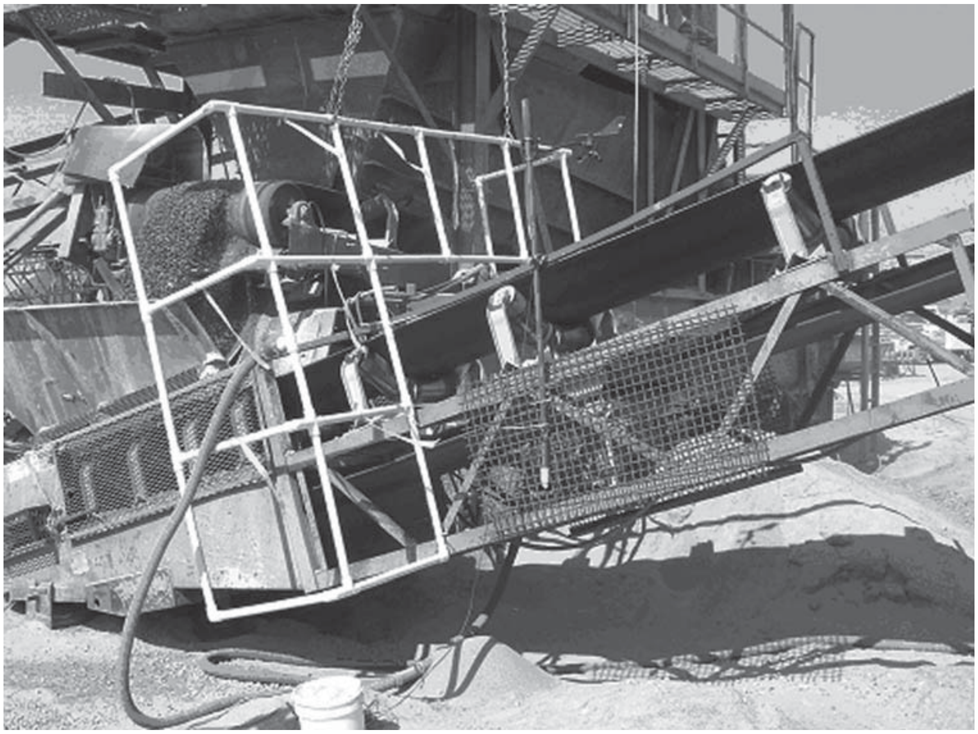

Figure 3. Close-up view of the sampling orifices in the conveyor transfer point array at the Carroll Canyon plant.

As part of this testing program, meteorological monitoring stations were installed to measure the following parameters during the process equipment test programs.

- Average and peak wind speeds
- Wind direction
- Ambient temperature

The sample gas velocities and volumetric flow rates through the main sampling duct during the PM_4 and PM_{10} tests were determined according to the procedures outlined in EPA Reference Method 2.

The authors believe that this fugitive dust capture technique provides the most accurate means possible to quantify fugitive dust emissions without affecting the rate of fugitive dust emissions and without interfering with safe plant operations.

PM_4 Emission Factor Test Program Process Data

During each of the test runs, study participants compiled data concerning the process operating conditions and the characteristics of the materials being handled.

- Crystalline silica content of aggregate being processed through the tested units
- Material moisture content (% wt)
- Material particle size distribution (sieve analyses)
- Material throughput (t/hr)

Ambient PM_4 Crystalline Silica Measurements

The PM_4 crystalline silica ambient concentrations were measured using TECO Model 2000 FRMs adjusted for PM_4 monitoring. Two Model 2000 FRMs were located

Table 1. PM_{10}, PM_4, and PM_4 crystalline silica emission factors at Barstow.

		Emission Factor Values (lb/t) of Stone Throughput		
Equipment Tested	Emission Factor	Measured Value	Ambient Upwind Equivalent[b]	Emission Factor
Vibrating screen	PM_{10}	0.000167[a,c]	NA[c]	0.000167[a,c]
	PM_4	0.000079[c]	NA[c]	0.000079[c]
	PM_4 crystalline silica	0.000006[c]	NA[c]	0.000006[c]
Crusher	PM_{10}	0.002753	0.000172	0.002581
	PM_4	0.001442	0.000172	0.001270
	PM_4 crystalline silica	0.000111	0.000028	0.000083
Conveyor transfer point	PM_{10}	0.000625	0.000050	0.000575
	PM_4	0.000402	0.000050	0.000352
	PM_4 crystalline silica	0.000035	0.000006	0.000029

Notes: [a]PM_{10} emission factors were calculated based on TEOM data. [b]Ambient levels of PM_4 PM and PM_4 crystalline silica upwind of the units tested were subtracted from the emission factors to account for material not emitted by the source. [c]Ambient levels of PM and crystalline silica upwind of the vibrating screens were not subtracted because the upwind samplers were below the elevation of the screens; therefore, the air quality at this elevation was not necessarily representative of air quality on the inlet side of the screen.

Table 2. PM_{10}, PM_4, and PM_4 crystalline silica emission factors at Carroll Canyon.

Equipment Tested	Emission Factor	Emission Factor Values (lb/t) of Stone Throughput: Measured Value	Ambient Upwind Equivalent	Emission Factor
Vibrating screen	PM_{10}	0.000930	0.000100	0.000831
	PM_4	0.000386	0.000029	0.000356
	PM_4 crystalline silica	0.000048	0.000001	0.000046
Crusher	PM_{10}	0.001271	0.000039	0.001232
	PM_4	0.000611	0.000017	0.000593
	PM_4 crystalline silica	0.000099	0.000002	0.000098
Conveyor transfer point	PM_{10}	0.000552	0.000026	0.000525
	PM_4	0.000245	0.000009	0.000236
	PM_4 crystalline silica	0.000031	0.00000	0.000031

Table 3. PM_{10}, PM_4, and PM_4 crystalline silica emission factors at Vernalis.

Equipment Tested	Emission Factor	Emission Factor Values (lb/t) of Stone Throughput: Measured Value	Ambient Upwind Equivalent	Emission Factor
Vibrating screen	PM_{10}	0.001754	0.000061	0.001693
	PM_4	0.000888	0.000006	0.000882
	PM_4 crystalline silica	0.000083	0.000002	0.000081
Crusher	PM_{10}	0.001767	0.000089	0.001677
	PM_4	0.000788	0.000021	0.000767
	PM_4 crystalline silica	0.000110	0.000001	0.000110
Conveyor transfer point	PM_{10}	0.001193	0.000103	0.001090
	PM_4	0.000476	0.000019	0.000457
	PM_4 crystalline silica	0.000088	0.000003	0.000085

Table 4. Comparison of measured PM_{10} PM emission factors and PM_4 crystalline silica emission factors.

Source	Plant	PM_{10} Emission Factors (lb/t)	Crystalline Silica PM_4 Factors (lb/t)	Ratio, Percent PM_4 Crystalline Silica to PM_{10}
Screen	Barstow	0.000167	0.000006	3.59
	Carroll Canyon	0.000831	0.000046	5.54
	Vernalis	0.001693	0.000081	4.78
Crusher	Barstow	0.002581	0.000083	3.21
	Carroll Canyon	0.001232	0.000098	7.95
	Vernalis	0.001677	0.00011	6.56
Conveyor transfer point	Barstow	0.000575	0.000029	5.04
	Carroll Canyon	0.000525	0.000031	5.90
	Vernalis	0.00109	0.000085	7.80

on the downwind side of the facility at a location immediately adjacent to the plant fence line. A single upwind Model 2000 FRM was located on the upwind side of the facility.

These instruments were operated for 24 hr and obtained sample volumes of 16 m^3. R.J. Lee Group, Inc. (RJL) weighed the filter samples using a microbalance and analyzed for crystalline silica using NIOSH Method 7500.

RESULTS

Emission Factor Test Results

The PM_{10}, PM_4, and PM_4 crystalline silica emission factors for the equipment sources measured at the three facilities are presented in Tables 1–3. The emission factors presented in the column on the right were calculated by subtracting the measured downwind concentrations from the measured upwind (ambient) concentrations.

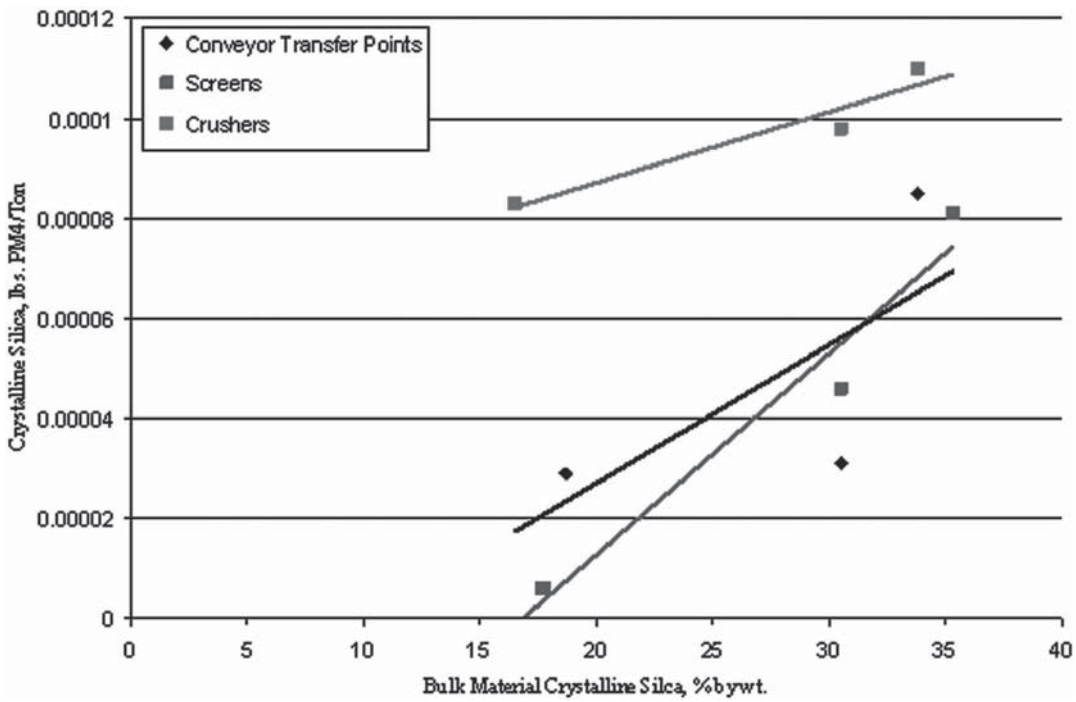

Figure 4. Relationship between bulk material crystalline silica content and the PM_4 crystalline silica emission factor.

As indicated in Table 4, the crystalline silica PM_4 emission factors range from 3.21 to 7.95% of the PM_{10} emission factors. This is a useful ratio because it compares the PM_4 crystalline silica emissions with PM_{10} emissions for which data are often available.

