



BCX
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Emission Summary and Dispersion Modelling Report

Windlectric Inc.
Ready Mix Concrete Batching Plant

Report to: Ministry of the Environment
and Climate Change
Environmental Approvals Access and
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Executive Summary

This Emission Summary and Dispersion Modelling (ESDM) report is being prepared by Windlectric Inc. for a temporary truck mix ready-mix concrete (RMC) batching plant in support of a Renewable Energy Approval Application (MOECC reference number: 1271-96VNH3) for Amherst Island Wind Energy Project. The ESDM Report has been prepared in accordance with Section 26 of Ontario Regulation 419/05; the Ministry of the Environment and Climate Change's (MOECC) *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*, and the MOECC's *Air Dispersion Modelling Guideline for Ontario (March 2009)*.

The purpose of the RMC plant is to provide ready-mix concrete for the Amherst Island Wind Energy Project during the construction phase only. The RMC plant may operate from 7am to 7pm on Monday to Saturday.

The RMC plant, which is typical of RMC plants in Ontario, will receive aggregate materials by truck and cementitious materials by tanker truck. These materials, along with water containing small quantities of admixtures (aqueous solutions), will be proportionately transferred directly into ready-mix trucks. If necessary, the water will be heated by a No.2 oil-fired hot water / steam boiler to raise the temperature of the concrete mix. During the winter months an outside sand stockpile may be heated by steam generated from the same boiler.

The emissions from the RMC plant will be i) particulate, which may also include respirable crystalline silica (quartz) generated as a result of the handling and transfer of aggregate and cementitious materials; and ii) combustion emissions, including nitrogen oxides, sulphur dioxide, carbon monoxide and particulate from the No.2 oil-fired boiler and two diesel-fired generators that will power the RMC plant. Any emissions from the use of admixtures are considered negligible per MOECC guidelines. Fugitive dust emissions from onsite roads and stockpiles will be controlled through the Best Management Practice Plan for fugitive particulate as required by the MOECC guidelines.

Emissions from the RMC plant were conservatively estimated using published US Environmental Protection Agency (EPA) and MOECC emission factors according to the MOECC's *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*.

Maximum site-wide emissions were conservatively modelled using the MOECC approved US EPA AERMOD system and the MOECC regional meteorological data for the eastern region. The resulting Point-of-Impingement (POI) concentrations, which occur at Windlectric's property line (i.e. south quadrants of Part Lot 35 - 37 Concession 1 and Part Lot 34 Concession 1), were compared to the Schedule 3 Standards in the MOECC *Summary of Standards and Guidelines to Support Ontario Regulation 419/05 Air Pollution – Local Air Quality (April 2012)*. As shown in Table ES-1, all contaminants are below their respective POI limits.



Table ES-1: Emission Summary Table

Contaminant Name	CAS No.	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Period (hr)	MOE POI Limit ($\mu\text{g}/\text{m}^3$)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
Total Suspended Particulate	-	2.29E-01	AERMOD	84.07	24	120	Visibility	3	70.1%
Respirable Crystalline Silica (quartz) (PM_{10})	14808-60-7	7.89E-03	AERMOD	3.9	24	5	Health	3	78.4%
Nitrogen Oxides	10102-44-0	8.13E-01	AERMOD	49.40	24	200	Health	3	24.7%
Nitrogen Oxides	10102-44-0	8.13E-01	AERMOD	341.13	1	400	Health	3	85.3%
Sulphur Dioxide	7446-09-5	1.86E-01	AERMOD	21.44	24	275	Health	3	7.8%
Sulphur Dioxide	7446-09-5	1.86E-01	AERMOD	154.78	1	690	Health	3	22.4%
Carbon Monoxide	630-08-0	1.76E-01	AERMOD	107.95	0.5	6000	Health	3	1.8%
Arsenic	7440-38-2	4.32E-06	AERMOD	0.001556	24	0.3	Health	Guideline	0.52%
Beryllium	7440-41-7	4.32E-06	AERMOD	0.001556	24	0.01	Health	3	15.56%
Cadmium	7440-43-9	4.32E-06	AERMOD	0.001556	24	0.025	Health	3	6.22%
Total Chromium	7440-47-3	4.32E-06	AERMOD	0.001556	24	1.5	Health	Guideline	0.10%
Lead	7439-92-1	4.32E-06	AERMOD	0.001556	24	0.5	Health	3	0.31%
Manganese	7439-96-5	4.32E-06	AERMOD	0.001556	24	2.5	Health	Guideline	0.06%
Nickel	7440-02-0	4.32E-06	AERMOD	0.001556	24	2	Vegetation	3	0.08%
Selenium	7782-49-2	4.32E-06	AERMOD	0.001556	24	10	Health	Guideline	0.02%



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1.0 INTRODUCTION AND FACILITY DESCRIPTION

Algonquin Power Co. (on behalf of Windlectric, Inc.) retained BCX Environmental Consulting (BCX) to prepare this Emission Summary and Dispersion Modelling Report (ESDM) for a Lafarge Canada Inc. owned and operated truck mix ready-mix concrete (RMC) batching plant (Facility) in support of a Renewable Energy Approval Application (MOECC reference number: 1271-96VNH3) for the Amherst Island Wind Energy Project.

The ESDM Report has been prepared in accordance with Section 26 of Ontario Regulation 419/05; the Ministry of the Environment and Climate Change's (MOECC) *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*, and the MOECC's *Air Dispersion Modelling Guideline for Ontario (March 2009)*.

The primary North American Industry Classification System (NAICS) code that best describes the Facility is 327320 – Ready-Mix Concrete Manufacturing.

1.1 Site Description

The plant will be located on Amherst Island, Ontario (Part Lot 35 - 37 Concession 1 and Part Lot 34 Concession 1) for the duration of the construction phase of the Amherst Wind Energy Project only. Since the Amherst Wind Energy Project falls under the Renewable Energy Act, it is exempt from zoning requirements under the Planning Act.

The purpose of the RMC plant is to provide ready-mix concrete for the Amherst Wind Energy Project. The RMC plant may operate from 7am to 7pm per day from Monday to Saturday. The RMC plant will operate with a maximum production rate of 600 cubic metres per day.

1.2 Process Description

A detailed process description is provided below. A process flow diagram (Figure 1), site layout (Figure 2), and property line (Figure 3) are provided in Appendix A.

1.2.1 Ready-Mix Concrete Batching Plant

Aggregate materials (i.e. unwashed limestone and washed sand) will be delivered to the Facility by truck and deposited onto stockpiles. Aggregate materials will be transferred from the stockpiles by a front-end loader into the aggregate hopper.

Aggregate materials will be transferred from the aggregate hopper to the elevated aggregate bins via an inclined conveyor.

Aggregate materials will be gravity fed from the aggregate bins to the aggregate weigh scale below each bin. The appropriate mass of aggregate materials will be transferred via conveyor and deposited directly into the ready-mix truck through a long rubber sock equipped with a dust shroud inside a partially enclosed loading point.

Cementitious materials (i.e. Portland cement and fly ash) will be delivered by tanker truck and stored in two silos and an auxiliary silo (pig). The cementitious materials are composed essentially of naturally occurring materials as indicated in the MSDS' provided in Appendix B.

Silo #1 and Silo #2 will have capacities of 65 tonnes and 35 tonnes, respectively. Emissions from these silos will be controlled by two identical pulse jet-type baghouses. The auxiliary silo will have a capacity of 160 tonnes. Emissions from this silo will be controlled by the baghouse on Silo #1. The auxiliary silo will be used to replenish Silo #1 as required. Cementitious materials from silos #1 and #2 will be fed by augers to the cement weigh scale located above the loading point. The appropriate mass of cementitious materials from the cement weigh scale will be gravity fed directly into the ready-mix truck through a long rubber sock equipped with a dust shroud inside the partially enclosed loading point.

Water containing small quantities of admixtures (i.e. chemical additives added to achieve certain properties in concrete) as described in Appendix C will be added directly into a ready-mix truck. If necessary, the water will be heated by a No.2 oil-fired hot water / steam boiler to raise the temperature of the concrete mix. During the winter months an outside sand stockpile may be heated by steam generated from the same boiler.

The RMC plant will be powered by a 198 hp diesel generator. A second smaller 109 hp diesel generator will be used during non-operating hours to provide power for the boiler.

1.2.2 Other Facility Operations

Other operations/activities associated with the RMC plant will include:

- maintenance activities;
- onsite vehicle fuelling and storage tanks;
- vehicles travelling on onsite roads; and
- wind erosion of stockpiles and from aggregate conveying.

1.3 Summary of Equipment and Operations

The RMC plant will consist of the following equipment and operations:

One (1) ready-mix concrete batching plant having a maximum production rate of 600 cubic metres per day, including the following equipment exhausting to the atmosphere:

- One (1) baghouse dust collector, to control emissions from storage Silo #1 and the auxiliary silo, complete with polyester filter material having a filtering area of 10.6 square metres and a pulse jet-type cleaning system, discharging to the atmosphere at a volumetric flow rate of 0.28 cubic metre per second through a vent having an equivalent exit diameter of 0.13 metre, extending to a height of 10.7 metres above grade;
- One (1) baghouse dust collector, to control emissions from storage Silo #2 and the cement weigh scale, complete with polyester filter material having a filtering area of 10.6 square metres and a pulse jet-type cleaning system, discharging to the atmosphere at a volumetric flow rate of 0.28 cubic metre per second through a vent having an equivalent exit diameter of 0.13 metre, extending to a height of 9.8 metres above grade;
- One (1) ready-mix concrete truck loading point with a long rubber sock equipped with a dust shroud, inside an enclosure on three sides and a top;
- One (1) No. 2 oil-fired hot water / steam boiler, having a maximum heat input of 2,216,000 kilojoules per hour (2.1 MMBtu/hr), discharging to the atmosphere through a stack having an exit diameter of 0.3 metre, extending 6.4 metres above grade;
- One (1) diesel generator rated at 148 kilowatts (198 HP), exhausting into the atmosphere through a stack having an exit diameter of 0.13 metre and a height of 6 metres above grade;
- One (1) diesel generator rated at 81 kilowatts (109 HP), exhausting into the atmosphere through a stack having an exit diameter of 0.13 metre and a height of 6 metres above grade; and
- Fugitive emissions from the delivery, storage and transfer of materials associated with ready-mix concrete batching operations.

This ESDM Report provides a full site-wide emission inventory and air dispersion modelling exercise for the entire Facility.

2.0 INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

Table 1 below provides a summary of sources and contaminants on site. Negligible sources are discussed in Section 3.0. Significant sources are discussed in Section 4.0.

Table 1: Source and Contaminants Identification Table

Source I.D.	Source Information		Expected Contaminants	Included in Modelling? Significant? (Yes or No)
	Source Description	General Location		
1	Delivery trucks to aggregate stockpiles (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
2	Material transfer from stockpiles to aggregate hoppers via front-end loader (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
3	Material transfer from aggregate hopper to inclined conveyor (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
4	Material transfer from inclined conveyor to elevated aggregate bins (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
5	Material transfer from aggregate bins to aggregate weigh scale (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
6	Material transfer from aggregate weigh scale to loading point conveyor (coarse aggregate / sand)	See Figure 2	TSP RCS	Yes Yes (coarse aggregate only)*
7	Delivery of cementitious materials to silos by tanker trucks (cementitious material)	See Figure 2	TSP RCS Metals	Yes Yes Yes
8	Material transfer from silos to cement weigh scale (cementitious material)	See Figure 2	TSP RCS Metals	No - vents through baghouse of Silo #2
9	Material transfer to ready mix trucks at the loading point (coarse aggregate / sand / cementitious materials / admixtures)	See Figure 2	TSP RCS Metals Admixtures (see Appendix C)	Yes Yes (coarse aggregate and cementitious material only)* Yes (cementitious material only) No - Non-volatile
10	No. 2 oil-fired hot water/steam boiler	See Figure 2	TSP NO _x SO ₂ CO	Yes Yes Yes Yes
11	Main diesel-fired generator	See Figure 2	TSP NO _x SO ₂ CO	Yes Yes Yes Yes
12	Secondary diesel-fired generator	See Figure 2	TSP NO _x SO ₂ CO	Yes Yes Yes Yes
13	Maintenance activities	See Figure 2	TSP	No - Exempt per EPA Section 9
14	Onsite equipment fuelling and storage tank	See Figure 2	Diesel Fumes	No - Table B-3
15	Vehicles travelling on onsite roads	See Figure 2	TSP	No - Procedure Section 7.4.1
16	Wind erosion of stockpiles	See Figure 2	TSP	No - Procedure Section 7.4.1
17	Wind erosion from aggregate conveying	See Figure 2	TSP	No - BMP Plan

Notes: TSP = Total Suspended Particulate, NO_x = Nitrogen Oxides, SO₂ = Sulphur Dioxide, CO = Carbon Monoxide
 RCS = Respirable Crystalline Silica (quartz) (PM₁₀)
 Metals = Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium
 BMP = Best Management Practices
 * The sand is washed and therefore the respirable sized fraction (PM₁₀ and less) is negligible.

3.0 ASSESSMENT OF SIGNIFICANCE OF CONTAMINANTS AND SOURCES

As identified in Table 1, some contaminant sources are expected to be negligible and are, therefore, not included in the emission summary or source summary tables. The rationale for defining these sources as insignificant is presented below. MOECC's *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*.

3.1 Sources Exempt Under the EPA (Air & Noise)

Maintenance Activities

Section 9 (3) of the *Environmental Protection Act* identifies equipment and operations which are not required to be considered in an ESDM report. Item "a" identifies routine maintenance carried out on any plant, structure, equipment, apparatus, mechanism or thing to be exempt under the EPA.

3.2 Screening Out Sources that Emit Contaminants in Negligible Amounts

Table B-3 in Appendix B of the MOECC's *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*, provides a list of examples for excluding insignificant sources that generally emit contaminants in negligible amounts.

Onsite Vehicle Fuelling and Storage Tanks

Table B-3 in Appendix B of the MOECC Procedure identifies onsite storage tanks and facilities that are used for fuelling onsite vehicles as a specific example of sources that emit contaminants in negligible amounts.

Admixtures

Admixtures meet the MOECC's definition "Low temperature handling of compounds with a vapour pressure less than 1 kilopascal" in Table B-3 in Appendix B of the MOECC guidance document.

Specifically admixtures are typically non-volatile aqueous solutions (i.e., they have low vapour pressures and/or low evaporation rates). Admixtures are used in only small amounts (typically less than 1%) and are added directly into the ready-mix truck. Further documentation on admixture properties is given in Appendix C of this report.

Further, the admixtures will be stored in the control trailer. Table B-3 in Appendix B of the MOECC Procedure identifies chemical storage room ventilation as a specific example of sources that emit contaminants in negligible amounts.

3.3 Fugitive Dust Emissions from Onsite Roads and Wind Erosion of Storage Piles

Fugitive dust emissions from onsite roadways and wind erosion of stockpiles may be excluded from the assessment of compliance with MOECC POI Limits where:

1. the nature of the fugitive dust emissions is such that they are not likely to pose a health risk to humans; and
2. the emissions are relatively small or have been minimized through effective implementation of a fugitive dust control plan, consistent with best management practices.

In Table 7-3 of the MOECC's *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)*, the MOECC identifies ready-mix concrete manufacturing (NAICS Code 327320) as an industry sector where fugitive particulate from onsite roadways and wind erosion of stockpiles must be included in the ESDM report unless an effective best management practices plan for fugitive particulate is implemented.

Windlectric Inc. will require that Lafarge Canada Inc. implement a best management practices plan for fugitive particulate from the RMC plant activities. A copy of Lafarge Canada Inc.'s plan is included in Appendix D. Fugitive sources of dust from onsite roadways, wind erosion of stockpiles and wind erosion of aggregate conveying are, therefore, considered insignificant at this Facility.

4.0 OPERATING CONDITIONS, EMISSIONS ESTIMATION AND DATA QUALITY

Emission rate calculations for significant sources are described in Appendix E. The data quality rating and emission estimation technique are identified for significant sources in the Source Summary Table, Table 2.

4.1 Maximum Emissions Scenario

4.1.1 Particulate and Respirable Crystalline Silica (Quartz) (PM₁₀)

The maximum emissions scenario for Total Suspended Particulate (TSP) and Respirable Crystalline Silica (quartz) (PM₁₀) (RCS) conservatively assumes that:

- (1) The daily delivery of aggregate materials allows for aggregate stockpiling (i.e. more than is required for the maximum daily concrete production rate); and
- (2) Concrete batching is occurring at the maximum daily rate, all year round.

As noted in Section 2, the sand is washed and therefore the respirable sized fraction (PM₁₀ and less) is negligible.

4.1.2 Nitrogen Oxides, Sulphur Dioxide, and Carbon Monoxide

The No.2 oil-fired boiler associated with the RMC plant is conservatively assumed to operate at its maximum hourly rate, 24 hours per day, all year round.

The main diesel-fired generator is assumed to operate from 7am-7pm only and the secondary diesel-fired generator is assumed to operate from 7pm-7am only. For the purposes of modelling, both generators are conservatively assumed to operate, all year round (the secondary generator will in fact only operate during winter months).