The plant-to-plant differences in PM_4 crystalline silica emission factors are primarily due to the crystalline silica content of the material being handled. As indicated in Figure 4, the bulk material crystalline silica content is responsible for most of the variance in the data. However, it is important to note that because of the small number of test values (three), it is not possible to demonstrate that the relationship between PM_4 crystalline silica emission factors and bulk crystalline silica content is significant at the 90% confidence level.

A less consistent relationship was observed for the conveyor transfer point tests. The reduced emission factor value for the Carroll Canyon plant (30.5% crystalline silica point) is probably due to the high aggregate throughput of this unit. It is theorized that at very high throughputs, some of the stone in the flowing material stream is shielded from attrition and, therefore, does not contribute to emissions. Despite this one test value, there appears to be a relationship between PM_4 crystalline silica emission factors and the crystalline silica content of the bulk material.

An alternative approach for summarizing the PM_4 crystalline silica concentrations is to compile average values for the datasets for the crushers, screens, and conveyor transfer points tested. Table 5 includes average values based on the data from the three plants provided in Tables 1–3.

Table 6 summarizes the crystalline silica fraction of the total PM_4. These data demonstrate that the crystalline silica content of the PM_4 material is considerably lower than the crystalline silica content measured in the bulk samples recovered from each unit tested. On the basis of an average of the tests at the three plants, the PM_4 crystalline silica content is 44% of the bulk material crystalline silica content. It is apparent that the crystalline silica content of the rock is not as prone to attrition size reduction as other constituents in the aggregate.

The process equipment PM_4 crystalline silica emission factors summarized in Tables 1–6 are consistent with previously published emission factors for $PM_{2.5}$ and PM_{10} from similar process units. The PM_4 crystalline silica emission factors are intended for use as input data to dispersion models to evaluate annual average PM_4 concentrations at plant fence lines.

Ambient PM_4 Crystalline Silica Concentrations

Ambient concentrations of PM_4 crystalline silica were measured during 3 consecutive 24-hr periods at the

Table 5. Average emission factors from Barstow, Carroll Canyon, and Vernalis: combined dataset.

Source	Analyte	Emissions (lb/t)
Vibrating screen	PM_{10}	0.00090
	PM_4	0.00044
	PM_4 crystalline silica	0.000044
Crusher	PM_{10}	0.00183
	PM_4	0.00088
	PM_4 crystalline silica	0.000097
Conveyor transfer point	PM_{10}	0.00073
	PM_4	0.00035
	PM_4 crystalline silica	0.000048

Table 6. Crystalline silica fraction of PM_4 PM.

Plant	Source	Crystalline Silica Content (percent weight of total PM_4)	Crystalline Silica Content (percent weight of material samples)
Barstow	Screen	7.5	17.7
	Crusher	6.5	16.5
	Conveyor transfer point	8.3	18.7
	Average	6.9	17.3
Carroll Canyon	Screen	12.5	30.5
	Crusher	15.4	30.4
	Conveyor transfer point	12.8	30.6
	Average	13.6	30.5
Vernalis	Screen	9.6	35.3
	Crusher	21.9	33.9
	Conveyor transfer point	18.4	33.8
	Average	16.6	34.3

Carroll Canyon and Vernalis plants. Two collocated TECO FRM samplers modified for PM_4 crystalline silica measurement operated at a location downwind of the quarry and processing equipment. A single TECO FRM instrument for PM_4 crystalline silica monitoring operated at a location upwind of the entire facility being tested. Meteorological monitoring stations were placed at the upwind and downwind locations. The results of the ambient monitoring tests demonstrated that the plants operated at levels well below the 3-μg/m^3 REL value. Tables 7 and 8 summarize the results for the Carroll Canyon and Vernalis plants, respectively.

The differences between the upwind and downwind ambient PM_4 crystalline silica concentrations are small. The slightly higher upwind values observed during several of the test days are due to emissions from unpaved roads near the upwind monitoring sites.

Quality Assurance/Quality Control Procedures for PM_4 and PM_{10} Sampling

All of the PM_4 crystalline silica concentration tests conducted with modified Appendix L samplers included quality assurance (QA)/quality control (QC) procedures established by EPA for IO-1.3 (TEOMs) and 40 CFR Part 50, Appendix L (TECO FRM 2000s). The QA/QC data indicated that the TECO PM_4 samplers, the TECO PM_{10} samplers, and the TECO TEOM monitor used for PM_4 and PM_{10} monitoring performed extremely well throughout the three test programs.

All of the PM_4 concentration samplers used for emission factor testing and ambient air monitoring met all of the pre- and post-test requirements concerning filter temperature, ambient temperature, barometric pressure, sample flow, and sample gas stream leak rates.

A TEOM monitor was used during the tests at Barstow for the emission factor tests of the tertiary crusher, the vibrating screen, and the conveyor transfer point. The TEOM monitor satisfied the pre- and post-test QA requirements concerning ambient temperature, barometric pressure, sample flow, and sample gas stream leak rates.

SUMMARY

PM_4 crystalline silica emission factors measured using an Appendix L-based filter sampler ranged from 0.000006 to 0.000110 lb/t of stone processed in vibrating screens, tertiary crushers, and conveyor transfer points. The measured PM_4 crystalline silica emissions ranged from 3.21 to 7.95% of the simultaneously measured PM_{10} emission factors. The PM_4 crystalline silica emissions measured in this study appeared to be related to the crystalline silica content of the mineral being handled. The concentration of crystalline silica in PM_4 PM averaged 44% of the crystalline silica content of the bulk mineral.

Ambient concentrations of PM_4 crystalline silica were measured upwind and downwind of the facilities during the emission factor test programs. The measured ambient concentrations of PM_4 crystalline silica ranged from below the detectable limit of 0.3 μg/m^3 to 2.8 μg/m^3. These concentrations are well below the California REL of 3 μg/m^3.

Table 7. Plant upwind-downwind ambient monitoring at Carroll Canyon.

	PM_4 Crystalline Silica (μg/m^3)		
Date	Upwind	Downwind (primary)	Downwind (collocated)
September 17	1.3	1.1	1.0
September 18	1.4	0.7	0.8
September 19	0.6	0.5	0.4

Table 8. Plant upwind-downwind ambient monitoring at Vernalis.

	PM_4 Crystalline Silica (μg/m^3)		
Date	Upwind	Downwind (primary)	Downwind (collocated)
September 24	0.8	0.6	0.9
September 25	2.8	0.9	0.8
September 26	2.5	0.0	1.2

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About the Authors

John Richards is president and Todd Brozell is vice president of Air Control Techniques, P.C. Charles Rea is executive director of CalCIMA in Sacramento, CA. Geoff Boraston is director of Environmental Affairs of Granite Construction, Inc., in Sacramento, CA. John Hayden is vice president, Environment, Safety and Health, of NSSGA in Alexandria, VA. Please address correspondence to: John Richards, Air Control Techniques, P.C., 301 East Durham Road, Cary, NC 27513; phone +1-919-460-7811; fax: +1-919-460-7897; e-mail: john.richards@aircontroltechniques.com.

APPENDIX D

Assessment of Negligibility

Table D1
Assessment of Negligibility

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Emission Threshold [g/s]	Negligible?	Averaging Period [hours]	MOE POI Limit [µg/m³]	Limiting Effect	Regulation Schedule No.
SPM	N/A-1	6.62E+00	1.46E-02	No	24	120	Visibility	Schedule 3
PM10	N/A-2	3.38E+00	6.09E-03	No	24	50		AAQC
PM2.5	N/A-3	2.26E+00	3.04E-03	No	24	25		AAQC
Crystalline Silica	14808-60-7	1.43E-02	6.09E-04	No	24	5	Health	Guideline
Ferric Oxide	1309-37-1	3.41E-02	3.04E-03	No	24	25	Soiling	Schedule 3
Carbon Monoxide	630-08-0	7.70E+01	2.47E-01	No	½	6000	Health	Schedule 3
Nitrogen Oxides	10102-44-0	2.31E+02	2.43E-02	No	24	200	Health	Schedule 3
Nitrogen Oxides	10102-44-0	2.31E+02	2.00E-02	No	1	400	Health	Schedule 3
Ammonia	7664-41-7	7.70E+00	1.22E-02	No	24	100	Health	Schedule 3
Sulfur Dioxide	7446-09-5	3.85E+01	3.35E-02	No	24	275	Health & Vegetation	Schedule 3
Sulfur Dioxide	7446-09-5	3.85E+01	3.45E-02	No	1	690	Health & Vegetation	Schedule 3
Dioxins and Furans (TEQ)	N/A-4	1.54E-08	1.22E-11	No	24	0.0000001	Health	Schedule 3
Silver	7440-22-4	9.61E-06	1.22E-04	Yes	24	1	Health	Schedule 3
Arsenic	7440-38-2	1.89E-04	3.65E-05	No	24	0.3	Health	Guideline
Barium	7440-39-3	5.51E-03	1.22E-03	No	24	10	Health	Guideline
Beryllium	7440-41-7	1.04E-05	1.22E-06	No	24	0.01	Health	Schedule 3
Calcium Oxide	1305-78-8	5.29E+00	1.22E-03	No	24	10	Corrosion	Schedule 3
Cadmium	7440-43-9	3.46E-05	3.04E-06	No	24	0.025	Health	Schedule 3
Chloride	N/A-5	3.31E-02	1.22E-05	No	24	0.1	—	De Minimus
Chromium	7440-47-3	1.21E-04	6.09E-05	No	24	0.5	Health	Schedule 3
Copper	7440-50-8	8.35E-02	6.09E-03	No	24	50	Health	Schedule 3
Hydrogen Fluoride	7664-39-3	1.49E-02	1.05E-04	No	24	0.86	Vegetation	Schedule 3
Hydrogen Fluoride	7664-39-3	1.49E-02	1.07E-04	No	30-day	0.34	Vegetation	Schedule 3
Iron*	15438-31-0	2.68E-01	4.87E-04	No	24	4	Soiling	Schedule 3
Hydrogen chloride	7647-01-0	7.72E-01	2.43E-03	No	24	20	Health	Schedule 3
Mercury	7439-97-6	3.78E-04	2.43E-04	No	24	2	Health	Schedule 3
Potassium	7440-09-7	2.83E-01	9.74E-04	No	24	8	—	JSL
Portland Cement	65997-15-1	1.75E+00	2.43E-03	No	24	20	Health	JSL
Manganese	7439-96-5	1.35E-02	4.87E-05	No	24	0.4	Health	Schedule 3
Lead	7439-92-1	1.18E-03	6.09E-05	No	24	0.5	Health	Schedule 3
Lead	7439-92-1	1.18E-03	6.09E-05	No	24	0.5	Health	Schedule 3
Sulfur trioxide	N/A-8	2.20E-01	1.22E-05	No	24	0.1	—	De Minimus
Selenium	7782-49-2	2.36E-03	1.22E-03	No	24	10	Health	Guideline
Thallium	7440-28-0	8.50E-05	2.92E-05	No	24	0.24	—	JSL
Titanium	7440-32-6	5.83E-03	1.46E-02	Yes	24	120	Particulate	Schedule 3
Zinc	7440-66-6	5.35E-03	1.46E-02	Yes	24	120	Particulate	Schedule 3
C3 benzenes	N/A-10	4.09E-05	1.22E-05	No	24	0.1	—	De Minimus
C4 benzenes	N/A-11	9.45E-05	1.22E-05	No	24	0.1	—	De Minimus
C6 benzenes	N/A-12	1.45E-05	1.22E-05	No	24	0.1	—	De Minimus
Acenaphthylene	208-96-8	1.89E-03	4.26E-04	No	24	3.5	—	JSL
Acetone	67-64-1	5.83E-03	1.45E+00	Yes	24	11880	Health	Schedule 3
Benzaldehyde	100-52-7	3.78E-04	2.43E-04	No	24	2	—	JSL
Benzene	71-43-2	4.88E-02	1.22E-02	No	24	100	Upper Risk Threshold	Schedule 6
Benzene	71-43-2	4.88E-02	2.86E-04	No	Annual	0.45	Health	Schedule 3
Benzo(a)anthracene	56-55-3	6.77E-07	1.22E-05	Yes	24	0.1	—	De Minimus
Benzo(a)pyrene	50-32-8	2.05E-06	6.09E-07	No	24	0.005	Upper Risk Threshold	Schedule 6
Benzo(a)pyrene	50-32-8	2.05E-06	6.35E-09	No	Annual	0.00001	Health	Schedule 3
Benzo(b)fluoranthene	205-99-2	8.82E-06	1.22E-05	Yes	24	0.1	—	De Minimus
Benzo(g,h,i)perylene	191-24-2	1.23E-06	1.46E-04	Yes	24	1.2	—	JSL
Benzo(k)fluoranthene	207-08-9	2.36E-06	1.22E-05	Yes	24	0.1	—	De Minimus
Benzoic acid	65-85-0	5.51E-02	8.52E-02	Yes	24	700	Health	Guideline
Biphenyl	92-52-4	9.61E-05	3.00E-03	Yes	1	60	Odour	Guideline
Bis(2-ethylhexyl)phthalate	117-81-7	1.50E-03	6.09E-03	Yes	24	50	Health	Schedule 3
Bromomethane	74-83-9	6.77E-04	1.64E-01	Yes	24	1350	Health	Guideline
Carbon disulfide	75-15-0	1.73E-03	4.02E-02	Yes	24	330	Odour	Guideline
Chlorobenzene	108-90-7	2.52E-04	1.75E-01	Yes	1	3500	Health	Guideline
Chlorobenzene	108-90-7	2.52E-04	1.36E-01	Yes	10-min	4500	Odour	Guideline
Chloromethane	74-87-3	5.98E-03	3.90E-02	Yes	24	320	Health	Schedule 3
Chrysene	218-01-9	2.52E-06	1.22E-05	Yes	24	0.1	—	De Minimus
Di-n-butylphthalate	84-74-2	6.46E-04	6.09E-03	Yes	24	50	Health	Guideline
Dibenz(a,h)anthracene	53-70-3	9.92E-06	1.22E-05	Yes	24	0.1	—	De Minimus
Ethylbenzene	100-41-4	2.99E-04	1.22E-01	Yes	24	1000	Health	Schedule 3
Ethylbenzene	100-41-4	2.99E-04	5.75E-02	Yes	10-min	1900	Odour	Guideline
Fluoranthene	206-44-0	1.39E-04	1.70E-02	Yes	24	140	—	JSL
Fluorene	86-73-7	2.99E-04	1.22E-05	No	24	0.1	—	De Minimus
Formaldehyde	50-00-0	7.24E-03	7.91E-03	Yes	24	65	Health	Schedule 3
Freon 113	76-13-1	7.87E-04	9.74E+01	Yes	24	800000	Health	Schedule 3
Indeno(1,2,3-cd)pyrene	193-39-5	1.37E-06	1.22E-05	Yes	24	0.1	—	De Minimus
Methyl ethyl ketone	78-93-3	4.72E-04	1.22E-01	Yes	24	1000	Health	Schedule 3
Methylene chloride	75-09-2	7.72E-03	2.68E-02	Yes	24	220	Health	Schedule 3
Methylnaphthalene	90-12-0	6.61E-05	1.46E-03	Yes	24	12	—	JSL
Naphthalene	91-20-3	3.46E-03	2.74E-03	No	24	22.5	Health	Guideline
Naphthalene	91-20-3	3.46E-03	1.51E-03	No	10-min	50	Odour	Guideline
Phenanthrene	85-01-8	6.14E-03	1.22E-05	No	24	0.1	—	De Minimus
Phenol	108-95-2	1.73E-03	3.65E-03	Yes	24	30	Health	Schedule 3
Pyrene	129-00-0	6.93E-05	2.43E-05	No	24	0.2	—	JSL
Styrene	100-42-5	2.36E-05	4.87E-02	Yes	24	400	Health	Schedule 3
Toluene	108-88-3	2.99E-03	2.43E-01	Yes	24	2000	Odour	Guideline
Xylenes	1330-20-7	2.05E-03	8.89E-02	Yes	24	730	Health	Schedule 3
Xylenes	1330-20-7	2.05E-03	9.08E-02	Yes	10-min	3000	Odour	Guideline

Notes: *Metallic iron

Emission Threshold Calculation

The Emission Threshold Calculation is in accordance with section 7.1.2 of the MOECC's Procedure for Preparing an ESDM Report (March 2009).
If the total facility emission rate is found to be less than the emission threshold, the contaminant is assumed to be negligible.

$$\text{Emission Threshold [g/s]} = \frac{0.5 \times \text{Ministry POI Limit [µg/m}^3]}{\text{Dispersion Factor [µg/m}^3 \text{ per g/s]}}$$

Dispersion Factors

Distance to Source [m]	Averaging Period	Dispersion Factor [µg/m³ per g/s]
20	1	10000
20	½	12142
20	10-min	16515
20	24	4107

APPENDIX E

Best Management Practices Plan (BMPP)

May 2016

REPORT

COLACEM CANADA INC.
L'ORIGNAL, ONTARIO

Best Management Practices Plan for the Control of Fugitive Dust

Version 1.0

Submitted to:
Colacem Canada Inc.
L'Orignal, Ontario

Report Number: 1529718

Golder Associates

Foreword

This Best Management Practices Plan documents the control of fugitive dust at the Colacem Canada Inc. (Colacem) cement plant operations in L'Orignal, Ontario (the Facility) and has been prepared in accordance with Appendix E (Technical Bulletin - Review of Approaches to Manage Industrial Fugitive Dust Sources) of the Procedure for Preparing an Emission Summary and Dispersion Modelling Report (Ontario Ministry of the Environment 2009) and meets the anticipated application requirements for the Environmental Compliance Approval expected to be submitted in in the first quarter 2016.

This is the original draft version of a Best Management Practices Plan for the L'Orignal Facility.

As operations change and new fugitive dust sources are added to the Facility, this Plan will be updated as required. In order to maintain version control, all pages in the Plan have been dated and documented with a version number. This Plan is Version 1.0. The version number will change if the entire report is reissued; if individual pages are provided to update small portions of the Plan then they will be issued with an .X subversion number and the updated pages will be listed on the following Version Control Page.

Version Control

Version	Date	Description of Changes	Updated Pages	Approved By Sign Off
1.0	January 27, 2016	Original	NA	Marc Bataille

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FIGURES

APPENDICES

1.0 INTRODUCTION

The purpose of this Best Management Practices Plan (the Plan) is to document the Best Management Practices (BMPs) for the control of fugitive dust emissions from Colacem Canada Incorporated (Colacem) cement plant operations in L'Orignal, Ontario (the Facility) and outline the decision making process that was used to develop these BMPs. This Plan was prepared in accordance with Appendix E (Technical Bulletin - Review of Approaches to Manage Industrial Fugitive Dust Sources) of the Procedure for Preparing an Emission Summary and Dispersion Modelling Report (January 2009) and meets the anticipated application requirements of the Environmental Compliance Approval (ECA) application expected to be submitted in the first quarter of 2016.

Based on previous ECAs issued by the Ministry of Environment and Climate Change (the Ministry) for similar facilities, Colacem will likely be required to develop a Plan for the Facility that meets the following requirements:

FUGITIVE DUST CONTROL

> *The Company shall develop in consultation with the District Manager and acceptable to the Director, a Best Management Practices Plan for the control of fugitive dust emissions. This Best Management Practices Plan shall include, but not be limited to:*
>
> *(1) identification of the main sources of fugitive dust emissions such as:*
> *(a) on-site traffic;*
> *(b) paved roads/areas;*
> *(c) unpaved roads/areas;*
> *(d) material stock piles;*
> *(e) loading/unloading areas and loading/unloading techniques;*
> *(f) material spills;*
> *(g) material conveyance systems;*
> *(h) exposed openings in process and storage buildings; and*
> *(i) general work areas.*
>
> *(2) potential causes for high dust emissions and opacity resulting from these sources;*
>
> *(3) preventative and control measures in place or under development to minimize the likelihood of high dust emissions and opacity from the sources of fugitive dust emissions identified above. Details of the preventative and control measures shall include:*
> *(a) a description of the control equipment to be installed;*
> *(b) a description of the preventative procedures to be implemented; and/or*
> *(c) the frequency of occurrence of periodic preventative activities, including material application rates, as applicable.*
>
> *(4) an implementation schedule for the Best Management Practices Plan, including training of facility personnel;*
>
> *(5) inspection and maintenance procedures and monitoring initiatives to ensure effective implementation of the preventative and control measures; and*
>
> *(6) a list of all Ministry comments received, if any, on the development of the Best Management Practices Plan, and a description of how each Ministry comment was addressed in the Best Management Practices Plan.*

Documentation Requirements - Best Management Practices Plan
The Company shall record, in a log book, each time a specific preventative and control measure described in the Best Management Practices Plan is implemented. The Company shall record, as a minimum:

> *(1) the date when each emission control measure is installed, including a description of the control measure;*
>
> *(2) the date when each new preventative measure or operating procedure to minimize emissions is implemented, including a description of the preventative measure or operating procedure; and*
>
> *(3) the date, time of commencement, and time of completion of each periodic activity conducted to minimize emissions, including a description of the preventative measure/procedure and the name of the individual performing the periodic activity.*

Therefore this Plan will:

- identify the proposed sources of fugitive dust emissions associated with the Facility;
- review the assumptions of composition and size distribution of the fugitive dust particulate composition of the road dust;
- describe how fugitive dust can be controlled from each significant source and describe the BMPs in place at the Facility;
- contain a proposed schedule by which the Plan will be implemented;
- describe how the Plan will be implemented, including the training of personnel;
- describe proposed inspection and maintenance procedures; and
- describe proposed methods of monitoring and record-keeping to verify and document ongoing compliance with the Plan.