4.1.3 Metals

The maximum emissions scenario for metals conservatively assumes that:

- (1) Concrete batching is occurring at the maximum daily rate, all year round; and
- (2) Very conservatively used the highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission factor for each source in the air dispersion modelling.

These operating conditions represent a very conservative maximum worst-case scenario. Actual emissions are expected to be much lower.

5.0 SOURCE SUMMARY TABLE

The Source Summary Tables (Table 2A and Table 2B) show the emission rate for each significant contaminant emitted from each significant source. The MOECC's *Procedure for Preparing an Emission Summary and Dispersion Modelling Report (March 2009)* Appendix D-Format 2 – Sorted by Source, is used. As required by Section 26 of O. Reg. 419 only significant sources and contaminants are listed in the Source Summary Table.

Table 2A: Source Summary Table – TSP, NO_x, SO₂, and CO

Source I.D.	Description	Source Data						Emission Data							
		Stack Volumetric Flow Rate (m ³ /s)	Stack Exit Temperature (°C)	Stack Inner Diameter (m)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates (x, y) ⁽¹⁾ (m)	Modelled Source	Contaminant	CAS #	Maximum Emission Rate (g/s)	Averaging Period (hr)	Emission Estimating Technique	Emissions Data Quality	% of Overall Emissions
1	Delivery trucks to aggregate stockpiles (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	AGG	TSP	-	4.17E-02	24	EF	A	17.1%
1	Delivery trucks to aggregate stockpiles (sand)	n/a	n/a	n/a	n/a	n/a	n/a	SAND1, SAND2	TSP	-	9.68E-03	24	EF	A	4.0%
2	Material transfer from stockpiles to hopper via front-end loader (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	TSP	-	1.82E-02	24	EF	A	7.5%
2	Material transfer from stockpiles to hopper via front-end loader (sand)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	TSP	-	4.24E-03	24	EF	A	1.7%
3	Material transfer from aggregate hopper to inclined conveyor (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	TSP	-	2.67E-03	24	EF	E	1.1%
3	Material transfer from aggregate hopper to inclined conveyor (sand)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	TSP	-	9.87E-05	24	EF	E	0.0%
4	Material transfer from inclined conveyor to elevated aggregate bins (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	1.82E-02	24	EF	A	7.5%
4	Material transfer from inclined conveyor to elevated aggregate bins (sand)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	4.24E-03	24	EF	A	1.7%
5	Material transfer from aggregate bins to aggregate weigh scale (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	1.82E-02	24	EF	A	7.5%
5	Material transfer from aggregate bins to aggregate weigh scale (sand)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	4.24E-03	24	EF	A	1.7%
6	Material transfer from aggregate weigh scale to loading point conveyor (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	2.67E-03	24	EF	E	1.1%
6	Material transfer from aggregate weigh scale to loading point conveyor (sand)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	TSP	-	9.87E-05	24	EF	E	0.0%
7	Delivery of cementitious material to silo #1 by tanker truck (cementitious material)	n/a	n/a	n/a	n/a	n/a	n/a	BH1	TSP	-	2.80E-03	24	EC	Above-Average	1.1%
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cementitious material)	n/a	n/a	n/a	n/a	n/a	n/a	BH2	TSP	-	2.80E-03	24	EC	Above-Average	1.1%
9	Material transfer to ready mix truck at the loading point (coarse aggregate / sand / cementitious materials)	n/a	n/a	n/a	n/a	n/a	n/a	LP	TSP	-	6.50E-02	24	EF	B	26.7%
10	No.2 oil-fired boiler	0.15	237	0.3	6.4	n/a	n/a	BOILER	TSP	-	6.25E-03	24	EF	A	2.6%
									Nitrogen Oxides	10102-44-0	3.79E-02	1 and 24	EF	A	3.1%
									Sulphur Dioxide	7446-09-5	1.34E-01	1 and 24	EF	A	62.9%
									Carbon Monoxide	630-08-0	9.47E-03	0.5	EF	A	3.5%
11	Main diesel-fired generator	0.49	455	0.13	6	n/a	n/a	GEN1	TSP	-	2.75E-02	24	EF	D	11.3%
									Nitrogen Oxides	10102-44-0	7.75E-01	1 and 24	EF	D	62.5%
									Sulphur Dioxide	7446-09-5	5.13E-02	1 and 24	EF	D	24.0%
									Carbon Monoxide	630-08-0	1.67E-01	0.5	EF	D	62.2%
12	Secondary diesel-fired generator	0.28	470	0.13	6	n/a	n/a	GEN2	TSP	-	1.51E-02	24	EF	D	6.2%
									Nitrogen Oxides	10102-44-0	4.27E-01	1 and 24	EF	D	34.4%
									Sulphur Dioxide	7446-09-5	2.82E-02	1 and 24	EF	D	13.2%
									Carbon Monoxide	630-08-0	9.19E-02	0.5	EF	D	34.3%

Notes: n/a = Not Applicable; EF = Emission Factor; EC = Engineering Calculation; A, B = Above Average Data Quality, D, E = Marginal Data Quality

TSP - Total Suspended Particulate

⁽¹⁾ Refer to Table 4 for UTM coordinates.



Table 2B: Source Summary Table – RCS

Source I.D.	Description	Source Data							Emission Data						
		Stack Volumetric Flow Rate (m ³ /s)	Stack Exit Temperature (°C)	Stack Inner Diameter (m)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates (x, y) ⁽¹⁾ (m)	Modelled Source	Contaminant	CAS #	Maximum Emission Rate (g/s)	Averaging Period (hr)	Emission Estimating Technique	Emissions Data Quality	% of Overall Emissions
1	Delivery trucks to aggregate stockpiles (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	AGG	RCS	14808-60-7	2.96E-03	24	EF & EC	A	37.5%
2	Material transfer from stockpiles to hopper via front-end loader (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	RCS	14808-60-7	1.29E-03	24	EF & EC	A	16.4%
3	Material transfer from aggregate hopper to inclined conveyor (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	HOPPER	RCS	14808-60-7	1.47E-04	24	EF & EC	D	1.9%
4	Material transfer from inclined conveyor to elevated aggregate bins (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	RCS	14808-60-7	1.29E-03	24	EF & EC	A	16.4%
5	Material transfer from aggregate bins to aggregate weigh scale (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	RCS	14808-60-7	1.29E-03	24	EF & EC	A	16.4%
6	Material transfer from aggregate weigh scale to loading point conveyor (coarse aggregate)	n/a	n/a	n/a	n/a	n/a	n/a	BINS	RCS	14808-60-7	1.47E-04	24	EF & EC	D	1.9%
7	Delivery of cementitious material to silo #1 by tanker truck (cementitious material)	n/a	n/a	n/a	n/a	n/a	n/a	BH1	RCS	14808-60-7	5.60E-06	24	EC	Above-Average	0.1%
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cementitious material)	n/a	n/a	n/a	n/a	n/a	n/a	BH2	RCS	14808-60-7	2.80E-04	24	EC	Above-Average	3.6%
9	Material transfer to ready mix truck at the loading point (coarse aggregate / sand / cementitious materials)	n/a	n/a	n/a	n/a	n/a	n/a	LP	RCS	14808-60-7	4.78E-04	24	EF & EC	B	6.1%

Notes: n/a = Not Applicable; EF = Emission Factor; EC = Engineering Calculation; A, B = Above Average Data Quality, D, E = Marginal Data Quality

RCS = Respirable Crystalline Silica (quartz) (PM₁₀)

⁽¹⁾ Refer to Table 4 for UTM coordinates.

Table 2C: Source Summary Table – Metals

Source I.D.	Description	Source Data							Emission Data						
		Stack Volumetric Flow Rate (m ³ /s)	Stack Exit Temperature (°C)	Stack Inner Diameter (m)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates (x, y) ⁽¹⁾ (m)	Modelled Source	Contaminant	CAS #	Maximum Emission Rate (g/s) ⁽²⁾	Averaging Period (hr)	Emission Estimating Technique	Emissions Data Quality	% of Overall Emissions
7	Delivery of cementitious material to silo #1 by tanker truck (cement)	n/a	n/a	n/a	n/a	n/a	n/a	BH1	Metals	-	1.02E-07	24	EF	E	2.4%
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cement supplement)	n/a	n/a	n/a	n/a	n/a	n/a	BH2	Metals	-	6.63E-07	24	EF	E	15.3%
9	Material transfer to ready mix truck at the loading point (coarse aggregate / sand / cementitious materials)	n/a	n/a	n/a	n/a	n/a	n/a	LP	Metals	-	3.56E-06	24	EF	E	82.3%

Notes: n/a = Not Applicable; EF = Emission Factor; EC = Engineering Calculation; A, B = Above Average Data Quality, D, E = Marginal Data Quality

TSP - Total Suspended Particulate

⁽¹⁾ Refer to Table 4 for UTM coordinates.

⁽²⁾ The highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission rate from each source.

6.0 AIR DISPERSION MODELLING

Air dispersion modelling for the maximum emission scenario was undertaken using the U.S. EPA AERMOD dispersion system. This model calculates maximum hourly concentrations, which is used to provide maximum 24-hour average concentrations using the appropriate MOECC supplied meteorological data.

6.1 AERMOD

AERMOD is an MOECC approved steady-state Gaussian plume dispersion modelling system that can be used to assess pollutant concentrations from a wide variety of complex industrial settings including multiple stacks, fugitive emissions, and building wake effects. The AERMOD modelling system was developed by the AMS/EPA Regulatory Model Improvement Committee (AERMIC), and consists of two pre-processors (AERMET and AERMAP) and the dispersion model, AERMOD.

AERMET is a general purpose meteorological pre-processor which uses surface and upper air meteorological conditions together with surface characteristics to calculate the boundary layer parameters needed by AERMOD. AERMAP is the terrain pre-processor used to calculate a representative terrain-influenced height associated with each receptor within the modelling domain.

6.1.1 Dispersion Modelling Input Summary Table

Per Section 26 of Ontario Regulation (O.Reg.) 419/05, Table 3 provides a description of the way in which the approved dispersion model was used.

6.1.2 Land Use

The land use for the purposes of modelling is rural.

6.1.3 AERMOD Meteorology

The MOECC regional hourly surface and upper air meteorological data set for the eastern region of Ontario (Kingston, Cornwall) was used for the AERMOD dispersion model per the *MOECC ADMGO*. A wind rose is provided in Appendix F. The wind rose shows the distribution of wind directions and wind speeds from the surface data.

Table 3: Dispersion Modelling Input Summary Table

Relevant Section of Regulation 419	Section Title	Description of How the Approved Dispersion Model was Used
Section 8	Negligible Sources of Contaminant	See Section 3
Section 9	Same Structure Contamination	Not Applicable
Section 10	Operating Conditions	See Section 4
Section 11	Source of Contaminant Emission Rate	See Appendix E and Table 2
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	See Section 4
Section 13	Meteorological Conditions	See Section 6.1.3
Section 14	Area of Modelling Coverage	See Section 6.1.5
Section 15	Stack Height for Certain New Sources of Contaminant	Not Applicable
Section 16	Terrain Data	See Section 6.1.4
Section 17	Averaging Periods	1hr, 24hr

6.1.4 Terrain Data

The terrain data used, Tile 121, (Adolphustown, Milford, Bath, Picton), Datum NAD83, UTM Zone 18, was downloaded from Ontario Digital Elevation Model Data on the MOECC's website.

6.1.5 Modelling Domain and Modelling Grid

All modelling was undertaken in UTM coordinates as defined in Table 4.

The model was based on a modelling grid entered in the site and extended out approximately 5 km from the property line in all directions. A tiered grid was used for modelling receptor placements and was created based upon the modelling receptor spacing recommended in the *MOECC ADMGO*.

6.1.6 Source Locations and Parameters

The source parameters used in the AERMOD input file are detailed in Table 4. Figures 4A and 4B show the locations of all sources that emit contaminants in significant quantities.

6.1.7 Building Downwash

The baghouses, boiler and generators were modelled as point sources. As such, building downwash has been considered in the modelling exercise.

Table 4: AERMOD Modelling Parameters Table

Source Type	Source ID	Description	Emission Rates ⁽³⁾						Base Elevation ⁽¹⁾⁽²⁾	Release Height Above Grade	Stack Inner Diameter	Exit Velocity	Stack Exit Temperature	Stack Release Type	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side	X Coordinate	Y Coordinate
			TSP	RCS	Metals ⁽¹¹⁾	NO _x	SO ₂	CO											
POINT	BH1	Baghouse	2.80E-03	5.60E-06	1.02E-07	-	-	-	86	10.7	0.13	21.10	Ambient	HORIZONTAL	-	-	-	363746.56	4891153.70
POINT	BH2	Baghouse	2.80E-03	2.80E-04	6.63E-07	-	-	-	86	9.8	0.13	21.10	Ambient	HORIZONTAL	-	-	-	363740.82	4891153.28
POINT	BOILER	No.2 oil-fired boiler ⁽⁴⁾⁽⁵⁾⁽⁶⁾	6.25E-03	0.00E+00	-	3.79E-02	1.34E-01	9.47E-03	85.86	6.4	0.3	2.15	509.8	CAPPED	-	-	-	363754.19	4891131.05
POINT	GEN1	Main diesel-fired generator ⁽⁷⁾⁽¹⁰⁾	2.75E-02	0.00E+00	-	7.75E-01	5.13E-02	1.67E-01	85.96	6	0.13	37.05	728.15	VERTICAL	-	-	-	363751.21	4891126.22
POINT	GEN2	Secondary diesel-fired generator ⁽⁸⁾⁽¹⁰⁾	1.51E-02	0.00E+00	-	4.27E-01	2.82E-02	9.19E-02	86	6	0.13	21.33	743.15	VERTICAL	-	-	-	363749.15	4891131.30
VOLUME	LP	Loading Point	6.50E-02	4.78E-04	3.56E-06	-	-	-	86	3.5	-	-	-	-	0.81	4.65	3.5	363744.24	4891155.39
VOLUME	SAND1	Sand Stockpile ⁽⁹⁾	7.74E-03	0.00E+00	-	-	-	-	85	1.5	-	-	-	-	5.32	0.70	22.9	363822.93	4891160.39
VOLUME	AGG	Coarse Aggregate Stockpile	4.17E-02	2.96E-03	-	-	-	-	85	1.5	-	-	-	-	5.32	0.70	22.9	363817.89	4891186.32
VOLUME	SAND2	Sand Stockpile ⁽⁹⁾	1.94E-03	0.00E+00	-	-	-	-	85.49	1.5	-	-	-	-	2.33	0.70	10.0	363765.39	4891135.72
VOLUME	HOPPER	Hopper	2.52E-02	1.44E-03	-	-	-	-	85	3	-	-	-	-	0.86	1.40	3.7	363779.93	4891153.82
VOLUME	BIN	Aggregate Bin and Aggregate Weigh Scale	4.76E-02	2.73E-03	-	-	-	-	86	2.25	-	-	-	-	1.58	2.09	6.8	363749.95	4891141.51

1 All sources are elevated (Release Height > 0).

2 Base elevations were extracted from AERMAP.

3 TSP = Total Suspended Particulate, RCS = Respirable Crystalline Silica (quartz) (PM₁₀), NO_x = Nitrogen Oxides, SO₂ = Sulphur Dioxide, CO = Carbon Monoxide

4 An exhaust gas temperature of 458 degrees fahrenheit was assumed based on specifications for boilers with a similar maximum heat input value. (Hurst Boilers Inc., 2015)

5 The outlet flow rate of the No.2 oil-fired heater was conservatively estimated based on the default dry fuel factor (f-factor) for distillate oil of 9190 dscf/MMBtu from US EPA AP-42, Section 1.3, Fuel Oil Combustion, Background Documentation, September 1998.

6 Sample Calculation:

Default f-factor = 9,190 dscf/MMBtu, Boiler Rating = 15 gal/hr x 140 MMBTU/1000 gal = 2.1 MMBTU/hr

Outlet flow of flue gas = 9,190 dscf/MMBtu * 2.1 MMBTU/hr = 322 cfm

7 An exhaust gas temperature of 851 degrees fahrenheit and an exhaust gas flow rate of 1042 cfm was assumed based on specifications for a similar Caterpillar diesel engine. (Caterpillar, 2015)

8 An exhaust gas temperature of 878 degrees fahrenheit and an exhaust gas flow rate of 600 cfm was assumed based on specifications for a similar Caterpillar diesel engine. (Caterpillar, 2015)

9 The sand delivery is split between SAND1 and SAND2 in a 5:1 ratio. (Windlectric, 2015)

10 It was assumed that the main diesel-fired generator operates from 7am-7pm (day) only and the secondary diesel-fired generator operates from 7pm-7am (night) only. Both generators were assumed to operate 7 days per week, all year round. The TSP emission rate is a maximum daily emission rate (Windlectric, 2015)

11 The highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission rate

7.0 EMISSION SUMMARY TABLE AND CONCLUSIONS

The Emission Summary Table (Table 5) shows the predicted maximum conservative POI concentrations from all sources compared to the Schedule 3 Standards in the MOECC *Summary of Standards and Guidelines to support Ontario Regulation 419: Air Pollution – Local Air Quality (April 2012)*. As can be seen from the Emission Summary Table, all contaminants are below the allowable limits.