For ease of implementation and to promote clarity, this Plan follows the following structure:

- Section 2 provides a brief description of the Facility.
- Section 3 documents the BMPs that are in place at the Facility and the decision making process used to develop these BMPs This section follows the Plan Do Check and Act (PDCA) cycle according to ISO guidelines. The “Plan” section includes identification and characterization of the emission sources and existing BMPs at the Facility. The “Do” section includes a schedule for implementation of the proposed improvements. The “Check” section includes a description of monitoring procedures and a recordkeeping system. The “Act” section includes guidelines for periodic review of the BMPs in order to promote its continuous improvement.

Ministry comments pertaining to the development and maintenance of this Plan will be included in Appendix A. As this is the original draft version of the BMP, Appendix A serves as a placeholder for future Ministry comments during review of the ECA application.

2.0 FACILITY DESCRIPTION

Colacem proposes to operate a cement plant located in L'Orignal, Ontario (the Facility). Table 1 presents general information about the Facility relevant to this Plan.

Table 1: Facility Description

Facility:	Colacem Canada Inc. cement plant operations
Location:	L'Orignal, Ontario
Area occupied:	55.85 hectare lot
Main activities/Process areas/equipment used:	Raw Materials Receiving, Raw Materials Storage and Transfers, Raw Mill, Kiln, Petcoke Receiving and Grinding, Clinker Storage and Transfer, Cement Mill, Finished Cement, Cement Packaging, Concrete Mixing Plant Alternative Fuels and Paved Roads
Production:	3,000 tonnes of clinker per day, with an estimated annual production of 1.16 Million tonnes of cement
Nearest sensitive receptors (distance/ direction):	East of the Facility (approximately 200 m from the entrance to the Facility)
Predominant wind direction:	Primarily North-Northwest as well as Northwest and West as shown on wind-rose included on Figure 2

Figure 1 is a site plan showing the fugitive dust sources present onsite and the location of nearest sensitive receptors.

3.0 RESPONSIBILITIES

The following identifies the responsibilities held by each of the employment levels at the Facility as they pertain to this Plan.

3.1 Senior Management Representative: Facility Manager

The Senior Management Representative, or designate, is responsible for:

- ensuring the required resources are in place to execute the plan.

3.2 Accountable Site Representative: Superintendent – Production

The Accountable Site Representative, or designate, is responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- scheduling and coordinating the implementation of fugitive dust control measures;
- maintaining documentation of schedules and logs; and
- ensuring the training of site personnel and contractors on the plan and best management practices to be implemented.

3.3 Unit Operations Supervisor: Supervisor – Production

The Unit Operations Supervisor is responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- implementing fugitive dust control measures; and
- completing dust control logs.

3.4 Site Personnel and Contractors

All Site Personnel and Contractors are responsible for:

- following the dust control procedures that are currently in place.

4.0 FUGITIVE DUST EMISSIONS BEST MANAGEMENT PRACTICES PLAN

This section describes the fugitive dust control measures that are implemented at the Facility and the decision making process that has been used in the BMP development for the Facility. This section follows the Plan Do Check and Act (PDCA) cycle according to ISO guideline as follows:

- Section 4.1 **PLAN** - identifies and characterizes the emission sources and BMPs at the Facility.
- Section 4.2 **DO** - documents the schedule for implementation of the proposed improvements.
- Section 4.3 **CHECK** - describes the monitoring procedures and a recordkeeping system.
- Section 4.4 **ACT** - describes the BMP review and update procedures in order to promote its continuous improvement.

4.1 PLAN – Identification and Classification of Fugitive Dust Emission Sources

4.1.1 Identification of the Sources of Fugitive Dust Emissions

Fugitive dust emissions occur due to mechanical disturbances of granular materials exposed to the air. Dust generated from these open sources is termed “fugitive” because it is not discharged to the atmosphere in a confined flow stream, such as in an exhaust pipe or stack (USEPA 1995).

The mechanical disturbance may be equipment movement, the wind or both. Therefore, some fugitive dust emissions occur and/or are intensified by equipment use, while others, i.e. wind erosion emissions, are independent of equipment use.

The main factors affecting the amount of fugitive dust emitted from a source include characteristics of the granular material being disturbed (i.e. particulate size distribution, density and moisture) and intensity and frequency of the mechanical disturbance (i.e. wind conditions and/or equipment use conditions). Precipitation and evaporation conditions can affect the moisture of the granular material being disturbed and, therefore, have an indirect effect on the amount of fugitive dust emitted.

Once dust is emitted, its travelling distance from the source is affected by various parameters. Namely climatic conditions, specifically wind speed, wind direction and precipitation, and particle size distribution. Higher wind speeds increase the distance travelled while precipitation can accelerate its deposition. Finer particulates can travel longer before settling and, therefore, deserve greater attention.

Table 2 presents a summary of the main sources of fugitive dust emissions existing at the Facility, as well as the potential causes for high dust emissions and opacity resulting from these sources.

Table 2: Sources of Fugitive Dust Emissions within the Facility and Potential Causes for High Emissions

Identification of Sources of Fugitive Dust Emissions		Potential Causes for High Emissions and Opacity from Each Source (Parameters/Conditions)
Source Category/Location	**Source Description**	
Raw Materials Receiving	Fugitive emission from truck drops and pneumatic conveying	■ Moisture content/low ■ Material size/fine ■ Material transfer rate/high ■ Material drop height/high ■ Wind speed/high ■ Bucket Load size/high
Raw Mill	Fugitive emissions controlled by dust collectors	■ Moisture content/dry ■ Material processing rate/high ■ Wind speed/high ■ Material density/ low ■ Equipment vibration/high
Kiln	Fugitive emissions controlled from clinker cooler	■ Moisture content/low ■ Material size/fine ■ Material transfer rate/high ■ Material drop height/high ■ Wind speed/high ■ Equipment vibration/high ■ Material Density/low
Pet Coke Receiving and Grinding	Fugitive emissions from petcoke receiving	■ Moisture content/low ■ Material size/fine ■ Material transfer rate/high ■ Material drop height/high ■ Wind speed/high ■ Equipment vibration/high ■ Material Density/low
Clinker Storage and Transfer	Fugitive emissions controlled by dust collectors	■ Material size/fine ■ Material transfer rate/high ■ Material drop height/high ■ Wind speed/high ■ Equipment vibration/high ■ Material Density/low ■ Moisture content/low
Cement Mill	Fugitive emissions controlled by dust collectors	■ Moisture content/dry ■ Material processing rate/high ■ Wind speed/high ■ Material density/ low ■ Equipment vibration/high
Finished Cement	Fugitive emissions controlled by dust collectors	■ Moisture content/dry ■ Material processing rate/high ■ Wind speed/high ■ Material density/ low ■ Equipment vibration/high
Cement Packaging	Fugitive emissions from packing plant line controlled by dust	■ Material size/fine ■ Material transfer rate/high ■ Equipment vibration/high

Identification of Sources of Fugitive Dust Emissions		Potential Causes for High Emissions and Opacity from Each Source (Parameters/Conditions)
Source Category/Location	**Source Description**	
	collectors	■ Material Density/low ■ Moisture Content/low
Concrete Mixing Plant	Fugitive emissions from concrete mixing activities	■ Material size/fine ■ Material transfer rate/high ■ Material drop height/high ■ Wind speed/high ■ Equipment vibration/high ■ Material Density/low ■ Moisture Content/low
Paved Roads	Fugitive emissions from paved roadways throughout the Facility	■ Number of vehicles/high ■ Weight of vehicles/heavy ■ Speed of vehicles/high ■ Silt content/high ■ Wind speed/high

4.1.2 Fugitive Dust Best Management Practices

Control measures to reduce fugitive dust emissions should take into account the sources of the dust emission, the dispersion conditions and the location of sensitive areas in order to avoid relevant impacts of dust emissions on receptors.

Control measures intend to affect one or more factors affecting the generation and/or dispersion of fugitive dust emissions. These control measures can be classified as follows;

- **Control Procedure**: Control measures pertaining to the design and installation of structures to prevent the generation of dust and/or the dispersion of dust emitted reaching sensitive areas.
- **Preventative Measures**: Regularly scheduled measures implemented on expected sources of dust emissions reaching sensitive areas.
- **Reactive Control Measures**: Measures which are implemented in the event of unexpected circumstances which can lead to the generation of dust and/or the dispersion of dust emitted reaching sensitive areas.

Table 3a-3b presents Preventative Procedures, Control Measures and Reactive Measures for fugitive dust emissions that are associated with the Colacem cement plant.

Table 3a: Description of Control Procedures for Fugitive Dust Emissions Existing and Under Development at the Facility

Preventative Procedure	Emission Source Effected	Description	Frequency
Use of Shielding	Dust from Material Handling	Where practical, efficient and safe loading and unloading locations are positioned to take advantage of existing shielding to reduce cross winds (e.g. building/enclosure structure for loading, and stockpiles for unloading).	Always
Indoor Material Transfer	Dust from Material Handling	Construct permanent buildings for major processing operations	Always for material transfer points identified as high risk for fugitive dust emissions When Necessary Based on Daily Observations, Inspections and/or Incidents
Installation of Dust Collector	Dust from Material Handling	Install Dust Collectors to service areas associated with fugitive dust emissions	Always for material transfer points identified as high risk for fugitive dust emissions When Necessary Based on Daily Observations, Inspections and/or Incidents

Table 3b: Description of Preventative Measures for Fugitive Dust Emissions Existing and Under Development at the Facility

Control Measures	Emission Source Effected	Description	Frequency
Driver Training	Road Dust from Paved Roads	Staff to receive training on speed limits (which may at times be less than the posted limits depending on road/area conditions, meteorological conditions and load); and use of dedicated traffic routes. Contractors/suppliers to receive communication (Hazard Awareness Training) stating that they are required to adhere to posted speed limits and traffic routes.	During indoctrination or as a result of corrective actions
Road Vacuuming	Road Dust from Paved Roads	Mechanical sweeping of roads to prevent dust from piling on the roadway	According to sweeping schedule to be developed prior to operations
Road Watering	Road Dust from Paved Roads	To supress dust particles on the road from becoming airborne	According to watering schedule to be developed prior to operations

Table 3c: Description of Reactive Measures for Fugitive Dust Emissions Existing and Under Development at the Facility

Reactive Measures	Emission Source Effected	Description	Frequency
Review of Access Routes and Traffic Volume	Road Dust from paved Roads	Review designated traffic routes for opportunities to reduce the travel distance, while recognizing the need for efficiency and safety. Review operations (equipment size; loading techniques; etc.) to minimize the number of trips recognizing the need for efficiency and safety.	When necessary
Controlled Loading and Unloading Techniques	Dust from Material Handling	Trucks are loaded/unloaded in a slow and controlled manner to minimize drop height and avoid spillage.	When necessary based on daily observations, inspections and/or incidents
Reduced Loading/ Unloading During Very High Wind Conditions	Dust from Material Handling	Loading/unloading rates are adjusted during periods of very dry weather and very high winds when other control/preventative measures are not effective.	Based on High Wind Conditions
Minimize the Size of the Active Loading/Unloading Areas	Dust from Material Handling	The size of the loading area is limited by the stockpiles (serves as partial enclosure). The size of the unloading area is limited by the design of the stockpile area. The size of the active areas on the loading/unloading areas (and in particular the distance that the loading/unloading equipment moves) is minimized by the operators recognizing the need for efficiency and safety.	When Necessary Based on Daily Observations, Inspections and/or Incidents
Enclosure on Transfer Points	Dust from Material Handling	Construct/erect temporary enclosure to capture dust during the transfer of materials.	When Necessary Based on Daily Observations, Inspections and/or Incidents

4.1.3 Fugitive Dust Residual Risk Assessment

Each fugitive dust source at the Facility was assessed using the risk management tool described in the guidance document (CEMI 2010) to assess if the proposed BMPs adequately manage the risk associated with each source. See Appendix B for the risk factors used in the ranking process. The following table identifies all fugitive dust sources with their respective relative risk score for the Facility after the implementation of the BMPs. The Facility has several sources that includes roads, material transfer, material transport and processing sources.

The Facility has eleven road segments used by the various raw material and cement trucks (e.g., trucks from the quarry hauling limestone). These roads have been assigned a source identification of RS-1 to RS-11 and are presented on Figure 1. The trucks that use each individual segment are described below in the Source Description column. The remaining sources in the table below are described further in the ESDM Report.

Table 4: Fugitive Dust Sources and Associated Relative Risk Scores

Source ID	Source Description	Proposed BMP (if any)	Relative Risk Score	Relative Risk Level
RS-1	Cement Truck, Cement Fume and Fly Ash Transportation, Alternative Fuel Transportation, Ready Mix: Iron, Bauxite, Shale, Gypsum, Silica, Petcoke Transportation	Vacuuming, Watering	97	High
RS-2	Cement Truck, Cement Fume and Fly Ash Transportation, Alternative Fuel Transportation, Ready Mix: Iron, Bauxite, Shale, Gypsum, Silica, Petcoke Transportation	Vacuuming, Watering	97	High
RS-3	Cement Truck, Cement Fume and Fly Ash Transportation, Alternative Fuel Transportation, Ready Mix: Iron, Bauxite, Shale, Gypsum, Silica, Petcoke Transportation	Vacuuming, Watering	97	High
E18	Kiln End Process Filter	Dust Collectors, Full Enclosure	86	High
RS-4	Petcoke, Ready Mix: Iron, Bauxite, Shale, Gypsum, Petcoke Transportation	Vacuuming, Watering	76	Medium
RS-5	Cement Truck	Vacuuming, Watering	76	Medium
RS-6	Petcoke Transportation	Vacuuming, Watering	76	Medium
RS-7	Ready Mix: Iron, Bauxite, Shale, Gypsum, Silica Transportation	Vacuuming, Watering	76	Medium
RS-8	Alternative Fuel Transportation	Vacuuming, Watering	76	Medium
RS-9	Cement Fume and Fly Ash Transportation	Vacuuming, Watering	76	Medium
RS-10	Cement Truck, Cement Fume and Fly Ash Transportation, Alternative Fuel Transportation, Petcoke Transportation	Vacuuming, Watering	76	Medium
RS-11	Limestone Transportation	Vacuuming, Watering	76	Medium
E4	Limestone Crusher Dedusting	Dust Collectors	72	Medium
E23	Petcoke Grinding	Dust Collectors, Grinding Occurs Indoors	71	Medium
E57	Concrete Mixing Plant Silo A	Dust Collectors	63	Medium
E58	Concrete Mixing Plant Silo B	Dust Collectors	63	Medium
E59	Concrete Mixing Plant Silo C	Dust Collectors	63	Medium
FUG9	Concrete Mixing Plant Fugitives	Dust Collectors	63	Medium
FUG10	Concrete Mixing Plant Fugitives	Dust Collectors	63	Medium
E37	Raw Material Receiving of Silica Fume	Dust Collectors, Full Enclosure	56	Medium
E38	Raw Material Receiving of Fly Ash	Dust Collectors, Full Enclosure	56	Medium
E33	Cement Clinker Hopper Loading	Dust Collectors, Full Enclosure	56	Medium
E34	Cement Limestone Hopper Loading	Dust Collectors, Full Enclosure	56	Medium
E35	Cement Gypsum Hopper Loading	Dust Collectors, Full Enclosure	56	Medium

Source ID	Source Description	Proposed BMP (if any)	Relative Risk Score	Relative Risk Level
E36	Cement No. 4 Constituent Hopper Loading	Dust Collectors, Full Enclosure	56	Medium
E39	Cement Mill 1	Dust Collectors, Full Enclosure	56	Medium
E40	Cement Mill 2	Dust Collectors, Full Enclosure	56	Medium
E41	Cement Mill 1	Dust Collectors, Full Enclosure	56	Medium
E42	Cement Mill 2	Dust Collectors, Full Enclosure	56	Medium
E43	Cement Silo 1A top filter	Dust Collectors, Full Enclosure	56	Medium
E44	Cement Silo 1A Bulk Loading A	Dust Collectors, Full Enclosure	56	Medium
E45	Cement Silo 1A Bulk Loading B	Dust Collectors, Full Enclosure	56	Medium
E46	Cement Silo 1B top filter	Dust Collectors, Full Enclosure	56	Medium
E47	Cement Silo 1B Bulk Loading A	Dust Collectors, Full Enclosure	56	Medium
E48	Cement Silo 1B Bulk Loading B	Dust Collectors, Full Enclosure	56	Medium
E49	Cement Silo 2A top filter	Dust Collectors, Full Enclosure	56	Medium
E50	Cement Silo 2A Bulk Loading A	Dust Collectors, Full Enclosure	56	Medium
E51	Cement Silo 2A Bulk Loading B	Dust Collectors, Full Enclosure	56	Medium
E52	Cement Silo 2B top filter	Dust Collectors, Full Enclosure	56	Medium
E53	Cement Silo 2B Bulk Loading A	Dust Collectors, Full Enclosure	56	Medium
E54	Cement Silo 2B Bulk Loading B	Dust Collectors, Full Enclosure	50	Medium
E55	Packing Plant Line A	Dust Collectors, Full Enclosure	50	Medium
E56	Packing Plant Line B	Dust Collectors, Full Enclosure	50	Medium
FUG7	Petcoke Receiving	Dust Collectors, Full Enclosure	41	Low
FUG8	Petcoke Loading to Hopper	Dust Collectors, Full Enclosure	41	Low
E19	Petcoke Reception Bin	Dust Collector	41	Low
E20	Petcoke Hopper	Dust Collector	41	Low
E21	Coarse Petcoke Silo 1	Dust Collector	41	Low
E22	Coarse Petcoke Silo 2	Dust Collector	41	Low
E24	Pulverized Petcoke Silo 1	Dust Collector	41	Low
E25	Pulverized Petcoke Silo 2	Dust Collector	41	Low
E12	Conveyor Belt to Raw Mill	Dust Collectors, Full Enclosure	31	Low
E13	Feed to Raw Mill	Dust Collectors, Full Enclosure	31	Low
E14	Raw Mill Air Slide	Dust Collectors, Full Enclosure	31	Low
E17	Air lift bin dedusting	Dust Collector, Full Enclosure	31	Low
E27	Clinker Cooler	Dust Collectors, Full Enclosure	31	Low
E29	Finished Clinker Silo Loading	Dust Collectors, Full Enclosure	31	Low
STOR1	Petcoke Storage	Dust Collectors, Below Grade	30	Low
E15	Raw Mix Silo Loading	Dust Collectors, Full Enclosure	30	Low
E16	Raw Mix Silo Unloading	Dust Collectors, Full Enclosure	30	Low
FUG6	Gypsum Receiving	Dust Collectors	29	Low
E1	Raw Material Receiving of Bauxite	Dust Collectors	29	Low
E2	Raw Material Receiving of Shale	Dust Collectors	29	Low
E3	Gypsum reception bin	Dust Collectors	29	Low
FUG1	Limestone Receiving	Dust Collectors	29	Low
FUG2	Bauxite Receiving	Dust Collectors	29	Low
FUG3	Shale Receiving	Dust Collectors	29	Low
FUG4	Iron Ore Receiving	Dust Collectors	29	Low

Source ID	Source Description	Proposed BMP (if any)	Relative Risk Score	Relative Risk Level
FUG5	Silica Receiving	Dust Collectors	29	Low
NEG1	Limestone and Shale Storage	Dust Collectors, Full Enclosure	29	Low
NEG2	Gypsum Storage	Dust Collectors, Full Enclosure	29	Low
E5	Bauxite Storage	Dust Collectors, Full Enclosure	29	Low
E26	Alternative Fuel	Dust Collectors, Full Enclosure	29	Low
E28	Clinker Receiving Bin	Dust Collectors, Full Enclosure	29	Low
E6	Iron Hopper	Dust Collectors, Full Enclosure	28	Low
E7	Silica Hopper	Dust Collectors, Full Enclosure	28	Low
E8	Limestone reclaimer belt	Dust Collectors, Full Enclosure	28	Low
E9	Limestone reclaimer belt	Dust Collectors, Full Enclosure	28	Low
E10	Gypsum reclaimer belt	Dust Collectors, Full Enclosure	28	Low
E11	Conveyor Belt to Cement Mill	Dust Collectors, Full Enclosure	28	Low
E30	Clinker Bulk Loading	Dust Collectors, Full Enclosure	28	Low
E31	Clinker Silo Unloading for Bulk	Dust Collectors, Full Enclosure	28	Low
E32	Clinker Silo Unloading for Cement Mill	Dust Collectors, Full Enclosure	28	Low

There are four sources that are still considered to be “high” risk after the implementation of the BMPs, indicating that these four sources have relatively higher potential to generate fugitive dust at the Facility. These sources should be monitored carefully for dust disturbances with the Dust Control Inspection Form, Paved Roadways Vacuum Log and Non-Conformance Logs discussed in Section 4.3.

4.2 DO – Implementation Schedule for the BMP Plan

The BMPs listed in Table 3 are examples of control measures to be implemented at the Facility.

All dust generating work performed onsite, whether it is being completed by Colacem or under contractual agreements, must conform to the requirements of this Plan.

Table 5 presents the process for the implementation of any new BMP for control of fugitive dust emissions at the Facility, as well as the corresponding start-up checklist that is to be completed. The purpose of the checklists is to document that the new emission source will be implemented following that same dust control procedures of the current sources at the Facility. Examples of the checklists are presented in Appendix C. These checklists are template documents that can be customized for the Facility once operations have begun.

Table 5: Implementation Process for New Emission Sources

New Emission Source	Examples	Start-up Checklists
Paved Roadway	New stretch of paved roadway	Paved Roadway Start-up Checklist
Material Processing	New crushing unit, new screening unit	Material Processing Start-up checklist
Material Handling / storage	New loading/unloading procedure/activity, new conveyor transfer point, new storage pile location	Material Handling

4.2.1 Training

All site personnel and contractors are to receive training on the requirements of this Plan. Training will be incorporated into the Facility indoctrination that is required prior to working on the property. These training records will be kept with all other training records in the training department.