Table 5: Emission Summary Table

Contaminant Name	CAS No.	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Period (hr)	MOE POI Limit ($\mu\text{g}/\text{m}^3$)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
Total Suspended Particulate ⁽¹⁾	-	2.29E-01	AERMOD	84.07	24	120	Visibility	3	70.1%
Respirable Crystalline Silica (quartz) (PM ₁₀) ⁽¹⁾	14808-60-7	7.89E-03	AERMOD	3.9	24	5	Health	3	78.4%
Nitrogen Oxides ⁽¹⁾	10102-44-0	8.13E-01	AERMOD	49.40	24	200	Health	3	24.7%
Nitrogen Oxides ⁽¹⁾	10102-44-0	8.13E-01	AERMOD	341.13	1	400	Health	3	85.3%
Sulphur Dioxide	7446-09-5	1.86E-01	AERMOD	21.44	24	275	Health	3	7.8%
Sulphur Dioxide	7446-09-5	1.86E-01	AERMOD	154.78	1	690	Health	3	22.4%
Carbon Monoxide	630-08-0	1.76E-01	AERMOD	107.95	0.5	6000	Health	3	1.8%
Arsenic ⁽²⁾⁽³⁾	7440-38-2	4.32E-06	AERMOD	0.001556	24	0.3	Health	Guideline	0.52%
Beryllium ⁽²⁾⁽³⁾	7440-41-7	4.32E-06	AERMOD	0.001556	24	0.01	Health	3	15.56%
Cadmium ⁽²⁾⁽³⁾	7440-43-9	4.32E-06	AERMOD	0.001556	24	0.025	Health	3	6.22%
Total Chromium ⁽²⁾⁽³⁾	7440-47-3	4.32E-06	AERMOD	0.001556	24	1.5	Health	Guideline	0.10%
Lead ⁽²⁾⁽³⁾	7439-92-1	4.32E-06	AERMOD	0.001556	24	0.5	Health	3	0.31%
Manganese ⁽²⁾⁽³⁾	7439-96-5	4.32E-06	AERMOD	0.001556	24	2.5	Health	Guideline	0.06%
Nickel ⁽²⁾⁽³⁾	7440-02-0	4.32E-06	AERMOD	0.001556	24	2	Vegetation	3	0.08%
Selenium ⁽²⁾⁽³⁾	7782-49-2	4.32E-06	AERMOD	0.001556	24	10	Health	Guideline	0.02%

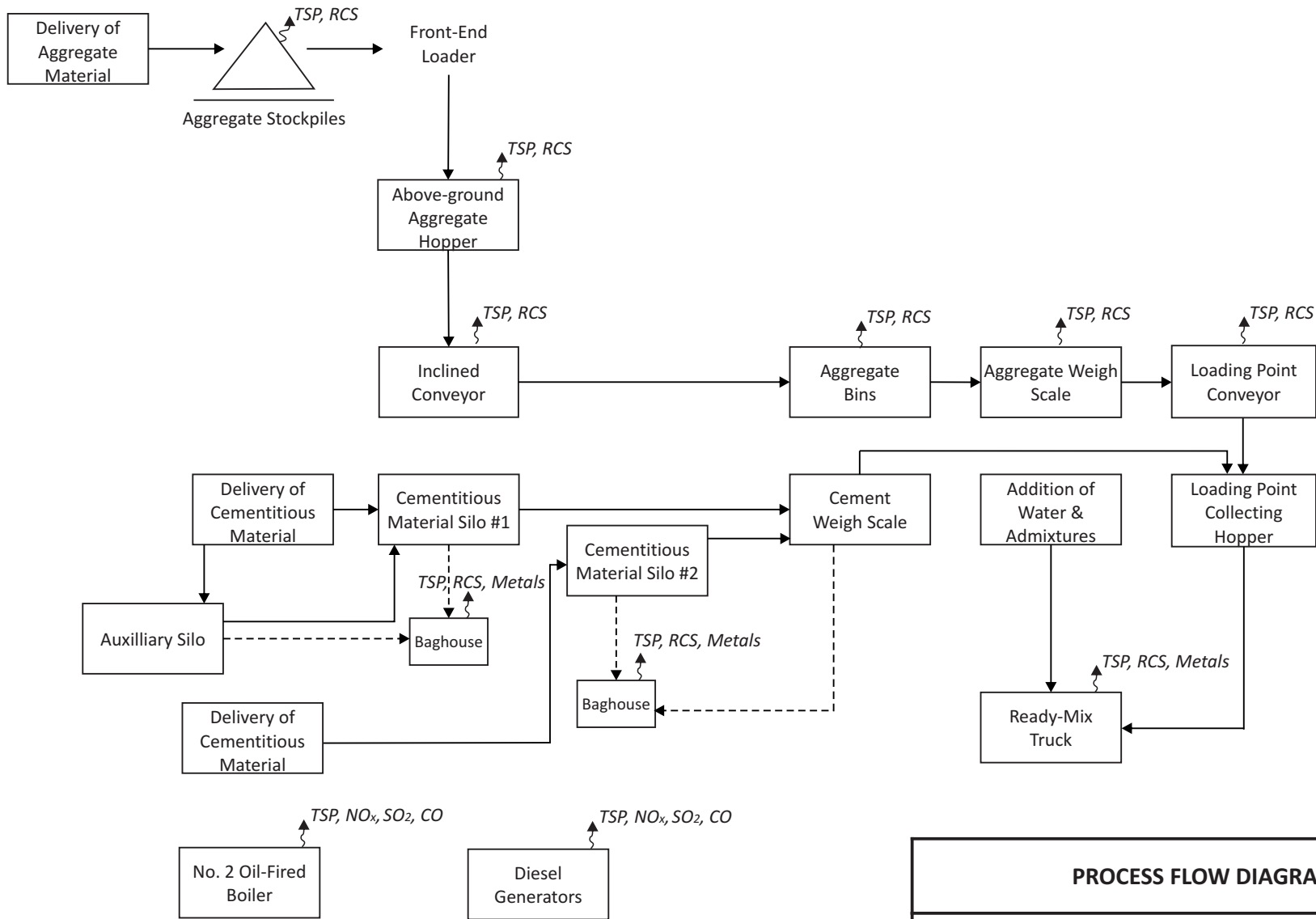
⁽¹⁾ Removal of meteorological anomalies (MOECC Procedure). See Max Table in Appendix F.

⁽²⁾ The total of the highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission rate from each source.


⁽³⁾ Very conservatively used the highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission rate from each source for air dispersion modelling.

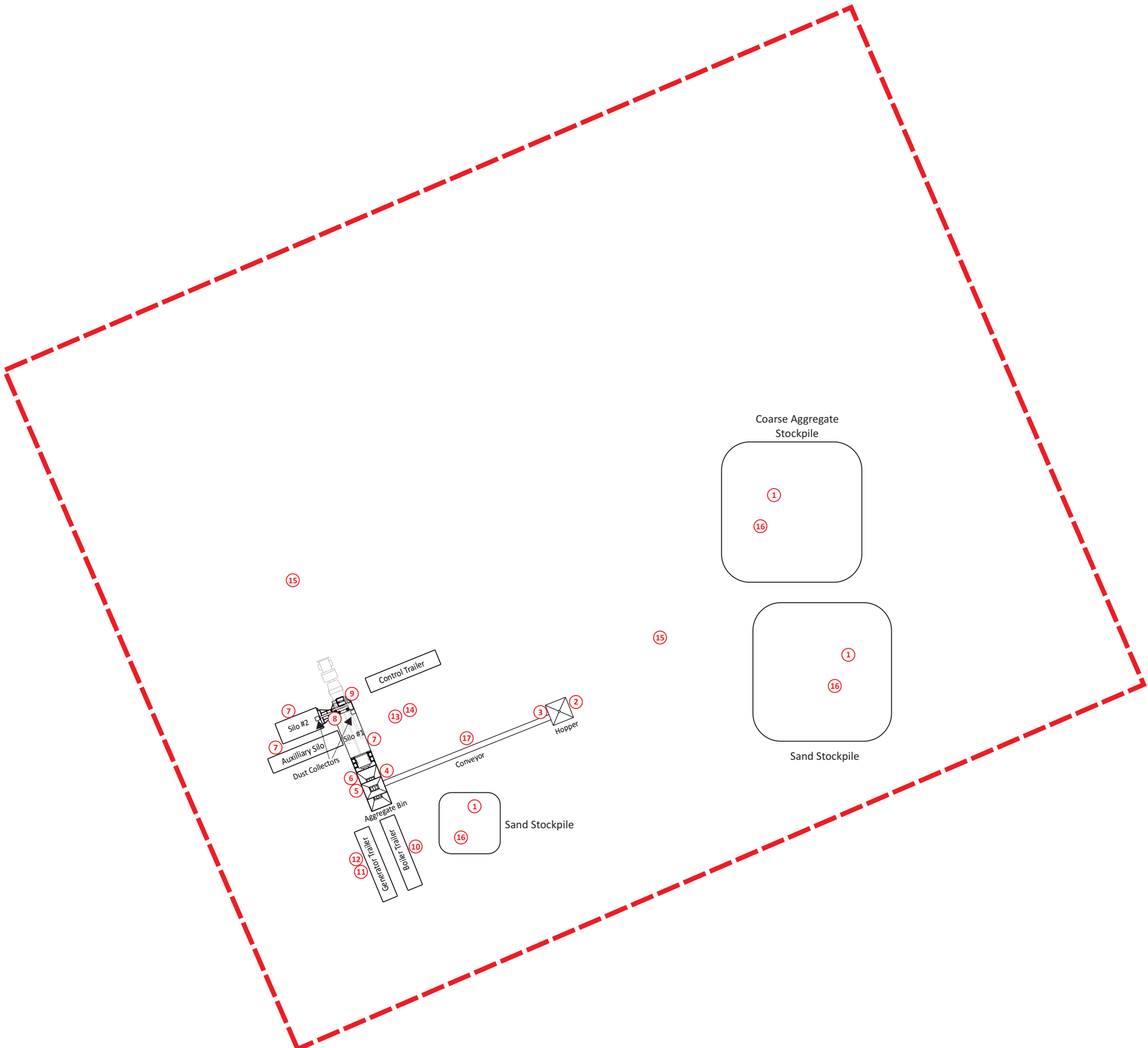
Appendix A

Figures



TSP - Total Suspended Particulate
 RCS - Respirable Crystalline Silica (quartz) (PM10)
 NOx - Nitrogen Oxides
 SO2 - Sulphur Dioxide
 CO - Carbon Monoxide

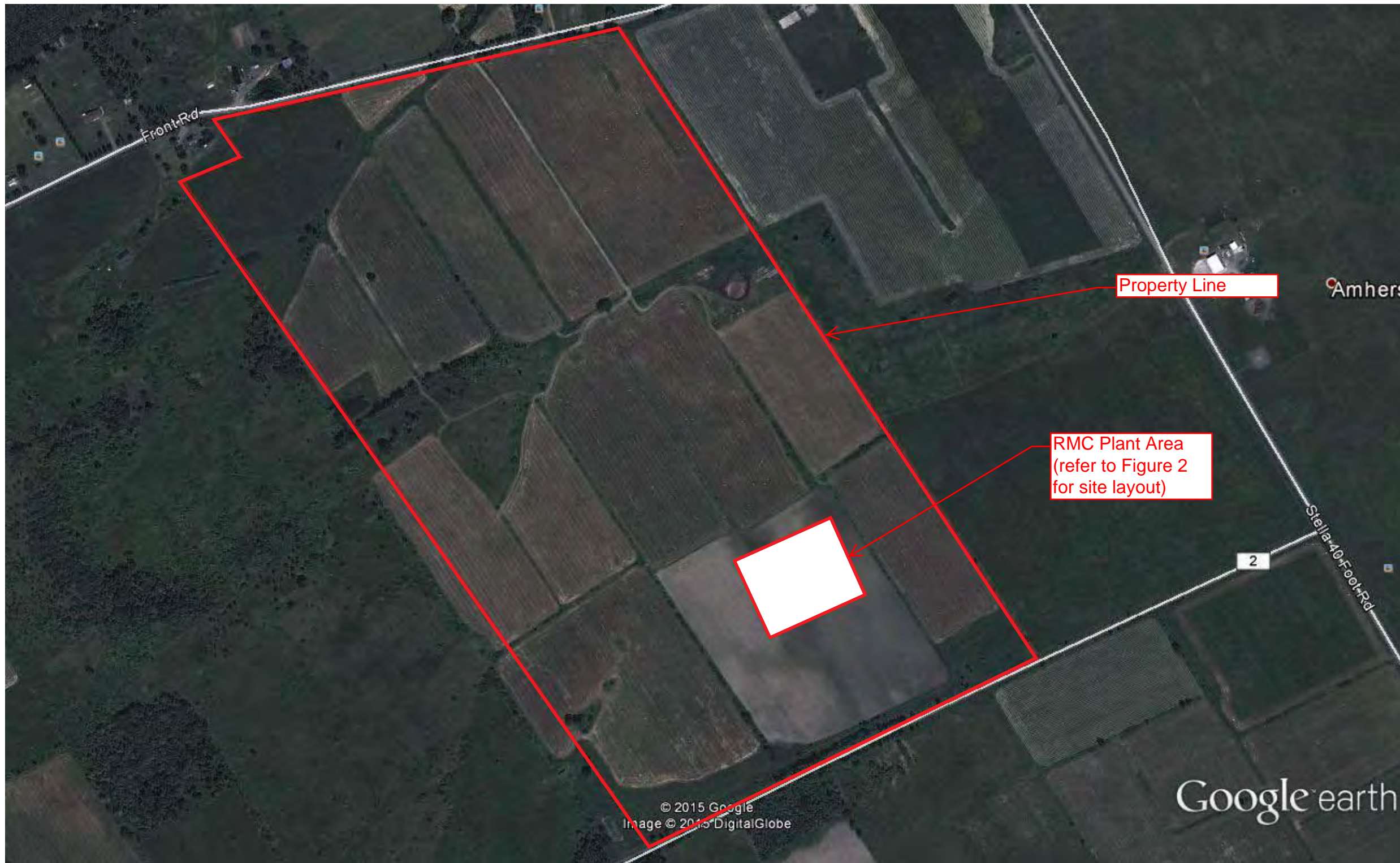
PROCESS FLOW DIAGRAM	
WINDLECTRIC INC. 354 Davis Road, Oakville, Ontario, L6J 2X1	
	File No.: 1179-01.01 Date: February 2015 Dwg.: 1179-01.01_1 Drawn By: NC
	Emission Summary and Dispersion Modelling Report
	FIGURE 1





LEGEND	
	Area Designated for RMC Plant
	Source ID



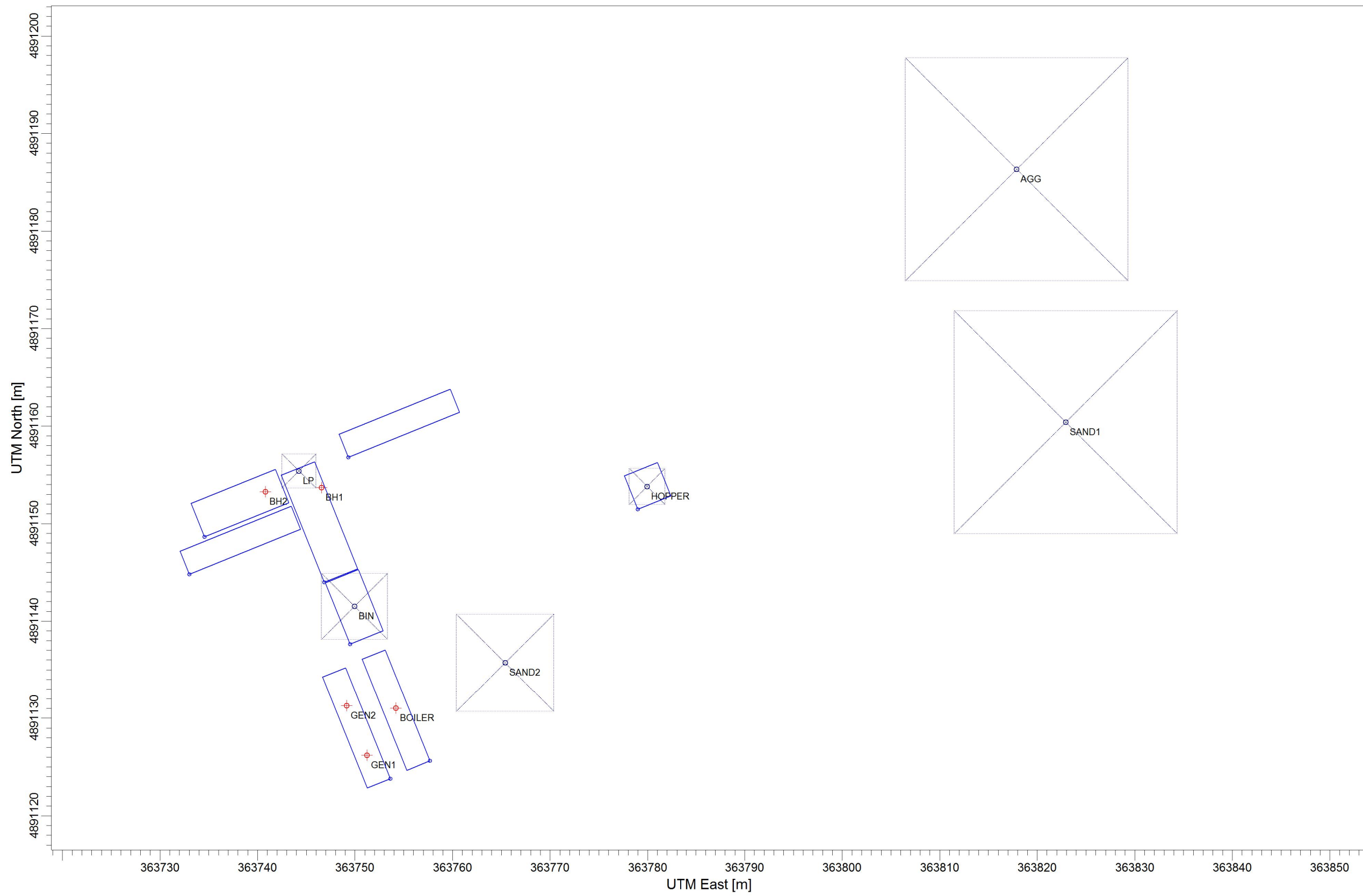
SITE LAYOUT		
WINDLECTRIC INC. 354 Davis Road, Oakville, Ontario, L6J 2X1		File No.: 1179-01.01 Date: February 2015
	Emission Summary and Dispersion Modelling Report	Dwg.: 1179-01.01 2 Drawn By: NC
		FIGURE 2