4.3 CHECK – Inspection, Maintenance and Documentation

An inspection of the conformity with the BMPs will be documented weekly using a Dust Control Inspection Form (see Appendix D for an example form for discussion only). Each dust emission source type has a corresponding log sheet (see Appendix E) to record all dust control activity pertaining to those sources.

In the event of a non-conformance, the inspector will add the incident to the Non-Conformance Log (see Appendix F). Corrective action is to be taken to eliminate the causes of the non-conformance. It is expected that all deficiencies identified in inspections be addressed immediately. Reviews of the Non-Conformance Logs will be done quarterly as part of the BMP continuous improvement program, explained in more details in Section 4.4.

Table 6 provides a summary of the proposed inspections that will take place at the site under this Plan and the inspection frequency.

Table 6: Inspection Frequency Summary

Inspection Type	Frequency
Dust Control Inspection Form	Weekly
Equipment Maintenance Inspection Form	Monthly
Activity Logs	Whenever the activity occurs
Non-conformance log	Whenever a non-conformance occurs

Table 7 presents all the inspection and maintenance procedures in place and the respective documentation to support ongoing conformity with preventative and control measures described in the Table 3 for each emission type.

Table 7: Inspection Documentation for the Facility Organized by Emission Source Type

Dust Emission Source Type	Documentation	Document Control/ Recordkeeping
Paved Roadways	Dust Control Inspection Form	7 years
	Paved Roadways Vacuum Log	
	Non-Conformance Log	
Material Handling / Storage	Dust Control Inspection Form	7 years
	Material Handling Log	
	Non-Conformance Log	
Material Processing	Dust Control Inspection Form	7 years
	Material Handling Log	
	Non-Conformance Log	
	Equipment Maintenance and Inspection Form	

As part of recordkeeping procedures the above information should be recorded in electronic files and hard copies, for a minimum period of seven years. The Production Superintendent is responsible for recordkeeping the information listed above and copies of all documents are kept in the Production Superintendent's office.

4.3.1 Fugitive Dust Characterization

Paved roadways have a predictive high fugitive dust emission risk ranking, even with the proposed best management practices of watering and vacuuming implemented on a regular schedule. The close proximity of the roadways to the property boundary and the predominant wind direction from the roadway sources towards the closest sensitive areas contribute to increased risk levels from these sources. It is recommended that further investigation of the fugitive dust emissions from the paved roadways be conducted as part of the "Check" stage once the Facility is in operation.

Fugitive dust sampling can be conducted to confirm the silt content for the Facility's paved roadways. In the absence of fugitive dust sampling, the silt content was assumed to be 5.00 g/m^2, a value based on fugitive dust management plans associated with similar facilities. This assumption can be replaced with site specific data from road dust sampling to obtain a more accurate risk assessment for the paved roadways.

Additionally, road dust sampling can review the assumptions of composition and size distribution of the fugitive dust particulate composition of the road dust that have been utilized in the Fugitive Dust Source Risk Ranking tool.

4.4 ACT – BMP Plan Review and Continuous Improvement

Inspections and monitoring procedures will assist Colacem personnel with the maintenance of an effective BMP Plan. The BMP Plan should be monitored and updated, as follows:

- when there are significant changes in the fugitive dust emissions sources;
- periodically, every five years;
- when there are verified complaints associated with fugitive dust emissions from the Facility; and

- when there are visible dust emissions occurring more frequently and/or at a higher rate (excluding seasonal conditions).

Review of the BMP Plan is intended to evaluate the effectiveness of the dust control practices and focus on the identification of improvement opportunities that can reduce the risk of complaints related to fugitive dust emissions.

5.0 REFERENCES

Centre for Excellence in Mining Innovation. 2010. Guide to the Preparation of a Best Management Practices Plan for the Control of Fugitive Dust for the Ontario Mining Section. Version 1.0, June 2010.

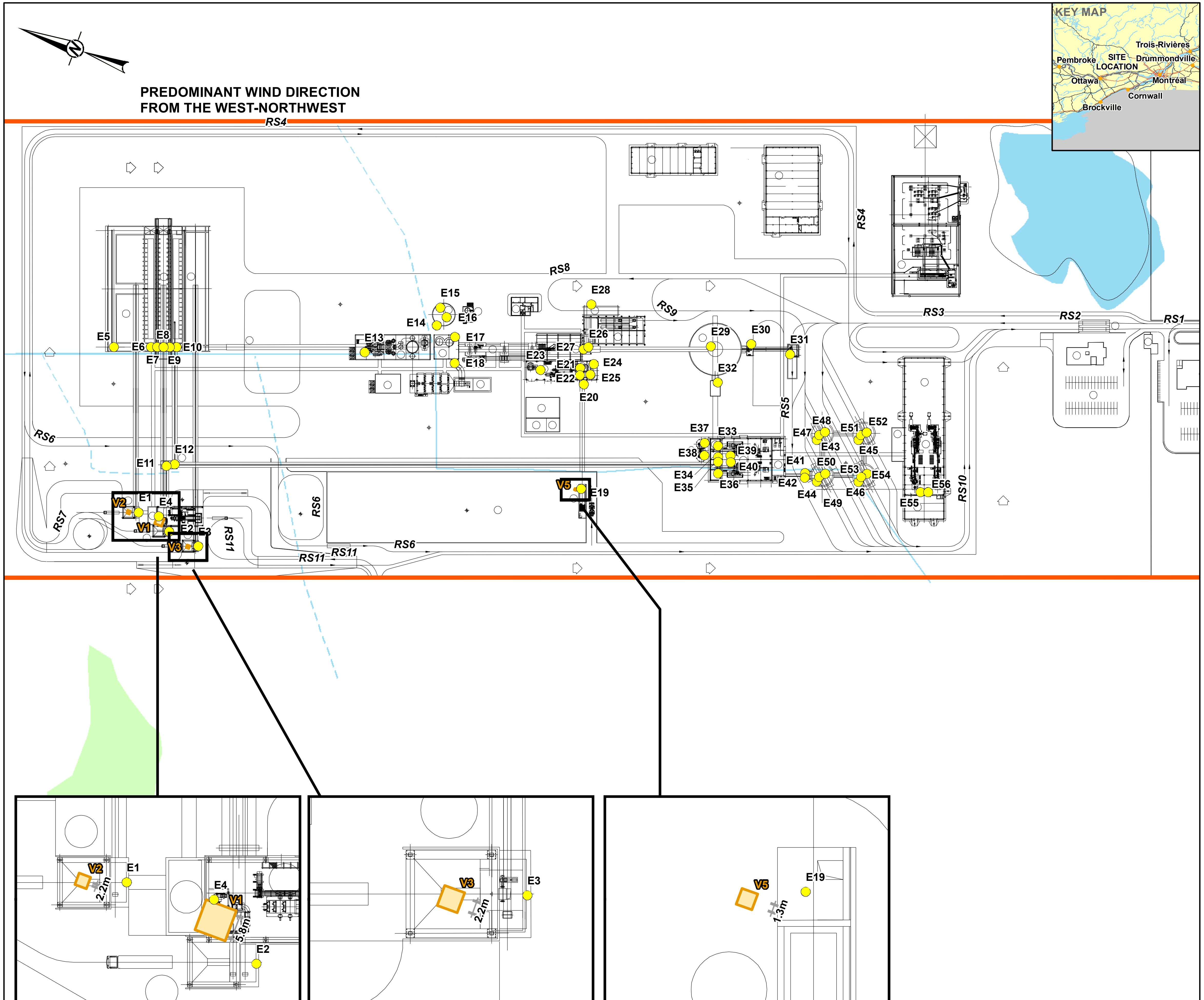
Golder Associates Ltd. 2010. Literature Review of the Current Fugitive Dust Control Practices within the Mining Industry. June 2010.

Ontario Ministry of the Environment and Climate Change. 2004. Review of Approaches to Manage Industrial Fugitive Dust Sources. January 2004.

Ontario Ministry of the Environment and Climate Change. 2009. Procedure for Preparing an Emission Summary and Dispersion Modelling Report – Version 3.0. March 2009.

United States Environmental Protection Agency (USEPA). 1995. AP-42 – Compilation of Air Pollutant Emission Factors – Fifth Edition. January 1995.

FIGURES



LEGEND

- POINT SOURCE
- LAYOUT
- WATERBODY
- WOODED AREA
- SITE BOUNDARY OF PROPOSED PROJECT
- VOLUME SOURCE

Fugitive Sources

V1	(FUG1, FUG3 to FUG 5)
V2	(FUG2)
V3	(FUG6)
V4	(FUG7)

Point Sources

E1 to E56

Road Sources

RS1 to RS11

NOTE(S)
THE INSETS IN THE FIGURE ARE NOT DRAWN TO SCALE.

0 100 200
1:3,000 METRES

REFERENCE(S)
MNR LIO, OBTAINED 2015
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2015
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

CLIENT
COLACEM CANADA INC.

PROJECT
COLACEM L'ORIGNAL CEMENT PLANT ECA

TITLE
FUGITIVE DUST SOURCES

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-01-20
DESIGNED	JMC
PREPARED	JMC
REVIEWED	KL
APPROVED	JDM

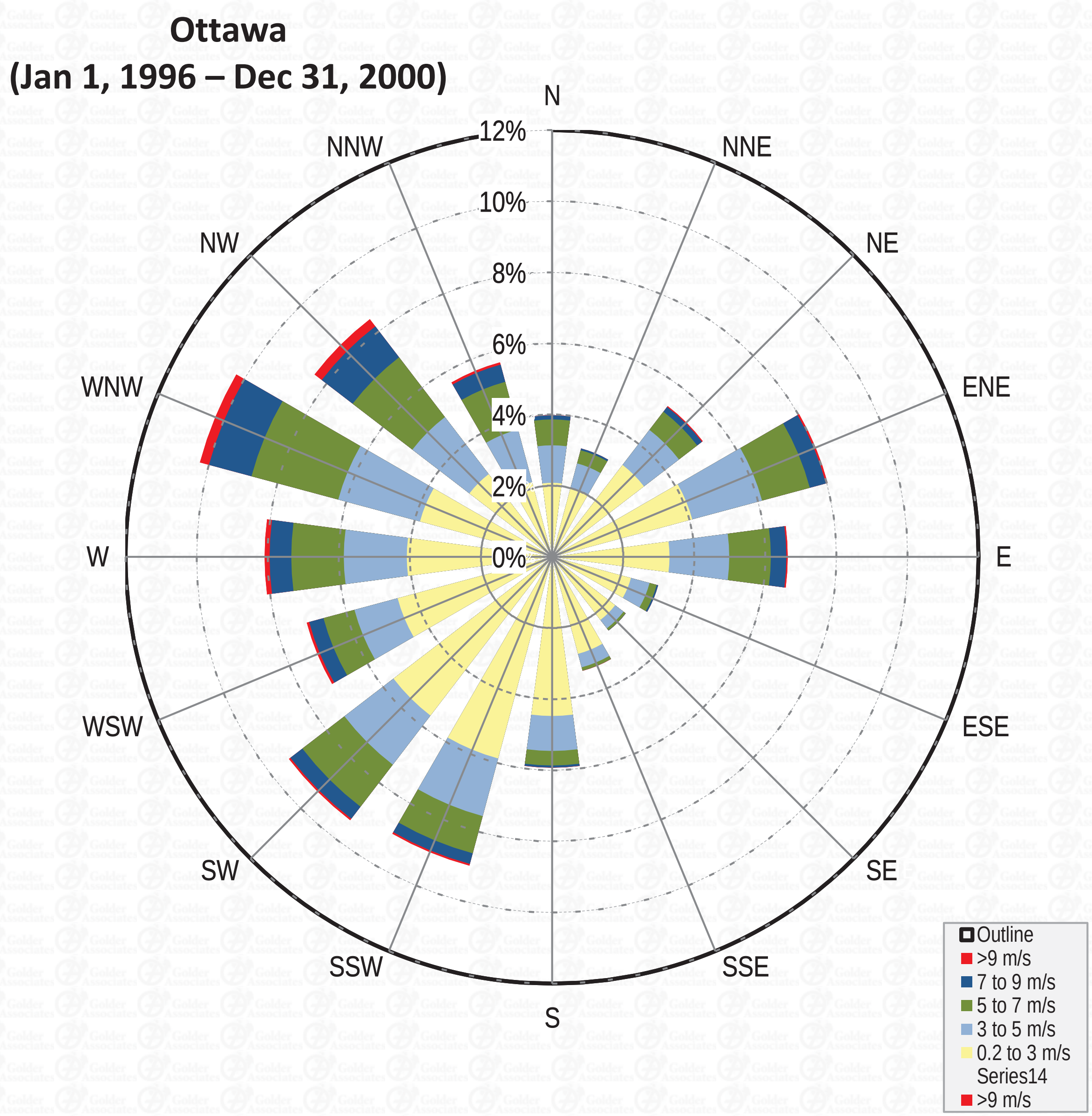
PROJECT NO.	CONTROL	REV.	MAP
1529718	-	-	E1

Wind-Rose Figure

Colacem Canada Incorporated L'Orginal Ontario

Best Management Practice Plan for the Control of Fugitive Dust

FIGURE 2



Date: October 2015

Project: 1529718

Golder Associates

APPENDIX A

Ministry Comments

The table provides the list of Ministry comments pertaining to the creation of this document.

Date	Ministry Comment

n:\active\2015\3 proj\1529718 colacem_l'orignal_champlain\air\esdm report\final esdm\appendices\app e - bmpp\app a- minsitry comments\appendix a.docx

APPENDIX B

Fugitive Dust Source Risk Ranking

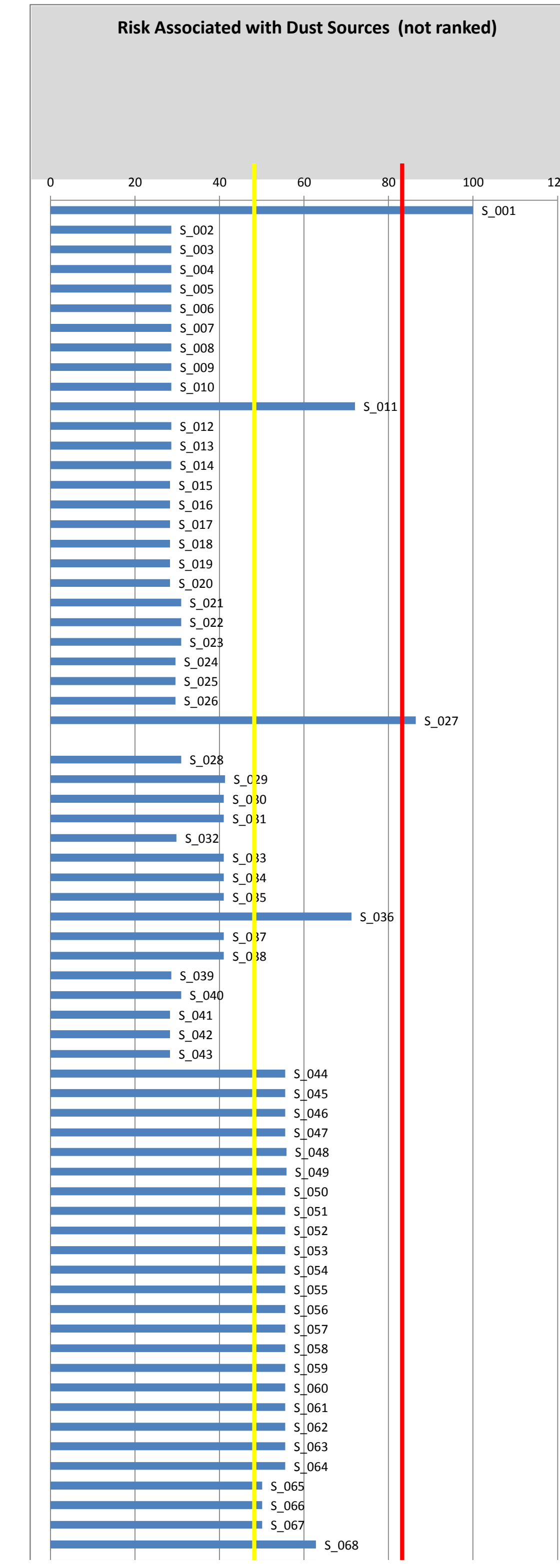
Fugitive Dust Risk Management Tool

Step 1 - Calculation of risks associated with fugitive dust sources

(orange)	Cells to be populated
(green)	Drop-down menu
(yellow)	Automatically

100	Max:
85	Red: >
50	Yellow: >

				Source	Path	Path	Source	Receptor	Path / Receptor	Path	Source	Source	Source	Source	
				Risk Factors											
				1	2	3	4	5	6	7	8	9	10	11	Risk
Source ID Number	Description of the structure / equipment	ESDM Report Source ID	Category	Frequency of process / activity that generates fugitive dust:	Position of the source related to sensitive areas (e.g.: communities, working areas):	Predominant wind direction is from the source to the closest sensible area?	Relative amount of visible dust generated in the process / activity:	Dust composition	Dust size range (higher mass percentage)	Is there some wind barrier (e.g.: trees, buildings, landscape) which can prevent the emissions from this source to reach the closest sensitive area?	Is there some measure applied on regular basis to prevent dust emission from this source (preventative)?	Is there some measure applied to this source to reduce dust emission once it occur (reactive)?	Is there some monitoring procedure applied to this source related to fugitive dust control?	Monitoring data / information trigger some control measure?	Total Normal.
S_001	WCS - Worst Case Scenario		Material transfer (drop operations)	Continuous	Close	Yes	High	Metals	Fine	No	No	No	No	No	100
S_002	FUG1	Limestone Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_003	FUG2	Bauxite Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_004	FUG3	Shale Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_005	FUG4	Iron Ore Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_006	FUG5	Silica Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_007	FUG6	Gypsum Receiving	Material transfer (drop operations)	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_008	E1	Raw Material Receiving of Buaxite	Material transfer (drop operations)	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_009	E2	Raw Material Receiving of Shale	Material transfer (drop operations)	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_010	E3	Gypsum reception bin	Material transfer (drop operations)	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_011	E4	Limestone Crusher Dedusting	Process	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	72
S_012	NEG1	Limestone and Shale Storage	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_013	NEG2	Gypsum Storage	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_014	E5	Bauxite Storage	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_015	E6	Iron Hopper Hopper	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_016	E7	Silica Hopper	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_017	E8	Limestone reclaimer belt	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_018	E9	Limestone reclaimer belt	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_019	E10	Gypsum reclaimer belt	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_020	E11	Conveyor Belt to Cement Mill	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_021	E12	Conveyor Belt to Raw Mill	Material transport (conveying, trucks)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	31
S_022	E13	Feed to Raw Mill	Material transport (conveying, trucks)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	31
S_023	E14	Raw Mill Air Slide	Material transport (conveying, trucks)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	31
S_024	E15	Raw Mix Silo Loading	Material transfer (drop operations)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	30
S_025	E16	Raw Mix Silo Unloading	Material transfer (drop operations)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	30
S_026	E17	Air lift bin dedusting	Material transfer (drop operations)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	30
S_027	E18	Kiln End Process Filter	Process	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	86
S_028	E26	Alternative Fuel	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_029	E27	Clinker Cooler	Material transport (conveying, trucks)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	31
S_030	FUG7	Petcoke Receiving	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_031	FUG8	Petcoke Loading to Hopper	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_032	E19	Petcoke Reception Bin	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_033	STOR1	Petcoke Storage	Material transport (conveying, trucks)	Intermittent	Far	No	High	No metals	Fine	Yes	Yes	Yes	Yes	Yes	30
S_034	E20	Petcoke Hopper	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_035	E21	Coarse Petcoke Silo 1	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_036	E22	Coarse Petcoke Silo 2	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_037	E23	Petcoke Grinding	Process	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	71
S_038	E24	Pulverized Petcoke Silo 1	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_039	E25	Pulverized Petcoke Silo 2	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	41
S_040	E28	Clinker Receiving Bin	Material transfer (drop operations)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	29
S_041	E29	Finished Clinker Silo Loading	Material transport (conveying, trucks)	Continuous	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	31
S_042	E30	Clinker Bulk Loading	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_043	E31	Clinker Silo Unloading for Bulk	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_044	E32	Clinker Silo Unloading for Cement Mill	Material transport (conveying, trucks)	Intermittent	Far	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	28
S_045	E33	Cement Clinker Hopper Loading	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_046	E34	Cement Limestone Hopper Loading	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_047	E35	Cement Gypsum HopperLoading	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_048	E36	Cement No. 4 Constituent Hopper Loading	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_049	E37	Raw Material Receiving of Silica Fume	Material transfer (drop operations)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_050	E38	Raw Material Receiving of Fly Ash	Material transfer (drop operations)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_051	E39	Cement Mill 1	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_052	E40	Cement Mill 2	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_053	E41	Cement Mill 1	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_054	E42	Cement Mill 2	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_055	E43	Cement Silo 1A top filter	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_056	E44	Cement Silo 1A Bulk Loading A	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_057	E45	Cement Silo 1A Bulk Loading B	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_058	E46	Cement Silo 1B top filter	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_059	E47	Cement Silo 1B Bulk Loading A	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_060	E48	Cement Silo 1B Bulk Loading B	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_061	E49	Cement Silo 2A top filter	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_062	E50	Cement Silo 2A Bulk Loading A	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_063	E51	Cement Silo 2A Bulk Loading B	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_064	E52	Cement Silo 2B top filter	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_065	E53	Cement Silo 2B Bulk Loading A	Material transport (conveying, trucks)	Intermittent	Far	Yes	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	56
S_066	E54	Cement Silo 2B Bulk Loading B	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	50
S_067	E55	Packing Plant Line A	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	50
S_068	E56	Packing Plant Line B	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	Yes	Yes	Yes	Yes	Yes	50
S_069	E57	Concrete Mixing Plant Silo A	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	63
S_070	E58	Concrete Mixing Plant Silo B	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	63
S_071	E59	Concrete Mixing Plant Silo C	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	63
S_072	FUG9	Concrete Mixing Plant Fugitives	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	63
S_073	FUG10	Concrete Mixing Plant Fugitives	Material transport (conveying, trucks)	Intermittent	Close	No	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	63
S_074	RS-1	CT, SF, AF, RM, PC	Paved road / area	Intermittent	Close	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	97
S_075	RS-2	CT, SF, AF, RM, PC	Paved road / area	Intermittent	Close	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	97
S_076	RS-3	CT, SF, AF, RM, PC	Paved road / area	Intermittent	Close	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	97
S_077	RS-4	PC, RM	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_078	RS-5	CT	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_079	RS-6	PC	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76