PROPERTY LINE		 N
WINDLECTRIC INC. 354 Davis Road, Oakville, Ontario, L6J 2X1		File No.: 1179-01.01 Date: February 2015
	Emission Summary and Dispersion Modelling Report	Dwg.: 1179-01.01 3 Drawn By: NC
		FIGURE 3

PROJECT TITLE:
FIGURE 4A - AIR DISPERSION MODELLING CONFIGURATION

COMMENTS:
 Windlectric Inc.
 PTLOT 35 - 37 Concession 1
 and PTLOT 34 Concession 1
 Amherst Island, Ontario



SOURCES:
11

RECEPTORS:
1745

COMPANY NAME:
BCX Environmental Consulting

MODELER:
NC

DATE:
23/02/2015

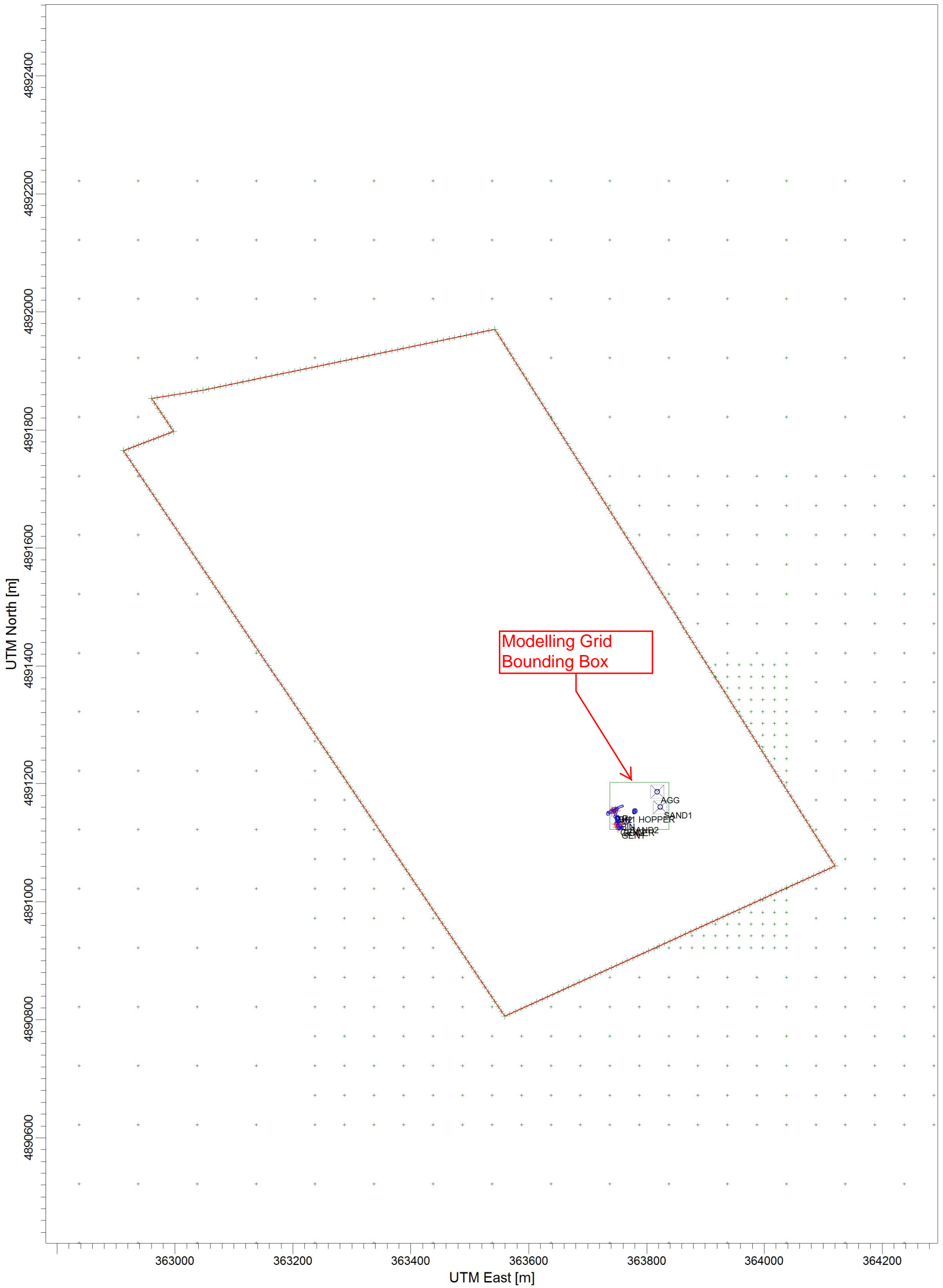
SCALE: 1:417
 0 0.01 km



PROJECT NO.:
1179-01.01

PROJECT TITLE:

**FIGURE 4B - AIR DISPERSION MODELLING CONFIGURATION
MODELLING GRID**



COMMENTS:

Windlectric Inc.
PTLOT 35 - 37 Concession 1
and PTLOT 34 Concession 1
Amherst Island, Ontario

SOURCES:

11

COMPANY NAME:

BCX Environmental Consulting

RECEPTORS:

1065

MODELER:

NC

SCALE:

1:6,876

0 0.2 km

DATE:

21/02/2015

PROJECT NO.:

1179-01.01



Appendix B

Material Safety Data Sheets

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Limestone and Dolomite

Product Identifiers: Limestone, Dolomite, Dolostone, Carbonate Rock, Calcium Carbonate, Aggregates, Crushed Stone, Crushed Rock, Crushed Run, Gravel, Manufactured Sand, Concrete Sand, Asphalt Sand, Mason Sand, Fill Sand, Golf Course Sand, Base Material, Dense Graded Aggregate

Manufacturer:
Lafarge North America Inc.
12018 Sunrise Valley Drive, Suite 500
Reston, VA 20191

Information Telephone Number:
703-480-3600 (9am to 5pm EST)

Emergency Telephone Number:
1-800-451-8346 (3E Hotline)

Product Use: Limestone and Dolomite are used in the manufacture of bricks, mortar, cement, concrete, plasters, paving materials, and other construction applications. Limestone and Dolomite are distributed in bags, totes and bulk shipment.

Do NOT use this product for abrasive blasting. This material safety data sheet and the information contained herein were not developed for abrasive blasting.

Note: This MSDS covers many types of Limestone and Dolomite. Individual composition of hazardous constituents will vary between types of Limestone and Dolomite.




Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀	LC ₅₀
Calcium Carbonate*	50-100	1317-65-3	15 (T), 5 (R)	10 (T)	NA	NA
Magnesium Carbonate*	0-50	546-93-0	15 (T), 5 (R)	3 (R); 10 (T)	NA	NA
Crystalline Silica (as Quartz)	0-15	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.025 (R)	NA	NA
Particulate Not Otherwise Regulated	-	NA	5 (R) 15 (T)	3 (R); 10 (T)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

See Section 9 for information on the mineral composition of Limestone and Dolomite.

Section 3: HAZARD IDENTIFICATION

	<p>WARNING</p> <p>Toxic - Harmful by inhalation. (Contains crystalline silica)</p> <p>DO NOT use for Abrasive Blasting.</p> <p>Use proper engineering controls, work practices, and Personal Protective Equipment (PPE) to prevent exposure to dust.</p> <p>Read MSDS for details.</p>	 <p>Respiratory Protection</p>  <p>Eye Protection</p>
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Emergency Overview: Limestone and Dolomites are an odorless, angular grey, white, and tan particles ranging in size from a powder to boulders. They are not combustible or explosive. A single, short-term exposure to Limestone and Dolomite presents little or no hazard.

Section 3: HAZARD IDENTIFICATION (continued)

Potential Health Effects:

Eye Contact: Eye contact to airborne dust may cause immediate or delayed irritation or inflammation. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Limestone and Dolomite may cause dry skin, abrasions, discomfort, and irritation.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Crystalline silica is classified by IARC and NTP as a known human carcinogen.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Ingestion: Do not ingest Limestone and Dolomite. Ingestion of small quantities of Limestone and Dolomite is not known to be harmful; ingesting large quantities can cause intestinal distress.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash or irritation.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).

Section 4: FIRST AID MEASURES (continued)

- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

General Hazard:	Avoid breathing dust.	Flashpoint & Method:	Non-combustible
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	Firefighting Equipment:	Limestone and Dolomite pose no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
Combustion Products:	Limestone and Dolomite decomposes at 825° C producing Calcium and Magnesium Oxide		

Section 6: ACCIDENTAL RELEASE MEASURES

General:	Place spilled material into a container. Avoid actions that cause dust to become airborne. Avoid inhalation of dust. Wear appropriate protective equipment as described in Section 8. Do not wash Limestone and Dolomite down sewage and drainage systems or into bodies of water (e.g. streams).
Waste Disposal Method:	Dispose of Limestone and Dolomite according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General:	Stack bagged material in a secure manner to prevent falling. Bagged aggregate is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.
	Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains Limestone and Dolomite. Dust can buildup or adhere to the walls of a confined space. The dust can release, collapse or fall unexpectedly.
	Do not stand on stockpiles of Limestone and Dolomite, they may be unstable. Use engineering controls (e.g. wetting stockpiles) to prevent windblown dust from stockpiles, which may cause the hazards described in Section 3.
Usage:	This product is NOT to be used for abrasive blasting.
	Cutting, crushing or grinding Limestone and Dolomite, hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.

Section 7: HANDLING AND STORAGE (continued)

- Housekeeping:** Avoid actions that cause dust to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum or thoroughly wet with water to clean-up dust. Use PPE described in Section 8 below.
- Storage Temperature:** Unlimited. **Storage Pressure:** Unlimited.
- Clothing:** Remove and launder clothing that is dusty before it is reused.
- Warning:** Crystalline silica exists in several forms, the most common of which is quartz. If crystalline silica (quartz) is heated to more than 870° C it can change to a form of crystalline silica known as tridymite, and if crystalline silica (quartz) is heated to more than 1470° C it can change to a form of crystalline silica known as cristobalite. Crystalline silica as tridymite and cristobalite are more fibrogenic than crystalline silica as quartz. The OSHA PEL for crystalline silica as tridymite and cristobalite is one-half the PEL for crystalline silica (quartz); the ACGIH TLV crystalline silica as tridymite and cristobalite is 0.05 mg/m³ (R).

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Engineering Controls:** Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

- Respiratory Protection:** Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.
- Eye Protection:** Wear ANSI approved glasses or safety goggles when handling dust to prevent contact with eyes. Wearing contact lenses when using Limestone and Dolomite, under dusty conditions, is not recommended.
- Skin Protection:** Wear gloves in situations where abrasions from Limestone and Dolomite may occur. Remove clothing and protective equipment that becomes dusty and launder before reusing.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

- | | | | |
|--------------------------|-------------------|-----------------------------|--------------|
| Physical State: | Solid | Evaporation Rate: | NA. |
| Appearance: | Variety of colors | pH (in water): | Neutral |
| Odor: | None. | Boiling Point: | >1000° C |
| Vapor Pressure: | NA. | Freezing Point: | None, solid. |
| Vapor Density: | NA. | Viscosity: | None, solid. |
| Specific Gravity: | 2.6-2.8 | Solubility in Water: | Insoluble |

The following table describes the mineral composition of Limestone and Dolomite.

Rock Type	Rock	Mineral	Mineral Formula	Mineral Composition
Sedimentary Rocks	Limestone	Calcite and Aragonite	CaCO ₃	Calcium Carbonate
		Clay Minerals	(Mg, Al) Si ₃ O ₁₂	Magnesium Aluminum Silicate
		Chert or Diatomite	SiO ₂	Silicon Dioxide
	Dolomite (Dolostone)	Dolomite	CaMg(CO ₃) ₂	Calcium Magnesium Carbonate
		Clay Minerals	(Mg, Al) Si ₃ O ₁₂	Magnesium Aluminum Silicate
		Chert or Diatomite	SiO ₂	Silicon Dioxide

Crystalline silica content: Sedimentary types 1-20%; Quartz 100%.

Section 10: STABILITY AND REACTIVITY

- Stability:** Stable. Avoid contact with incompatible materials.
- Incompatibility:** Limestone and Dolomite dissolve in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.
- Hazardous Polymerization:** None.
- Hazardous Decomposition:** Limestone and Dolomite decomposes at 825° C producing Calcium and Magnesium Oxide.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

- OSHA/MSHA Hazard Communication:** This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.
- CERCLA/SUPERFUND:** This product is not listed as a CERCLA hazardous substance.
- EPCRA
SARA Title III:** This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.
- EPRCA
SARA Section 313:** This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
- RCRA:** If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
- TSCA:** Calcium Carbonate and Crystalline silica are exempt from reporting under the inventory update rule.
- California
Proposition 65:** Crystalline silica (airborne particulates of respirable size) is known by the State of California to cause cancer.
- WHMIS/DSL:** Limestone and Dolomite may be subject to WHMIS depending on the intended use and worker exposure. Limestone and Dolomite products containing crystalline silica and calcium carbonate are classified as D2A, and are subject to WHMIS requirements.



Section 16: OTHER INFORMATION
Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2011.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Sustainability section.

Lafarge North America Inc. (LNA) believes the information contained herein is accurate; however, LNA makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein which is not intended to be and should not be construed as legal advice or as insuring compliance with any federal, state or local laws or regulations. Any party using this product should review all such laws, rules, or regulations prior to use, including but not limited to US and Canada Federal, Provincial and State regulations.

NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Sand and Gravel

Product Identifiers: Natural Sand, River Sand Screenings, Aggregates, Bank Sand and Gravel, Crushed Gravel, Round Gravel, Concrete Sand, Asphalt Sand, Mason Sand, Fill Sand, Golf Course Sand, Base Material, Dense Graded Aggregate, Quartz, Gravel, Crushed Rock, Crushed Stone

Manufacturer: Lafarge North America Inc.
12018 Sunrise Valley Drive, Suite 500
Reston, VA 20191

Information Telephone Number: 703-480-3600 (9am to 5pm EST)

Emergency Telephone Number: 1-800-451-8346 (3E Hotline)

Product Use: Sand and gravel are aggregates used in the manufacture of bricks, mortar, cement, concrete, plasters, paving materials, and other construction applications. Sand and gravel are distributed in bags, totes and bulk shipment.

DO NOT use this product for abrasive blasting. This material safety data sheet and the information contained herein were not developed for abrasive blasting.

Note: This MSDS covers many types of sand and gravel. Individual composition of hazardous constituents will vary between sand and gravel types.

Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀	LC ₅₀
Crystalline Silica (quartz)	50-99	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.025 (R)	NA	NA
Particulate Not Otherwise Regulated	-	NA	5 (R); 15 (T)	3 (R); 10 (T)	NA	NA

Warning: Crystalline silica exists in several forms, the most common of which is quartz. If crystalline silica (quartz) is heated to more than 870° C it can change to a form of crystalline silica known as tridymite, and if crystalline silica (quartz) is heated to more than 1470° C it can change to a form of crystalline silica known as cristobalite. Crystalline silica as tridymite and cristobalite are more fibrogenic than crystalline silica as quartz. The OSHA PEL for crystalline silica as tridymite and cristobalite is one-half the PEL for crystalline silica (quartz); the ACGIH TLV for crystalline silica as cristobalite is 0.025 mg/m³ (R).

Section 3: HAZARD IDENTIFICATION

	WARNING	Respiratory Protection Eye Protection
	Toxic - Harmful by inhalation. (Contains crystalline silica) DO NOT use for Sand Blasting. Use proper engineering controls, work practices, and Personal Protective Equipment (PPE) to prevent exposure to dust. Read MSDS for details.	

Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Sand and gravel are a white or light grey/brown solid material and is odorless. It is not combustible or explosive. A single, short-term exposure to sand and gravel presents little or no hazard.

Potential Health Effects:

Eye Contact: Eye contact to airborne dust may cause immediate or delayed irritation or inflammation. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Sand and gravel may cause dry skin, abrasions, discomfort, and irritation.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Crystalline silica is classified by IARC and NTP as a known human carcinogen.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Ingestion: Do not ingest sand or gravel. Although ingestion of small quantities of sand or gravel is not known to be harmful, large quantities can cause intestinal distress.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash or irritation.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).

Section 4: FIRST AID MEASURES (continued)

- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	Firefighting Equipment:	Sand and gravel poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust.		
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	Combustion Products:	None.

Section 6: ACCIDENTAL RELEASE MEASURES

General:	Place spilled material into a container. Avoid actions that cause the sand or gravel to become airborne. Avoid inhalation of dust. Wear appropriate protective equipment as described in Section 8. Do not wash sand or gravel down sewage and drainage systems or into bodies of water (e.g. streams).
Waste Disposal Method:	Dispose of sand and gravel according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General:	Stack bagged material in a secure manner to prevent falling. Bagged sand and gravel is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures. Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains sand or gravel. Sand or gravel can buildup or adhere to the walls of a confined space. The sand or gravel can release, collapse or fall unexpectedly.
Usage:	This product is NOT to be used for abrasive blasting. Cutting, crushing or grinding hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.
Housekeeping:	Avoid actions that cause the sand or gravel to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum or thoroughly wet with water to clean-up dust. Use PPE described in Section 8 below.
Storage Temperature:	Unlimited.
	Storage Pressure: Unlimited.
Clothing:	Remove and launder clothing that is dusty before it is reused.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls: Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

Respiratory Protection: Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.

Eye Protection: Wear ANSI approved glasses or safety goggles when handling dust to prevent contact with eyes. Wearing contact lenses when using sand or gravel, under dusty conditions, is not recommended.

Skin Protection: Wear gloves in situations where abrasion from sand or gravel may occur. Remove clothing and protective equipment that becomes dusty and launder before reusing.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Granular Solid.	Evaporation Rate:	NA.
Appearance:	White or light gray/brown.	pH (in water):	Neutral
Odor:	None.	Boiling Point:	>1000° C
Vapor Pressure:	NA.	Freezing Point:	None, solid.
Vapor Density:	NA.	Viscosity:	None, solid.
Specific Gravity:	2.7	Solubility in Water:	Insoluble

Section 10: STABILITY AND REACTIVITY

Stability: Stable. Avoid contact with incompatible materials.

Incompatibility: Sand and gravel dissolve in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None. **Hazardous Decomposition:** None.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION


This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

Section 15: REGULATORY INFORMATION (continued)

EPCRA SARA Title III:	This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.
EPCRA SARA Section 313:	This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
RCRA:	If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
TSCA:	Crystalline silica is exempt from reporting under the inventory update rule.
California Proposition 65:	Crystalline silica (airborne particulates of respirable size) is known by the State of California to cause cancer.
WHMIS/DSL: 	Sand and gravel may be subject to WHMIS depending on the intended use and worker exposure. Sand and gravel containing crystalline silica is classified as D2A, and are subject to WHMIS requirements.

Section 16: OTHER INFORMATION
Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

Section 16: OTHER INFORMATION (continued)

This MSDS (Sections 1-16) was revised on March 1, 2011.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Sustainability section.

Lafarge North America Inc. (LNA) believes the information contained herein is accurate; however, LNA makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein which is not intended to be and should not be construed as legal advice or as insuring compliance with any federal, state or local laws or regulations. Any party using this product should review all such laws, rules, or regulations prior to use, including but not limited to US and Canada Federal, Provincial and State regulations.

NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Portland Cement (cement)

Product Identifiers: Cement, Portland Cement, Hydraulic Cement, Oil Well Cement, Trinity[®] White Cement, Antique White Cement, Portland Limestone Cement, Portland Cement Type I, IA, IE, II, I/II, IIA, II L.A., III, IIIA, IV, IVA, V, VA, 10, 20, 30, 40, 50, GU, GUL, MS, MH, HE, LH, HS, OWH, OWG Cement, OW Class G HSR, InfiniCem[™]

Manufacturer: Lafarge North America Inc.
8700 West Bryn Mawr Avenue, Suite 300
Chicago, IL 60631

Information Telephone Number: 773-372-1000 (9am to 5pm CST)

Emergency Telephone Number: 1-800-451-8346 (3E Hotline)

Product Use: Cement is used as a binder in concrete and mortars that are widely used in construction. Cement is distributed in bags, totes and bulk shipment.

Note: This MSDS covers many types of Portland cement. Individual composition of hazardous constituents will vary between types of Portland cement.

Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀ (mouse, intraperitoneal)	LC ₅₀
Portland Cement*	100	65997-15-1	15 (T); 5 (R)	1 (R)	NA	NA
Calcium Sulfate*	2-10	13397-24-5	15 (T); 5 (R)	10 (T)	NA	NA
Calcium Carbonate*	0-15	1317-65-3	15 (T); 5 (R)	3 (R), 10 (T)	NA	NA
Calcium Oxide	0-5	1305-78-8	5 (T)	2 (T)	3059 mg/kg	NA
Magnesium Oxide	0-4	1309-48-4	15 (T)	10 (T)	NA	NA
Crystalline Silica	0-0.2	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.025 (R)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

Cement is made from materials mined from the earth and is processed using energy provided by fuels. Trace amounts of chemicals may be detected during chemical analysis. For example, cement may contain trace amounts of calcium oxide (also known as free lime or quick lime), free magnesium oxide, potassium and sodium sulfate compounds, chromium compounds, nickel compounds, and other trace compounds.

Section 3: HAZARD IDENTIFICATION

	<p>WARNING</p> <p>Corrosive - Causes severe burns. Toxic - Harmful by inhalation. (Contains crystalline silica)</p> <p>Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.</p> <p>Read MSDS for details.</p>	
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Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Cement is a solid, grey, off white, or white odorless powder. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard. Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible tissue (skin, eye, respiratory tract) damage due to chemical (caustic) burns, including third degree burns.

Potential Health Effects:

Eye Contact: Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet cement can cause moderate eye irritation, chemical burns and blindness. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Cement may cause dry skin, discomfort, irritation, severe burns, and dermatitis.

Burns: Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. A skin exposure may be hazardous even if there is no pain or discomfort.

Dermatitis: Cement is capable of causing dermatitis by irritation and allergy. Skin affected by dermatitis may include symptoms such as, redness, itching, rash, scaling, and cracking.

Irritant dermatitis is caused by the physical properties of cement including alkalinity and abrasion.

Allergic contact dermatitis is caused by sensitization to hexavalent chromium (chromate) present in cement. The reaction can range from a mild rash to severe skin ulcers. Persons already sensitized may react to the first contact with cement. Others may develop allergic dermatitis after years of repeated contact with cement.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure. Inhalation of high levels of dust can cause chemical burns to the nose, throat and lungs.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Cement is not listed as a carcinogen by IARC or NTP; however, cement contains trace amounts of crystalline silica and hexavalent chromium which are classified by IARC and NTP as known human carcinogens.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Section 3: HAZARD IDENTIFICATION (continued)

Ingestion: Do not ingest cement. Although ingestion of small quantities of cement is not known to be harmful, large quantities can cause chemical burns in the mouth, throat, stomach, and digestive tract.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) or sensitivity to hexavalent chromium can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions and burns.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, burns, irritation, dermatitis, and prolonged unprotected exposures to wet cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	Firefighting Equipment:	Cement poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust. Wet cement is caustic.		
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	Combustion Products:	None.

Section 6: ACCIDENTAL RELEASE MEASURES

- General:** Place spilled material into a container. Avoid actions that cause the cement to become airborne. Avoid inhalation of cement and contact with skin. Wear appropriate protective equipment as described in Section 8. Scrape wet cement and place in container. Allow material to dry or solidify before disposal. Do not wash cement down sewage and drainage systems or into bodies of water (e.g. streams).
- Waste Disposal Method:** Dispose of cement according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

- General:** Keep bulk and bagged cement dry until used. Stack bagged material in a secure manner to prevent falling. Bagged cement is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.
- Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains cement. Cement can buildup or adhere to the walls of a confined space. The cement can release, collapse or fall unexpectedly.
- Properly ground all pneumatic conveyance systems. The potential exists for static build-up and static discharge when moving cement powders through a plastic, non-conductive, or non-grounded pneumatic conveyance system. The static discharge may result in damage to equipment and injury to workers.
- Usage:** Cutting, crushing or grinding hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.
- Housekeeping:** Avoid actions that cause the cement to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum or thoroughly wet with water to clean-up dust. Use PPE described in Section 8 below.
- Storage Temperature:** Unlimited. **Storage Pressure:** Unlimited.
- Clothing:** Promptly remove and launder clothing that is dusty or wet with cement. Thoroughly wash skin after exposure to dust or wet cement.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Engineering Controls:** Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.
- Personal Protective Equipment (PPE):**
- Respiratory Protection:** Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.
- Eye Protection:** Wear ANSI approved glasses or safety goggles when handling dust or wet cement to prevent contact with eyes. Wearing contact lenses when using cement, under dusty conditions, is not recommended.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and protective equipment that becomes saturated with wet cement and immediately wash exposed areas.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid (powder).	Evaporation Rate:	NA.
Appearance:	Gray, off white or white powder.	pH (in water):	12 – 13
Odor:	None.	Boiling Point:	>1000° C
Vapor Pressure:	NA.	Freezing Point:	None, solid.
Vapor Density:	NA.	Viscosity:	None, solid.
Specific Gravity:	3.15	Solubility in Water:	Slightly (0.1 - 1.0%)

Section 10: STABILITY AND REACTIVITY

Stability: Stable. Keep dry until use. Avoid contact with incompatible materials.

Incompatibility: Wet cement is alkaline and is incompatible with acids, ammonium salts and aluminum metal. Cement dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Cement reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None.

Hazardous Decomposition: None.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION


OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

EPCRA SARA Title III: This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.

EPCRA SARA Section 313: This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Section 15: REGULATORY INFORMATION (continued)

RCRA:	If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
TSCA:	Portland cement and crystalline silica are exempt from reporting under the inventory update rule.
California Proposition 65:	Crystalline silica (airborne particulates of respirable size) and Chromium (hexavalent compounds) are substances known by the State of California to cause cancer.
WHMIS/DSL: 	Products containing crystalline silica and calcium carbonate are classified as D2A, E and are subject to WHMIS requirements.

Section 16: OTHER INFORMATION
Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2014.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Sustainability and Products sections. Please direct any inquiries regarding the content of this MSDS to SDSinfo@Lafarge.com.

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NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Fly Ash and Bottom Ash (Ash)

Product Identifiers: Coal Fly Ash, Class F Fly Ash, Class C Fly Ash, Type CI Fly Ash, Type CH Fly Ash, Type F Fly Ash, Lignite Coal Fly Ash, Subbituminous Coal Fly Ash, Anthracite Coal Fly Ash, Bituminous Coal Fly Ash, Bottom Ash, Ash

Manufacturer: Lafarge North America Inc.
12018 Sunrise Valley Drive, Suite 500
Reston, VA 20191

Information Telephone Number: 703-480-3600 (9am to 5pm EST)

Emergency Telephone Number: 1-800-451-8346 (3E Hotline)

Product Use: Fly Ash and Bottom Ash are used as a supplementary cementitious or pozzolanic material for cement, concrete and concrete products. It is also used in soil stabilization and as filler in asphalt and other products that are widely used in construction.

Note: This MSDS covers many types of ash. Individual composition of hazardous constituents will vary between types of ash.

Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀ (mouse, intraperitoneal)	LC ₅₀
Fly Ash	<100	68131-74-8	NA	NA	NA	NA
Crystalline Silica	0-10	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.025 (R)	NA	NA
Particulate Not Otherwise Regulated	-	NA	5 (R); 15 (T)	3 (R); 10 (T)	NA	NA

Note: Fly ash and bottom ash are byproducts from the combustion of coal. Trace amounts of chemicals may be detected during chemical analysis. For example the chemicals identified can include carbon and complex silicates or oxides of aluminum (Al), calcium (Ca), magnesium (Mg), sodium (Na), sulfur (S), potassium (K), titanium (Ti), iron (Fe) and phosphorus (P). Chemical identity: M_xO_y•SiO₂ (M = Al, Ca, Mg and other minor metal, with bound silica (SiO₂)).

Chemical analysis of fly ash and bottom ash also indicate the presence of trace amounts of metals, such as: Arsenic (As), Barium (Ba), Beryllium (Be), Cobalt (Co), Lead (Pb), and Manganese (Mn).

Section 3: HAZARD IDENTIFICATION

	WARNING	Respiratory Protection Eye Protection Gloves Boots
	Irritant: Causes eye, skin and inhalation irritation Toxic - Harmful by inhalation. (Contains crystalline silica) Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product. Read MSDS for details.	

Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Ash is a solid, grey/black or brown/tan, odorless powder which may contain solidified masses. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard.

Potential Health Effects:

Eye Contact: Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet ash can cause moderate eye irritation. Eye exposures require immediate first aid to prevent significant damage to the eye.

Skin Contact: Ash may cause dry skin, discomfort, and irritation.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure.

Ash may contain trace amounts of ammonia or ammonia bisulfate. Contact with water or moisture can cause the ammonia to be released from ash into the air. Inhalation of ammonia can cause coughing and irritation or burns to the nose, throat and lungs. These effects depend on the concentration of ammonia inhaled.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Ash is not listed as a carcinogen by IARC or NTP; however, ash contains trace amounts of crystalline silica which is classified by IARC and NTP as known human carcinogen.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Ingestion: Do not ingest ash. Although ingestion of small quantities of ash is not known to be harmful, large quantities can cause distress to the digestive tract.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, irritation, and prolonged unprotected exposures to wet ash, cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Section 4: FIRST AID MEASURES (continued)

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	Firefighting Equipment:	Ash poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust.		
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	Combustion Products:	None.

Section 6: ACCIDENTAL RELEASE MEASURES

General: Place spilled material into a container. Avoid actions that cause the ash to become airborne. Avoid inhalation of ash and contact with skin. Wear appropriate protective equipment as described in Section 8. Scrape wet ash and place in container. Allow material to dry or solidify before disposal. Do not wash ash down sewage and drainage systems or into bodies of water (e.g. streams).

Waste Disposal Method: Dispose of ash according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General: Keep bulk and bagged ash and dry until used. Stack bagged material in a secure manner to prevent falling. Bagged ash is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.

Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains ash. Ash can buildup or adhere to the walls of a confined space. The ash can release, collapse or fall unexpectedly.

Section 16: OTHER INFORMATION
Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2011.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Sustainability section.

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Appendix C

Admixtures

ADMIXTURES

Admixtures are those ingredients in concrete other than cementitious materials, aggregates and water that are added to the concrete ingredients. Mixing of the admixtures with water occurs before being transferred to the ready-mix truck. Only small amounts of admixtures are used, typically less than one percent. They are added to improve or enhance certain characteristics of the concrete (i.e. workability, strength gain and permeability). Admixtures can be classified by function (e.g. accelerators which decrease the concrete set time and early strength development; air entrainers which improve the concrete's durability in freeze thaw-environments, etc.).

The following table summarizes the types of admixtures by function, which could be used by the facility. Specific examples of each type of admixtures are provided. For each example the active ingredients and physical properties of the admixture are indicated.

The admixtures that could be used by the facility have low vapour pressures and/or low evaporation rates. The majority of the admixtures are aqueous solutions having only a slight odour or no odour at all. Without exception, adverse effects from the inhalation of the various admixes are not expected from typical use.

Volatile emissions from the use of admixtures are, therefore, expected to negligible due to the physical properties (low volatility and/or evaporation rates) of the admixtures, the minimal quantities used and the small exposure time over which the admixture constituents could be released. Admixtures meet the MOECC's definition "Low temperature handling of compounds with a vapour pressure less than 1 kilopascal" in Table B-3 in Appendix B of the MOECC guidance document.