Fugitive Dust Risk Management Tool

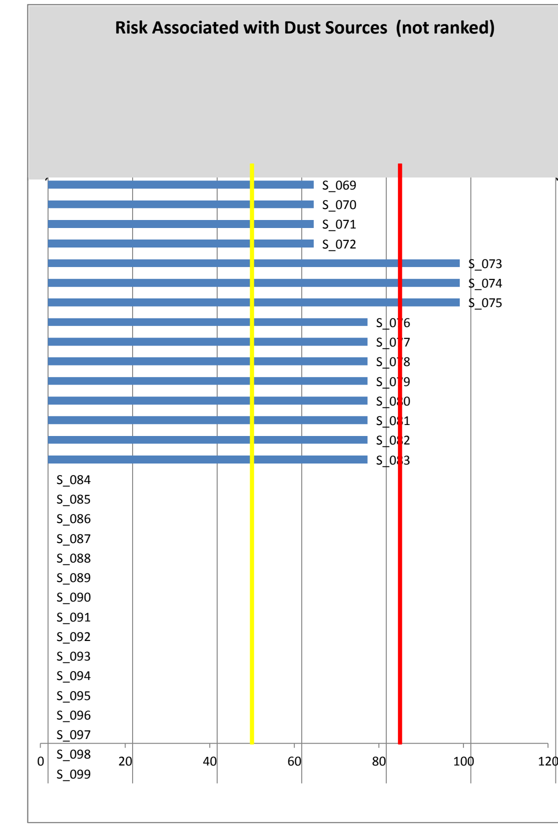
Step 1 - Calculation of risks associated with fugitive dust sources

(orange)	Cells to be populated
(green)	Drop-down menu
(yellow)	Automatically

100	Max:
85	Red: >
50	Yellow: >

				Source	Path	Path	Source	Receptor	Path / Receptor	Path	Source	Source	Source	Source	
				Risk Factors											
				1	2	3	4	5	6	7	8	9	10	11	Risk
Source ID Number	Description of the structure / equipment	ESDM Report Source ID	Category	Frequency of process / activity that generates fugitive dust:	Position of the source related to sensitive areas (e.g.: communities, working areas):	Predominant wind direction is from the source to the closest sensible area?	Relative amount of visible dust generated in the process / activity:	Dust composition	Dust size range (higher mass percentage)	Is there some wind barrier (e.g.: trees, buldings, landscape) which can prevent the emissions from this source to reach the closest sensitive area?	Is there some measure applied on regular basis to prevent dust emission from this source (preventative)?	Is there some measure applied to this source to reduce dust emission once it occur (reactive)?	Is there some monitoring procedure applied to this source related to fugitive dust control?	Monitoring data / information trigger some control measure?	Total Normal.
S_080	RS-7	RM	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_081	RS-8	AF	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_082	RS-9	SF	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_083	RS-10	CT, SF, AF, PC	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_084	RS-11	LS	Paved road / area	Intermittent	Far	Yes	Low	No metals	Fine	No	Yes	Yes	Yes	Yes	76
S_085															0
S_086															0
S_087															0
S_088															0
S_089															0
S_090															0
S_091															0
S_092															0
S_093															0
S_094															0
S_095															0
S_096															0
S_097															0
S_098															0
S_099															0
S_100															0

Truck Activities	Code
Limestone	LS
Petcoke	PC
Iron	RM
Bauxite	RM
Shale	RM
Gypsum	RM
Silica	RM
Alternative Fuels	AF
Silica fume and fly ash	SF
Cement Truck	CT
LS cement	LSC



APPENDIX C

Start Up Checklist

Paved Roadways
Start-up Checklist

Roadway Characteristics	
Source ID:	
Location (note proximity to the property line):	
Length:	
Surface materials:	
Anticipated volume of vehicle traffic:	
Peak traffic time:	
Anticipated vehicle speed limit:	

Special Considerations for the Control of Dust Emissions

Implementation	Yes
Has this roadway been added to the vacuum truck schedule?	
Has this roadway been added to the inspection protocol?	

Answering "Yes" to the implementation questions documents compliance with the Best Management Practice Plan for Control of Fugitive Dust Emissions.

Name of Plant Contact:		**Name of Supervisor:**	
Signature:		**Signature:**	
Date:		**Date:**	

Material Handling / Storage
Start-up Checklist

Unit Process Characteristics	
Source ID:	
Operation type:	
Location:	
Material being handled:	
Material handling rate:	
Peak handling time:	

Special Considerations for the Control of Dust Emissions

Implementation	Yes
Has the storgae pile been oriented with prevailings winds?	
Has the storage pile been oriented to reduce exposed surface area?	
Has the storage pile been placed to take advantage of natural wind breaks?	
Have material drop heights been discussed with the operators?	
Has this unit been added to the inspection logs?	

Answering "Yes" to the implementation questions documents compliance with the Best Management Practice Plan for Control of Fugitive Dust Emissions.

Name of Plant Contact:		**Name of Supervisor:**	
Signature:		**Signature:**	
Date:		**Date:**	

Material Processing Start-up Checklist

Unit Process Characteristics	
Source ID:	
Operation type:	
Location:	
Material being processed:	
Material processing rate:	
Peak processing time:	

Special Considerations for the Control of Dust Emissions

Implementation	Yes
Have material drop heights been minimized as much as possible?	
Has this unit been added to the inspection logs?	

Answering "Yes" to the implementation questions documents compliance with the Best Management Practice Plan for Control of Fugitive Dust Emissions.

Name of Plant Contact:		Name of Supervisor:	
Signature:		**Signature:**	
Date:		**Date:**	

APPENDIX D

Dust Control Inspection Form

Dust Control Weekly Inspection Form

Date:
Inspector Name:

Paved Roadways				
Please check all segments that were inspected: PR1 ____ PR2 ____ PR3 ____				
If some segments were not inspected, pleased indicate below which segment and why it was not inspected.				
Inspection Items	**Response**	**Requirement**	**Conformance (Y or N)**	**Description of Non-Conformance**
Is visible dust observed from any section of roadway?		N		
Are appropriate load sizes maintained on haul vehicles?		Y		
Are roadways well maintained? (ie good housekeeping)		Y		
Has the vacuum log been maintained?		Y		
Has the non-conformance log been maintained?		Y		
Have previous non-conformances been rectified?		Y		

Unpaved Roadways				
Please check all segments that were inspected: UP1 ____ UP2 ____ UP3 ____ UP4 ____ UP5 ____ UP6 ____ UP7 ____ UP8 ____				
If some segments were not inspected, pleased indicate below which segment and why it was not inspected.				
Inspection Items	**Response**	**Requirement**	**Conformance (Y or N)**	**Description of Non-Conformance**
Is visible dust observed from any section of roadway?		N		
Are appropriate load sizes maintained on haul vehicles?		Y		
Are roadways well maintained? (ie good housekeeping)		Y		
Has the watering log been maintained?		Y		
Has the non-conformance log been maintained?		Y		
Have previous non-conformances been rectified?		Y		

For revisions to this form, please contact the Production Superintendent

Dust Control Weekly Inspection Form

Date:
Inspector Name:

Material Handling / Storage				
Please check all areas that were inspected: SS ____ COS ____				
If some areas were not inspected, pleased indicate below which area and why it was not inspected.				
Inspection Items	**Response**	**Requirement**	**Conformance (Y or N)**	**Description of Non-Conformance**
Is visible dust observed from any material handling location?		N		
Are low drop heights maintained?		Y		
Are material handling locations well maintained? (ie good housekeeping)		Y		
Has the activity log been maintained?		Y		
Has the non-conformance log been maintained?		Y		
Have previous non-conformances been rectified?		Y		

Material Processing				
Please check all areas that were inspected: CR ____				
If some areas were not inspected, pleased indicate below which area and why it was not inspected.				
Inspection Items	**Response**	**Requirement**	**Conformance (Y or N)**	**Description of Non-Conformance**
Is visible dust observed from any location?		N		
Has the equipment been maintenance inspected within the last month?		Y		
Are storage areas well maintained? (ie good housekeeping)		Y		
Has the activity log been maintained?		Y		
Has the non-conformance log been maintained?		Y		
Have previous non-conformances been rectified?		Y		

All non-conformances must be documented in the Non-Conformance Log

Inspector Sign Off: ______________________________

For revisions to this form, please contact the Production Superintendent

APPENDIX E

Dust Control Activity Log Sheets

Paved Roads
Vacuum Log

Section of Roadway (Source ID)	Date	Description of Procedure (Equipment used)	Start Time	End Time	Operator Name & Company	Company Sign Off

Unpaved Roads
Watering Log

Section of Roadway (Source ID)	Date	Description of Watering (Equipment used, amount of water applied)	Start Time	End Time	Operator Name & Company	Company Sign Off

Material Handling / Storage
Dust Control Activity Log

Material Handling / Storage Area (Source ID)	Date	Description of Activity	Start Time	End Time	Operator Name & Company	Company Sign Off

For revisions to this form, please contact the Production Superintendent

Material Processing
Dust Control Activity Log

Material Processing Area (Source ID)	Date	Description of Activity	Start Time	End Time	Operator Name & Company	Company Sign Off

APPENDIX F

Non-Conformance Log

Non - Conformance Log

Date	Time	Inspector Name	Potential or Actual Non-Conformance		Cause	Action	Recommendation	Corrective Action Sign Off
			Location / Source ID	Activity / Process / Condition				

For revisions to this form, please contact the Production Superintendent

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
6925 Century Avenue, Suite #100
Mississauga, Ontario, L5N 7K2
Canada
T: +1 (905) 567 4444

Golder Associates

APPENDIX F

Dispersion Modelling Files (On CD)

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
6925 Century Avenue, Suite #100
Mississauga, Ontario, L5N 7K2
Canada
T: +1 (905) 567 4444