Table: Admixture Properties

Admixture Classification	Basic Composition	Typical Examples	Properties
Air Entrainers – improve durability in environments of freeze-thaw, de-icers, and sulphate reactivity. Improve workability. To reduce bleeding in concrete and improve cohesive property.	Alpha olefin sulphonate and potassium hydroxide	MICRO AIR	Vapour density: heavier than air; Vapour pressure: not available; Evaporation rate: equal to water; Specific gravity: 1.01; VOC Concentration as applied: 0g/L
Retarders – retard setting time	Does not contain hazardous chemicals as defined by 29 CFR 1910.1200 and WHMIS	POZZOLITH 100 XR	Vapour density: heavier than air; Vapour pressure: not available; Specific gravity: 1.22; VOC Concentration as applied: 0g/L
Water Reducer – mid range water reducing admixture designed to improve the performance of concrete both in the plastic and hardness states. Improved workability, pumpability, and reduced water content for a given workability	Sodium nitrate, sodium thiocyanate, triethanolamine	POLYHEED 997	Vapour density: heavier than air; Vapour pressure: not available; Specific gravity: 1.27; VOC Concentration as applied: 0g/L

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01/19/2004

Carcinogenicity

	ACGIH	IARC	NTP	OSHA
ALPHA OLEFIN SULFONATE	N.E.	N.E.	N.E.	N.E.
POTASSIUM HYDROXIDE	N.E.	N.E.	N.E.	N.E.

4. FIRST AID MEASURES

- Eye contact : Flush eyes with water, lifting upper and lower lids occasionally for 15 minutes. Seek medical attention.
- Skin contact : Remove contaminated clothing. Wash thoroughly with soap and water. If irritation persists seek medical attention. Wash contaminated clothing before reuse.
- Ingestion : Do not induce vomiting without medical advice. If conscious, drink plenty of water. If a person feels unwell or symptoms of skin irritation appear, consult a physician. If a person vomits, place him/her in the recovery position. Never give anything by mouth to an unconscious person.
- Inhalation : Remove victim from exposure. If difficulty with breathing, administer oxygen. If breathing has stopped administer artificial respiration, preferably mouth-to-mouth. Seek immediate medical attention.

5. FIRE-FIGHTING MEASURES

- Flash point : not applicable
- Autoignition temperature : not applicable
- Lower explosion limit : not applicable
- Upper explosion limit : not applicable
- Suitable extinguishing media : Use extinguishing agent suitable for type of surrounding fire.
- Fire and Explosion Hazards : None known.
- Special Fire-fighting Procedures : As in any fire, wear self-contained breathing apparatus pressure-demand (MSHA/NIOSH approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

- Methods for cleaning up : Evacuate personnel to safe areas. Wear personal protective equipment. Contain spill immediately. Soak up with inert absorbent material. Take up mechanically and collect in suitable container for disposal.

7. HANDLING AND STORAGE

- Handling : Keep out of reach of children. For personal protection see section 8.
- Storage : Store in a place accessible by authorized persons only. Keep container tightly closed.

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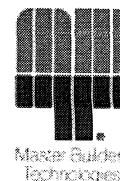
8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Eye protection	:	Wear as appropriate: safety glasses with side-shields goggles face-shield
Hand protection	:	Wear Chemically resistant gloves.
Body Protection	:	Wear as appropriate: Chemically resistant clothes preventive skin protection
Respiratory protection	:	In case of insufficient ventilation wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Hygienic Practices	:	Avoid contact with skin, eyes and clothing. Ensure adequate ventilation, especially in confined areas. Wash hands before breaks and at the end of workday. When using, do not eat, drink or smoke. Handle in accordance with good industrial hygiene and safety practice.
Engineering Controls	:	Local exhaust ventilation can be necessary to control any air contaminants to within their TLVs during the use of this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Color	:	brown
Physical State	:	liquid
Odor	:	No information available.
pH	:	10.7 - 12.3
Odor Threshold	:	no data available
Vapor Pressure	:	no data available
Vapor Density	:	Heavier than air
Boiling point/range	:	221 °F (105 °C)
Freeze Point	:	28 °F (-2 °C)
Water solubility	:	completely soluble
Specific Gravity	:	1.01
Viscosity	:	no data available
Evaporation rate	:	no data available
Partition coefficient (n-octanol/water)	:	no data available

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VOC Concentration as applied : 0 g/l
(less water and exempt solvents)

10. STABILITY AND REACTIVITY

Stability : Stable under recommended storage conditions.

Conditions to avoid : no data available

Materials to avoid : Strong mineral acids.

Hazardous decomposition products : Oxides of carbon
Oxides of sulfur
nitrogen oxides (NOx)

Hazardous polymerization : Will not occur under normal conditions.

11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>	<u>Exposure time</u>
	LC50	no data available		
<u>Component</u>				
ALPHA OLEFIN SULFONATE	LC50	no data available		
POTASSIUM HYDROXIDE	LC50	no data available		

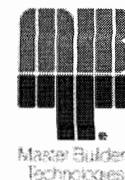
Acute oral toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Oral)	no data available	
<u>Component</u>			
ALPHA OLEFIN SULFONATE	LD50 (Oral)	no data available	
POTASSIUM HYDROXIDE	LD50 (Oral)	no data available	

Acute dermal toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Dermal)	no data available	
<u>Component</u>			
ALPHA OLEFIN SULFONATE	LD50 (Dermal)	no data available	

Material Safety Data Sheet



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POTASSIUM HYDROXIDE

LD50 (Dermal) no data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information : There is no data available for this product.

13. DISPOSAL CONSIDERATIONS

Recommendations: Use excess product in an alternate beneficial application. Handle disposal of waste material in manner which complies with local, state, province and federal regulation.

14. TRANSPORT INFORMATION

DOT	: Proper shipping name	Not regulated
IATA	: Proper shipping name	Not regulated

15. REGULATORY INFORMATION

SARA 311/312 (RTK)

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE (ACUTE) HEALTH HAZARD

SARA 313

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

<u>Weight %</u>	<u>CAS No.</u>	<u>Chemical Name</u>
-----------------	----------------	----------------------

This product contains no chemicals subject to the SARA 313 supplier notification requirements.

CERCLA

CERCLA section 103(a) specifically requires the person in charge of a vessel or facility to report immediately to the National Response Center (NRC) a release of a hazardous substance whose amount equals or exceeds the assigned RQ. The following hazardous substances are contained in this product.

<u>RQ</u>	<u>CAS No.</u>	<u>Chemical Name</u>
1,000 lbs	1310-58-3	POTASSIUM HYDROXIDE

TSCA Section 12(b) Export Notification

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

<u>CAS No.</u>	<u>Chemical Name</u>
----------------	----------------------

There are no TSCA 12(b) Chemicals in this product.

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California Proposition 65

The chemical(s) noted below and contained in this product, are known to the state of California to cause cancer, birth defects or other reproductive harm. Unless otherwise specified in Section 2 of this MSDS, these chemicals are present at < 0.1%:

<u>CAS No.</u>	<u>Chemical Name</u>
50-00-0	FORMALDEHYDE
75-07-0	ACETALDEHYDE
75-21-8	ETHYLENE OXIDE
123-91-1	DIOXANE

16. OTHER INFORMATION

Legend : N.E. - Not Established
TLV - Threshold Limit Value
STEL - Short Term Exposure Limit
PEL - Permissible Exposure Limit
CEIL - Ceiling

Prepared By : Environment, Health and Safety Department

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End of MSDS.

POZZOLITH® 100 XR

Version 1.3

02/08/2005

1. PRODUCT AND COMPANY INFORMATION

Company : **Degussa Admixtures, Inc.**
23700 Chagrin Blvd
BEACHWOOD, OH 44122

Telephone : 216-839-7500

Emergency telephone number : (800) 424-9300
(703) 527-3887 (Outside Continental US)

Product name : POZZOLITH® 100 XR

MSDS ID No. : 10087

TSCA Inventory : All components of this product are included, or are exempt from inclusion, in the EPA Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

Canadian DSL : All components of this product are included, or are exempt from inclusion, in the Canadian Domestic Substance List (DSL).

2. HAZARDOUS INGREDIENTS

Does not contain hazardous chemicals as defined by 29 CFR 1910.1200 and WHMIS.

3. HAZARDS IDENTIFICATION

HMIS® Rating	HEALTH	FLAMMABILITY	PHYSICAL HAZARD
	1	0	0

WHMIS Class : D2B

Primary Routes of Entry : Eye contact
Skin contact

Effects of Overexposure

Inhalation : Can cause slight irritation.

Skin : Can cause slight irritation.

Eyes : Can cause slight irritation.

Ingestion : Can cause slight irritation.

Chronic exposure : No known information available.

4. FIRST AID MEASURES

Eye contact : Flush eyes with water, lifting upper and lower lids occasionally for 15 minutes. Seek medical attention.

POZZOLITH® 100 XR

Version 1.3

02/08/2005

- Skin contact : Remove contaminated clothing. Wash thoroughly with soap and water. If irritation persists seek medical attention. Wash contaminated clothing before reuse.
- Ingestion : Do not induce vomiting without medical advice. If conscious, drink plenty of water. If a person feels unwell or symptoms of skin irritation appear, consult a physician. If a person vomits, place him/her in the recovery position. Never give anything by mouth to an unconscious person.
- Inhalation : Remove victim from exposure. If difficulty with breathing, administer oxygen. If breathing has stopped administer artificial respiration, preferably mouth-to-mouth. Seek immediate medical attention.

5. FIRE-FIGHTING MEASURES

- Flash point : Not combustible.
- Autoignition temperature : Not combustible.
- Lower explosion limit : not applicable
- Upper explosion limit : not applicable
- Suitable extinguishing media : Use extinguishing agent suitable for type of surrounding fire.
- Fire and Explosion Hazards : Containers can build up pressure if exposed to heat (fire). Cool closed containers exposed to fire with water spray.
- Special Fire-fighting Procedures : As in any fire, wear pressure demand self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

- Methods for cleaning up : Wear appropriate protective equipment (refer to section 8). Take action to eliminate source of leak; prevent from entry into open streams or sewers; contain spill by diking; vacuum up liquid or use absorbent media; remove to storage for disposal and rinse residual stain with water.

7. HANDLING AND STORAGE

- Handling : Keep out of reach of children. For personal protection see section 8.
- Storage : Keep tightly closed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- Eye protection : Wear as appropriate:
safety glasses with side-shields
goggles
face-shield
- Hand protection : Wear as appropriate:
impervious gloves

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02/08/2005

Body Protection	:	Wear as appropriate: impervious clothing preventive skin protection
Respiratory protection	:	In case of insufficient ventilation wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use NIOSH approved respirators.
Hygienic Practices	:	Avoid contact with skin, eyes and clothing. Ensure adequate ventilation, especially in confined areas. Wash hands before breaks and at the end of workday. When using, do not eat, drink or smoke. Handle in accordance with good industrial hygiene and safety practice.
Engineering Controls	:	Local exhaust ventilation can be necessary to control any air contaminants to within their TLVs during the use of this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Color	:	dark brown
Physical State	:	liquid
Odor	:	musty
pH	:	ca.8.0
Odor Threshold	:	no data available
Vapor Pressure	:	no data available
Vapor Density	:	Heavier than air
Boiling point/range	:	212 °F (100 °C)
Freeze Point	:	23 °F (-5 °C)
Water solubility	:	completely soluble
Specific Gravity	:	1.22
Viscosity	:	no data available
Evaporation rate	:	no data available
Partition coefficient (n-octanol/water)	:	no data available
VOC Concentration as applied (less water and exempt solvents)	:	0 g/l

10. STABILITY AND REACTIVITY

Stability	:	Stable under recommended storage conditions.
Conditions to avoid	:	Prolonged exposure to high temperatures

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02/08/2005

- Materials to avoid : Strong mineral acids.
- Hazardous decomposition products : Oxides of carbon
nitrogen oxides (NOx)
- Hazardous polymerization : Will not occur under normal conditions.

11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>	<u>Exposure time</u>
	LC50	no data available		

Acute oral toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Oral)	no data available	

Acute dermal toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Dermal)	no data available	

12. ECOLOGICAL INFORMATION

Ecotoxicological Information : There is no data available for this product.

13. DISPOSAL CONSIDERATIONS

Recommendations: Use excess product in an alternate beneficial application. Handle disposal of waste material in manner which complies with local, state, province and federal regulation.

14. TRANSPORT INFORMATION

DOT	: Proper shipping name	Not regulated
IATA	: Proper shipping name	Not regulated

15. REGULATORY INFORMATION

SARA 311/312 (RTK)

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Material Safety Data Sheet

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POZZOLITH® 100 XR

Version 1.3

02/08/2005

not applicable

SARA 313

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

This product contains no chemicals subject to the SARA 313 supplier notification requirements.

CERCLA

CERCLA section 103(a) specifically requires the person in charge of a vessel or facility to report immediately to the National Response Center (NRC) a release of a hazardous substance whose amount equals or exceeds the assigned RQ. The following hazardous substances are contained in this product.

<u>RQ</u>	<u>CAS No.</u>	<u>Chemical Name</u>
-----------	----------------	----------------------

No CERCLA chemicals exist in this product above reportable concentrations.

TSCA Section 12(b) Export Notification

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

<u>CAS No.</u>	<u>Chemical Name</u>
----------------	----------------------

There are no TSCA 12(b) Chemicals in this product.

California Proposition 65

The chemical(s) noted below and contained in this product, are known to the state of California to cause cancer, birth defects or other reproductive harm. Unless otherwise specified in Section 2 of this MSDS, these chemicals are present at < 0.1%:

<u>CAS No.</u>	<u>Chemical Name</u>
90-43-7	2-BIPHENYLOL
132-27-4	2-BIPHENYL, SODIUM SALT (AKA: SOPP; SODIUM 2-HYDROXYDIPHENYL)

16. OTHER INFORMATION

Legend : N.E. - Not Established
TLV - Threshold Limit Value
STEL - Short Term Exposure Limit
PEL - Permissible Exposure Limit
CEIL - Ceiling

Prepared By : Environment, Health and Safety Department

This information is furnished without warranty, representation, or license of any kind, except that this information is accurate to the best of the manufacturer's knowledge, or is obtained from sources believed by the manufacturer to be accurate and is not intended to be all inclusive. No warranty is expressed or implied regarding the accuracy of this information or the results to be obtained from its use thereof. The manufacturer assumes no responsibility for injuries proximately caused by use of the Material if reasonable safety procedures are not followed as stipulated in this Data Sheet. Additionally, the manufacturer assumes no responsibility for injuries proximately caused by abnormal use of the Material even if reasonable safety procedures are followed. Buyer assumes the risk in its use of the Material.

End of MSDS.

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Version 1.2

02/08/2005

SODIUM NITRATE	N.E.	N.E.	N.E.	N.E.
SODIUM THIOCYANATE	N.E.	N.E.	N.E.	N.E.
TRIETHANOLAMINE	N.E.	Inadequate data.	N.E.	N.E.

4. FIRST AID MEASURES

- Eye contact : Flush eyes with water, lifting upper and lower lids occasionally for 15 minutes. Seek medical attention.
- Skin contact : Remove contaminated clothing. Wash thoroughly with soap and water. If irritation persists seek medical attention. Wash contaminated clothing before reuse.
- Ingestion : Do not induce vomiting without medical advice. If conscious, drink plenty of water. If a person feels unwell or symptoms of skin irritation appear, consult a physician. If a person vomits, place him/her in the recovery position. Never give anything by mouth to an unconscious person.
- Inhalation : Remove victim from exposure. If difficulty with breathing, administer oxygen. If breathing has stopped administer artificial respiration, preferably mouth-to-mouth. Seek immediate medical attention.

5. FIRE-FIGHTING MEASURES

- Flash point : does not flash
- Autoignition temperature : not applicable
- Lower explosion limit : not applicable
- Upper explosion limit : not applicable
- Suitable extinguishing media : Use extinguishing agent suitable for type of surrounding fire.
- Fire and Explosion Hazards : Containers can build up pressure if exposed to heat (fire). Cool closed containers exposed to fire with water spray.
- Special Fire-fighting Procedures : As in any fire, wear pressure demand self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

- Methods for cleaning up : Wear appropriate protective equipment (refer to section 8). Take action to eliminate source of leak; prevent from entry into open streams or sewers; contain spill by diking; vacuum up liquid or use absorbent media; remove to storage for disposal and rinse residual stain with water.

7. HANDLING AND STORAGE

- Handling : Keep out of reach of children. For personal protection see section 8.
- Storage : Keep tightly closed.

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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- Eye protection : Wear as appropriate:
safety glasses with side-shields
goggles
face-shield

- Hand protection : Wear as appropriate:
impervious gloves

- Body Protection : Wear as appropriate:
impervious clothing
preventive skin protection

- Respiratory protection : In case of insufficient ventilation wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use NIOSH approved respirators.

- Hygienic Practices : Avoid contact with skin, eyes and clothing. Ensure adequate ventilation, especially in confined areas. Wash hands before breaks and at the end of workday. When using, do not eat, drink or smoke. Handle in accordance with good industrial hygiene and safety practice.

- Engineering Controls : Local exhaust ventilation can be necessary to control any air contaminants to within their TLVs during the use of this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

- Color : dark brown

- Physical State : liquid

- Odor : musty

- pH : Approx.8

- Odor Threshold : no data available

- Vapor Pressure : no data available

- Vapor Density : Heavier than air

- Boiling point/range : 212 °F (100 °C)

- Freeze Point : 32 °F (0 °C)

- Water solubility : completely soluble

- Specific Gravity : 1.27

- Viscosity : no data available

- Evaporation rate : no data available

- Partition coefficient (n-octanol/water) : no data available

- VOC Concentration as applied (less water and exempt) : 0 g/l

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Version 1.2

02/08/2005

solvents)

10. STABILITY AND REACTIVITY

- Stability : Stable under recommended storage conditions.
- Conditions to avoid : Prolonged exposure to high temperatures
- Materials to avoid : None known.
- Hazardous decomposition products : Oxides of carbon
Oxides of sulfur
nitrogen oxides (NOx)
- Hazardous polymerization : Will not occur under normal conditions.

11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>	<u>Exposure time</u>
	LC50	no data available		
<u>Component</u>				
SODIUM NITRATE	LC50	no data available		
SODIUM THIOCYANATE	LC50	no data available		
TRIETHANOLAMINE	LC50	no data available		

Acute oral toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Oral)	no data available	
<u>Component</u>			
SODIUM NITRATE	LD50 (Oral)	no data available	
SODIUM THIOCYANATE	LD50 (Oral)	no data available	
TRIETHANOLAMINE	LD50 (Oral)	no data available	

Acute dermal toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
	LD50 (Dermal)	no data available	
<u>Component</u>			
SODIUM NITRATE	LD50 (Dermal)	no data available	
SODIUM THIOCYANATE	LD50 (Dermal)	no data available	

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TRIETHANOLAMINE

LD50 (Dermal) no data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information : There is no data available for this product.

13. DISPOSAL CONSIDERATIONS

Recommendations: Use excess product in an alternate beneficial application. Handle disposal of waste material in manner which complies with local, state, province and federal regulation.

14. TRANSPORT INFORMATION

DOT : Proper shipping name Not regulated

IATA : Proper shipping name Not regulated

15. REGULATORY INFORMATION

SARA 311/312 (RTK)

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE (ACUTE) HEALTH HAZARD

SARA 313

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

<u>Weight %</u>	<u>CAS No.</u>	<u>Chemical Name</u>
10.00 - 30.00 %	7631-99-4	SODIUM NITRATE

CERCLA

CERCLA section 103(a) specifically requires the person in charge of a vessel or facility to report immediately to the National Response Center (NRC) a release of a hazardous substance whose amount equals or exceeds the assigned RQ. The following hazardous substances are contained in this product.

<u>RQ</u>	<u>CAS No.</u>	<u>Chemical Name</u>
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No CERCLA chemicals exist in this product above reportable concentrations.

TSCA Section 12(b) Export Notification

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

<u>CAS No.</u>	<u>Chemical Name</u>
----------------	----------------------

There are no TSCA 12(b) Chemicals in this product.

Material Safety Data Sheet

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Construction Chemicals

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02/08/2005

California Proposition 65

The chemical(s) noted below and contained in this product, are known to the state of California to cause cancer, birth defects or other reproductive harm. Unless otherwise specified in Section 2 of this MSDS, these chemicals are present at < 0.1%:

<u>CAS No.</u>	<u>Chemical Name</u>
50-00-0	FORMALDEHYDE
7440-47-3	CHROMIUM

16. OTHER INFORMATION

Legend : N.E. - Not Established
TLV - Threshold Limit Value
STEL - Short Term Exposure Limit
PEL - Permissible Exposure Limit
CEIL - Ceiling

Prepared By : Environment, Health and Safety Department

This information is furnished without warranty, representation, or license of any kind, except that this information is accurate to the best of the manufacturer's knowledge, or is obtained from sources believed by the manufacturer to be accurate and is not intended to be all inclusive. No warranty is expressed or implied regarding the accuracy of this information or the results to be obtained from its use thereof. The manufacturer assumes no responsibility for injuries proximately caused by use of the Material if reasonable safety procedures are not followed as stipulated in this Data Sheet. Additionally, the manufacturer assumes no responsibility for injuries proximately caused by abnormal use of the Material even if reasonable safety procedures are followed. Buyer assumes the risk in its use of the Material.

End of MSDS.

Material Safety Data Sheet

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Construction Chemicals

POZZUTE[®] 20+

Version 2.6

02/16/2005

1. PRODUCT AND COMPANY INFORMATION

Company	:	Degussa Admixtures, Inc. 23700 Chagrin Blvd BEACHWOOD, OH 44122
Telephone	:	216-839-7500
Emergency telephone number	:	(800) 424-9300 (703) 527-3887 (Outside Continental US)
Product name	:	POZZUTE [®] 20+
MSDS ID No.	:	11315
TSCA Inventory	:	All components of this product are included, or are exempt from inclusion, in the EPA Toxic Substances Control Act (TSCA) Chemical Substance Inventory.
Canadian DSL	:	All components of this product are included, or are exempt from inclusion, in the Canadian Domestic Substance List (DSL).

2. HAZARDOUS INGREDIENTS

<u>Chemical</u>	<u>CAS No.</u>	<u>TLV</u>	<u>STEL</u>	<u>PEL</u>	<u>CEIL</u>	<u>Weight %</u>
CALCIUM NITRATE	13477-34-4	N.E.	N.E.	N.E.	N.E.	30.00 - 60.00 %
SODIUM THIOCYANATE	540-72-7	N.E.	N.E.	N.E.	N.E.	1.00 - 5.00 %

3. HAZARDS IDENTIFICATION

HMIS [®] Rating	HEALTH 1	FLAMMABILITY 0	PHYSICAL HAZARD 0
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WHMIS Class	:	D2B
Primary Routes of Entry	:	Eye contact Skin contact Inhalation

Effects of Overexposure

Inhalation	:	Vapors can be irritating to respiratory tract and mucous membranes.
Skin	:	Can cause slight to moderate irritation. Prolonged or repeated skin contact tends to remove skin oils possibly leading to irritation and dermatitis.
Eyes	:	Can cause slight to moderate transient irritation, redness, tearing and blurred vision.
Ingestion	:	No hazard anticipated in normal industrial use. Intake can cause gastrointestinal irritation, nausea, and vomiting.
Chronic exposure	:	No known information available.

Carcinogenicity

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	ACGIH	IARC	NTP	OSHA
CALCIUM NITRATE	N.E.	N.E.	N.E.	N.E.
SODIUM THIOCYANATE	N.E.	N.E.	N.E.	N.E.

4. FIRST AID MEASURES

- Eye contact : Flush eyes with water, lifting upper and lower lids occasionally for 15 minutes. Seek medical attention.
- Skin contact : Remove contaminated clothing. Wash thoroughly with soap and water. If irritation persists seek medical attention. Wash contaminated clothing before reuse.
- Ingestion : Do not induce vomiting without medical advice. If conscious, drink plenty of water. If a person feels unwell or symptoms of skin irritation appear, consult a physician. If a person vomits, place him/her in the recovery position. Never give anything by mouth to an unconscious person.
- Inhalation : Remove victim from exposure. If difficulty with breathing, administer oxygen. If breathing has stopped administer artificial respiration, preferably mouth-to-mouth. Seek immediate medical attention.

5. FIRE-FIGHTING MEASURES

- Flash point : does not flash
- Autoignition temperature : not applicable
- Lower explosion limit : not applicable
- Upper explosion limit : not applicable
- Suitable extinguishing media : Use extinguishing agent suitable for type of surrounding fire. Keep containers and surroundings cool with water spray.
- Fire and Explosion Hazards : Containers can build up pressure if exposed to heat (fire). Cool closed containers exposed to fire with water spray.
- Special Fire-fighting Procedures : As in any fire, wear pressure demand self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

- Methods for cleaning up : Wear appropriate protective equipment (refer to section 8). Take action to eliminate source of leak; prevent from entry into open streams or sewers; contain spill by diking; vacuum up liquid or use absorbent media; remove to storage for disposal and rinse residual stain with water.

7. HANDLING AND STORAGE

- Handling : Keep out of reach of children. For personal protection see section 8.
- Storage : Keep tightly closed.

POZZUTEC® 20+

Version 2.6

02/16/2005

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

- Eye protection : Wear as appropriate:
safety glasses with side-shields
goggles
face-shield

- Hand protection : Wear as appropriate:
impervious gloves

- Body Protection : Wear as appropriate:
impervious clothing
preventive skin protection

- Respiratory protection : In case of insufficient ventilation wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use NIOSH approved respirators.

- Hygienic Practices : Avoid contact with skin, eyes and clothing. Ensure adequate ventilation, especially in confined areas. Wash hands before breaks and at the end of workday. When using, do not eat, drink or smoke. Handle in accordance with good industrial hygiene and safety practice.

- Engineering Controls : Local exhaust ventilation can be necessary to control any air contaminants to within their TLVs during the use of this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

- Color : brown

- Physical State : liquid

- Odor : slight

- pH : 3.5 - 6.5

- Odor Threshold : no data available

- Vapor Pressure : no data available

- Vapor Density : Heavier than air

- Boiling point/range : 221 °F (105 °C)

- Freeze Point : -4 °F (-20 °C)

- Water solubility : completely soluble

- Specific Gravity : 1.35

- Viscosity : no data available

- Evaporation rate : no data available

- Partition coefficient (n-octanol/water) : no data available

- VOC Concentration as applied (less water and exempt) : Note: no data available

POZZUTEC® 20+

Version 2.6

02/16/2005

solvents)

10. STABILITY AND REACTIVITY

- Stability : Stable under recommended storage conditions.
- Conditions to avoid : Prolonged exposure to high temperatures
- Materials to avoid : Strong mineral acids, oxidizing agents, strong bases and nitrites.
- Hazardous decomposition products : Oxides of carbon
Oxides of sulfur
nitrogen oxides (NOx)
- Hazardous polymerization : Will not occur under normal conditions.

11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity

<u>Product</u>	<u>Type</u> LC50	<u>Value</u> no data available	<u>Species</u>	<u>Exposure time</u>
<u>Component</u>				
CALCIUM NITRATE	LC50	no data available		
SODIUM THIOCYANATE	LC50	no data available		

Acute oral toxicity

<u>Product</u>	<u>Type</u> LD50 (Oral)	<u>Value</u> no data available	<u>Species</u>
<u>Component</u>			
CALCIUM NITRATE	LD50 (Oral)	20,000 mg/kg	
SODIUM THIOCYANATE	LD50 (Oral)	no data available	

Acute dermal toxicity

<u>Product</u>	<u>Type</u>	<u>Value</u>	<u>Species</u>
<u>Component</u>			
CALCIUM NITRATE	LD50 (Dermal)	13,000 mg/kg	
SODIUM THIOCYANATE	LD50 (Dermal)	no data available	

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Version 2.6

02/16/2005

12. ECOLOGICAL INFORMATION

Ecotoxicological Information : There is no data available for this product.

13. DISPOSAL CONSIDERATIONS

Recommendations: Use excess product in an alternate beneficial application. Handle disposal of waste material in manner which complies with local, state, province and federal regulation.

14. TRANSPORT INFORMATION

DOT	: Proper shipping name	Not regulated
IATA	: Proper shipping name	Not regulated

15. REGULATORY INFORMATION

SARA 311/312 (RTK)

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE (ACUTE) HEALTH HAZARD

SARA 313

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

<u>Weight %</u>	<u>CAS No.</u>	<u>Chemical Name</u>
30.00 - 60.00 %	13477-34-4	CALCIUM NITRATE

CERCLA

CERCLA section 103(a) specifically requires the person in charge of a vessel or facility to report immediately to the National Response Center (NRC) a release of a hazardous substance whose amount equals or exceeds the assigned RQ. The following hazardous substances are contained in this product.

<u>RQ</u>	<u>CAS No.</u>	<u>Chemical Name</u>
-----------	----------------	----------------------

No CERCLA chemicals exist in this product above reportable concentrations.

TSCA Section 12(b) Export Notification

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

<u>CAS No.</u>	<u>Chemical Name</u>
----------------	----------------------

There are no TSCA 12(b) Chemicals in this product.

California Proposition 65

The chemical(s) noted below and contained in this product, are known to the state of California to cause cancer, birth defects or other reproductive harm. Unless otherwise specified in Section 2 of this MSDS, these chemicals are present at < 0.1%:

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<u>CAS No.</u>	<u>Chemical Name</u>
50-00-0	FORMALDEHYDE

16. OTHER INFORMATION

Legend : N.E. - Not Established
TLV - Threshold Limit Value
STEL - Short Term Exposure Limit
PEL - Permissible Exposure Limit
CEIL - Ceiling

Prepared By : Environment, Health and Safety Department

This information is furnished without warranty, representation, or license of any kind, except that this information is accurate to the best of the manufacturer's knowledge, or is obtained from sources believed by the manufacturer to be accurate and is not intended to be all inclusive. No warranty is expressed or implied regarding the accuracy of this information or the results to be obtained from its use thereof. The manufacturer assumes no responsibility for injuries proximately caused by use of the Material if reasonable safety procedures are not followed as stipulated in this Data Sheet. Additionally, the manufacturer assumes no responsibility for injuries proximately caused by abnormal use of the Material even if reasonable safety procedures are followed. Buyer assumes the risk in its use of the Material.

End of MSDS.

Appendix D

Dust Management Plan



BEST MANAGEMENT PRACTICES PLAN FOR THE CONTROL OF FUGITIVE DUST EMISSIONS

**Amherst Island Wind Project
Temporary Ready Mix Concrete Batch Plant
Amherst Island, Ontario**

February 2015

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

VERSION CONTROL

**Amherst Island Wind Energy Project
Temporary Ready Mix Concrete Batch Plant**

Amherst Island, Ontario

Ver.	Date	Version Description	Prepared By
0	2015-02-19	Initial Draft for internal review	D England
1.0	2015-02-24	Initial version	D England

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

BACKGROUND: READY MIXED CONCRETE PROCESS

Aggregate materials are delivered to the Site by truck and deposited into the various aggregate stockpiles located on the east portion of the yard. The aggregate stockpiles located at the Site include sand and coarse stone.

Aggregate material is transferred from the stockpiles to the aggregate storage bins in the plant via a loader which deposits material into an above grade hopper.

Aggregate materials drop from the ground hopper onto a conveyor located above grade and then on to an incline conveyor covered by a wind shield on both sides and the top. The material is transported up the incline conveyor and discharged into multi-sectioned storage bins.

Aggregate from the multi-sectioned bins (i.e. sand, stone) drops into an aggregate weigh scale located beneath each bin. The appropriate amount of aggregate material is weighed and then transferred up a short inclined belt, and into the truck.

Aggregate is dropped into the drums of ready-mix trucks through an outer rubber sock.

Cementitious materials (i.e. Type 10 Portland) are delivered by tankers and are stored in vertical and horizontal silos. The silos are filled using a blower mounted on the tanker truck. During production, the cementitious materials are transferred from the silos through an auger system to the cement scale and then gravity fed through the loading point to the ready-mix trucks via an inner rubber sock (i.e. located inside the larger aggregate rubber sock) that has a greater length than the aggregate sock and therefore extends into the trucks drum. Each silo is equipped with a bag house dust collector located on the top of the silo.

At the loading point, cementitious material, aggregates, admixtures and water are loaded into the ready-mix trucks in the appropriate proportions according to the concrete mix design. If required, the water is preheated using a No. 2 oil firing hot water boiler. The loading point has a dust shroud and partial enclosure on 3 sides.

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

INTRODUCTION

This Best Management Practices Plan (BMPP) for Fugitive Dust Control has been prepared for inclusion with The “Emission Summary and Dispersion Modeling Report – Windlectric Inc., Ready Mix Concrete Batching Plant” prepared by BCX Environmental Consulting, dated February 2015. The document is typical of those in place at other Ready Mix plants operating in the Province of Ontario.

(1) Identification of the Main Sources of Fugitive Dust Emissions

The main sources of dust at Lafarge Temporary Ready Mix sites are from the following:

Main source of Fugitive Dust Emissions	
A	On-site traffic
B	Paved roads/areas (none on this site)
C	Unpaved roads/areas
D	Material stockpiles
E	Loading/unloading areas and loading/unloading techniques: <ul style="list-style-type: none"> • Raw material delivery and delivery techniques • Raw material transfer and transfer techniques • Product loading and loading techniques
F	Material spills
G	Material conveyance systems
H	Cement Silos
I	Scales (cement and aggregate)
J	Exposed openings in process and storage buildings
K	General works areas – covered under B and C

(2) Potential Causes for High Dust Emissions and Opacity Resulting from these Sources

The potential causes for high dust emissions and opacity from the above sources are as follows:

Main source of Fugitive Dust Emissions		Potential Causes of High Dust /Opacity Emissions
A	On-site traffic	Traffic movement (raw material delivery trucks / tankers; ready mix-trucks; loaders).

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

B	Paved roads/areas (none on this site)	Accumulated dust from raw material delivery, storage and transfer.
C	Unpaved roads/areas	Fines generated on unpaved areas; accumulated dust from raw material delivery, storage and transfer.
D	Material stockpiles	Wind erosion.
E	Loading/unloading areas and loading/unloading techniques: <ul style="list-style-type: none"> • Raw material delivery and delivery techniques • Raw material transfer and transfer techniques • Product loading and loading techniques 	Raw material drops.
F	Material spills	Raw material drops outside of a transfer point.
G	Material conveyance systems	Wind.
H	Cement Silos	Production.
I	Scales (cement and aggregate)	Production.
J	Exposed openings in process and storage buildings	Wind.

(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.

A. ON SITE TRAFFIC

- Traffic speed on site is limited to a maximum of 20 km/hr;

B. PAVED ROADS AND AREAS

- The Amherst Island Temporary Ready Mix Batch plant site does not contain any paved roads.

C. UNPAVED ROADS AND AREAS

- Unpaved roads and areas are treated with a water truck or equivalent dust suppression measures as required*.
- Intent of watering is to moisten the surface to suppress dust, not to saturate or pool water on roadway surface.
- Attention will be given to ensure that over watering causing site runoff and the offsite tracking of mud does not occur.

Temporary Ready Mix Concrete Batch Plant Best Management Practices Plan for the Control of Fugitive Dust Emissions

- Road watering for dust suppression will end once the temperature reaches 5 degrees Celsius in order to avoid the possibility of freezing creating safety and operational concerns.
- Prior to seasonal watering terminations, calcium chloride will be applied to ensure suppression continues over winter months.

*"As required" for this portion of the BMPP is defined as: The Plant Manager or designate observes that there is a high potential for dust to leave the property. Additional inspections will take place if weather conditions change (winds picking up or changing direction). The results of these inspections will be documented in the inspection form portion of the Daily Plant Maintenance Record Book.

D. MATERIAL STOCKPILES

- The working face of each stockpile is to be minimized;
- Aggregate is only to be handled on a very minimal basis, ideally 2 times, 1 for delivery and then for loading into plant hoppers.

E. LOADING/UNLOADING AREAS, LOADING/UNLOADING TECHNIQUES

- Raw material trucks deliver sand and stone to stockpiles.
- The Loader minimizes the working face of the stockpile and delivers material to a single above ground loading hopper.
- Cement is delivered to one of 3 possible Silos on-site. The emissions are controlled by a dedicated Dust Collector, one for each of the in truss silos, and shared usage for delivery trucks filling on site auxiliary storage silo. Each Dust Collector contains polyester – siliconized bags and a pulse type cleaning mechanism.
- Finished product is delivered to Ready Mix trucks at the Loading Point. The Loading point is equipped with a loading sock, dust shroud and partial enclosure on 3 sides.

F. MATERIAL SPILLS

Significant raw material (aggregate) spills are not expected. Minor spillage from the front-end loader and conveyor may occur.

- The front-end loader working area and beneath the conveyor will be monitored (visual inspection) throughout the day, with particular attention to spillage;
- Spilled aggregate will be cleaned up promptly;

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

G. MATERIAL CONVEYANCE SYSTEMS

- The conveyor leading to the aggregate bins is constructed with 35 degree outside rollers creating a trough for material as it travels up to the bins. The flow (drop) of material onto the conveyor is controlled by the gates and opening in the bottom of the above ground hopper.
- The flow of material is set to directly correlate to the length of the conveyor, width and speed of the conveyor belt, to avoid any material spillage from its sides and to keep material below the edge of the belt.

H. CEMENT SILO

- Each silo is equipped with a bag house dust collector;
- Bag house dust collectors are inspected on a monthly basis as per the Maintenance Log Book;
- Auxiliary storage silo utilize main silo dust collector systems or in truss systems.

I. SCALES (CEMENT AND AGGREGATE)

- The cement scales are serviced by the silo dust collectors.

J. EXPOSED OPENINGS IN PROCESS AND STORAGE AREAS

- Raw materials (i.e. coarse aggregate, sand and cementitious materials) discharged into ready mix trucks at the loading point are partially controlled by a rubber loading sock, dust shroud and partial enclosure on 3 sides.

(4) An Implementation Schedule for the Best Management Practices Plan, including Training of Facility Personnel

The procedures outlined in this document will be implemented prior to plant startup. Plant Employees will be formally trained on this documentation upon the implementation of the Plan and all other staff will be trained prior to plant operation. Information regarding this BMPP will be reviewed on a monthly basis at the plants monthly safety meetings.

(5) Inspection and Maintenance Procedures and Monitoring Initiatives to Ensure Effective Implementation of the Preventative and Control Measures

Temporary Ready Mix Concrete Batch Plant Best Management Practices Plan for the Control of Fugitive Dust Emissions

The effective implementation of the Plan will be the responsibility of the Plant Supervisor at the location. He/she will keep a master copy of the Plan and associated documents in the main site office.

The Plant Supervisor will monitor the **on-going** performance of the Plan based on the maintenance log-book entries.

Fugitive Dust Incidents and Suggestions for Improvement

As an important feedback mechanism, the Site will keep a **Record of Incidents and Suggestions for Improvement** and a **Complaint Log** along side the Fugitive Dust Control Plan.

Retention

The company will retain records required by this plan for a period of two years after decommissioning of the plant at the Amherst Island site, for audit/review purposes.

FUGITIVE DUST EMERGENCIES:

Spills

(a) Aggregate Raw Materials:

In the event of a significant aggregate raw material spill, Lafarge will begin clean up promptly.

(b) Cementitious Raw Materials:

The facility design includes high level alarms to protect against silo over flows during the transfer of cementitious raw materials into the silos. All cementitious spills shall be cleaned up promptly.

Excessive Winds

In the event of excessive winds in very dry conditions, the Plant Supervisor will conduct additional frequent visual inspections of the main sources of dust (see Table A.1). As necessary, the Plant Supervisor will order safe and appropriate additional dust mitigation which may include watering of the roads, working areas and stockpiles.

Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions

FUGITIVE DUST CONTROL TRAINING ATTENDANCE SHEET

Lafarge Site:

Date	Name	Signature

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**



Dust Suppression Inspection Log

This log is to be completed by an authorized supervisor or manager at the plant level in order to assess the need for dust suppression on site and to sign off once the watering has been completed. Please fill in all the following columns.

Date	Time	Dust Suppression required?	Water	Other	Inspectors Name (Please Print)	Sign off

**Temporary Ready Mix Concrete Batch Plant
Best Management Practices Plan for the Control of Fugitive Dust Emissions**

Appendix E

Emission Calculations

Particulate Emission Rates - Ready Mix Concrete Batching Plant

Source I.D.	Activity	M - Moisture Content (%) ⁽¹⁾	U - Wind Speed (m/s) ⁽²⁾	Maximum Loading Rate (tonne/day) ⁽⁶⁾	Uncontrolled Emissions (kg/day)	Control Efficiency (%)	Controlled Emissions (g/s)	Data Quality ⁽⁴⁾	Estimation Technique ⁽⁴⁾
1	Delivery trucks to aggregate stockpiles (coarse aggregate) ⁽³⁾⁽⁵⁾	2	3.98	1407.0	3.60E+00	0%	4.17E-02	A	EF
1	Delivery trucks to aggregate stockpiles (sand) ⁽³⁾⁽⁵⁾	4.8	3.98	1113.0	8.36E-01	0%	9.68E-03	A	EF
2	Material transfer from stockpiles to hopper via front-end loader (coarse aggregate) ⁽³⁾	2	3.98	614.4	1.57E+00	0%	1.82E-02	A	EF
2	Material transfer from stockpiles to hopper via front-end loader (sand) ⁽³⁾	4.8	3.98	487.2	3.66E-01	0%	4.24E-03	A	EF
3	Material transfer from aggregate hopper to inclined conveyor (coarse aggregate) ⁽⁷⁾⁽¹⁴⁾	-	-	614.4	9.22E-01	75%	2.67E-03	E	EF
3	Material transfer from aggregate hopper to inclined conveyor (sand) ⁽⁸⁾⁽¹⁴⁾	-	-	487.2	3.41E-02	75%	9.87E-05	E	EF
4	Material transfer from inclined conveyor to elevated aggregate bins (coarse aggregate) ⁽³⁾	2	3.98	614.4	1.57E+00	0%	1.82E-02	A	EF
4	Material transfer from inclined conveyor to elevated aggregate bins (sand) ⁽³⁾	4.8	3.98	487.2	3.66E-01	0%	4.24E-03	A	EF
5	Material transfer from aggregate bins to aggregate weigh scale (coarse aggregate) ⁽³⁾	2	3.98	614.4	1.57E+00	0%	1.82E-02	A	EF
5	Material transfer from aggregate bins to aggregate weigh scale (sand) ⁽³⁾	4.8	3.98	487.2	3.66E-01	0%	4.24E-03	A	EF
6	Material transfer from aggregate weigh scale to loading point conveyor (coarse aggregate) ⁽⁷⁾⁽¹²⁾	-	-	614.4	9.22E-01	75%	2.67E-03	E	EF
6	Material transfer from aggregate weigh scale to loading point conveyor (sand) ⁽⁸⁾⁽¹²⁾	-	-	487.2	3.41E-02	75%	9.87E-05	E	EF
7	Delivery of cementitious material to silo #1 by tanker truck (cementitious material) ⁽⁹⁾⁽¹⁰⁾	-	-	-	-	-	2.80E-03	Above-Average	EC
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cementitious material) ⁽⁹⁾⁽¹⁰⁾	-	-	-	-	-	2.80E-03	Above-Average	EC
9	Material transfer to ready mix truck at the loading point (coarse aggregate / sand / cementitious materials) ⁽¹¹⁾⁽¹³⁾⁽¹⁴⁾	-	-	201.0	1.12E+02	95.0%	6.50E-02	B	EF
Total TSP emissions from RMC Operations (not including combustion):							1.95E-01		

Maximum Daily Production Rate of Truck Mix RMC Plant =	600 m ³ /day
Quantity of coarse aggregate in RMC =	1024 kg/m ³
Quantity of sand in RMC =	812 kg/m ³
Quantity of cementitious materials in RMC =	335 kg/m ³

Maximum Daily Controlled Emissions (g/s) = Emission Factor (kg/tonne) x Loading Rate (tonnes/day) * (1-Control Efficiency, %) x (1000g/kg) x (day/24hr) x (hr/3600s)

Baghouse Maximum Daily Controlled Emissions (g/s) = Exhaust Flow Rate (m³/s) x Emission Factor (mg/m³) x (g/1000mg) x (daily operating hours/24hr)

- ⁽¹⁾ Since the sand is received washed, a moisture content of 4.8%, moisture upper limit for drop equation, has therefore been assumed to maintain the data quality rating of A (U.S. EPA, AP-42, Section 13.2.4 "Aggregate Handling and Storage Piles," November 2006). A moisture content of 2% was assumed for coarse aggregate. (Windlectric, 2015)
- ⁽²⁾ Wind speed is 3.98 m/s (The average wind speed from the MOECC regional meteorological data set).
- ⁽³⁾ Emission factor equation: $k(0.0016)(U/2.2)^{1.3} / (M/2)^{1.4}$ kg/t, where k=0.74 for TSP (particles less than 30 microns), M is the moisture % of materials, U(m/s) is wind speed at the material drop point (U.S. EPA, AP-42, Section 13.2.4 "Aggregate Handling and Storage Piles," November 2006).
- ⁽⁴⁾ Emission Factor Rating from U.S. EPA, AP-42; EF - Emission Factor; EC - Engineering Calculation.
- ⁽⁵⁾ The maximum daily delivery rate is based on 120 trucks (with each truck carrying a 21 tonne load) per day. The amount of coarse aggregate and sand delivered is proportioned based on a concrete composition of 1024 kg/cubic metre coarse aggregate and 812 kg/cubic metre sand (i.e. 67 coarse aggregate trucks and 53 sand trucks). (Windlectric, 2015)
- ⁽⁶⁾ Material handling rate through the plant is based on the maximum daily production rate of the plant (600 cubic metres/day) assuming the following composition: 1024 kg/cubic metre coarse aggregate, 812 kg/cubic metre sand, 335 kg/cubic metre cementitious materials. (Windlectric, 2015)
- ⁽⁷⁾ Emission factor: 0.0015 kg/t (uncontrolled conveyor transfer), U.S. EPA, AP-42, Section 11.19.2, "Crushed Stone Processing and Pulverized Mineral Processing," August 2004, Table 11.19.2-1 is assumed for the unwashed coarse aggregate.
- ⁽⁸⁾ Emission factor: 0.00007 kg/t (controlled conveyor transfer), U.S. EPA, AP-42, Section 11.19.2, "Crushed Stone Processing and Pulverized Mineral Processing," August 2004, Table 11.19.2-1 is assumed for the washed sand due to the higher moisture content and removal of fines content.
- ⁽⁹⁾ The silos are each controlled by a pulse-jet type of baghouse with an outlet flow rate of 0.28 cubic metres/hour (Windlectric, 2015). The baghouses are each conservatively assumed to operate 12 hours per day. (Windlectric, 2015)
- ⁽¹⁰⁾ The outlet loading rate for the baghouses, is 20 mg/m³ (MOE Procedure for Preparing an Emission Summary and Dispersion Modelling Report, March 2009).
- ⁽¹¹⁾ Emission factor for uncontrolled truck loading is 0.559 kg/tonne of cementitious material, (U.S. EPA, AP-42, Section 11.12 "Concrete Batching," January 2012).
- ⁽¹²⁾ A 75% control efficiency is assumed for enclosure on three sides and top.
- ⁽¹³⁾ A 50% control efficiency is assumed for a long sock and dust shroud enclosing the drop point (Windlectric, 2015)
- ⁽¹⁴⁾ A 90% control efficiency is assumed for the ready mix truck backing into an enclosure with 3 sides to ground and a top at the loading point with the front of the enclosure blocked by the ready mix truck. (Windlectric, 2015)

Respirable Crystalline Silica (quartz) (PM₁₀) - Ready-Mix Concrete Batching Plant

Source I.D.	Activity	M - Moisture Content (%) ⁽¹⁾	U - Wind Speed (m/s) ⁽²⁾	Loading Rate ⁽⁶⁾ (tonne/day)	Uncontrolled PM ₁₀ Emissions (kg/day)	% of Crystalline Silica (quartz) in PM ₁₀ ^{(8) (15)}	Control Efficiency (%)	Controlled Crystalline Silica (quartz) (PM ₁₀) Emissions	Data Quality ⁽⁴⁾	Estimation Technique ⁽⁴⁾
1	Delivery trucks to aggregate stockpiles (coarse aggregate) ⁽³⁾⁽⁵⁾	2	3.98	1407	1.70E+00	15%	0%	2.96E-03	A	EF & EC
2	Material transfer from stockpiles to hopper via front-end loader (coarse aggregate) ⁽³⁾⁽⁵⁾	2	3.98	614.4	7.44E-01	15%	0%	1.29E-03	A	EF & EC
3	Material transfer from aggregate hopper to inclined conveyor (coarse aggregate) ⁽⁷⁾⁽¹²⁾	-	-	614.4	3.38E-01	15%	75%	1.47E-04	D	EF & EC
4	Material transfer from inclined conveyor to elevated aggregate bins (coarse aggregate) ⁽³⁾	2	3.98	614.4	7.44E-01	15%	0%	1.29E-03	A	EF & EC
5	Material transfer from aggregate bins to aggregate weigh scale (coarse aggregate) ⁽³⁾	2	3.98	614.4	7.44E-01	15%	0%	1.29E-03	A	EF & EC
6	Material transfer from aggregate weigh scale to loading point conveyor (coarse aggregate) ⁽⁷⁾⁽¹²⁾	-	-	614.4	3.38E-01	15%	75%	1.47E-04	D	EF & EC
7	Delivery of cementitious material to silo #1 by tanker truck (cementitious material) ⁽⁹⁾⁽¹⁰⁾	-	-	-	-	0.2%	-	5.60E-06	Above-Average	EC
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cementitious material) ⁽⁹⁾⁽¹⁰⁾	-	-	-	-	10%	-	2.80E-04	Above-Average	EC
9	Material transfer to ready mix truck at the loading point (coarse aggregate / cementitious materials) ⁽⁶⁾⁽¹¹⁾⁽¹³⁾⁽¹⁴⁾	-	-	201	3.12E+01	2.65%	95%	4.78E-04	B	EF & EC
Total RCS emissions from RMC Operations:								7.89E-03		

Maximum Daily Production Rate of Truck Mix RMC Plant =	600 m ³ /day
Quantity of coarse aggregate in RMC =	1024 kg/m ³
Quantity of sand in RMC =	812 kg/m ³
Quantity of cementitious materials in RMC =	335 kg/m ³

Controlled Crystalline Silica PM₁₀ Emissions (g/s) = PM₁₀ Emission Factor (kg/tonne) x % of Crystalline Silica (quartz) in PM₁₀ x Loading Rate (tonnes/day) * (1-Control Efficiency, %) x 1000g/kg x day/24hr x hr/3600s

Controlled Crystalline Silica PM₁₀ Emissions (g/s) = Particulate Baghouse Outlet Loading Rate (mg/m³) x Flow Rate (m³/s) x (g/1000mg) x % of Crystalline Silica (quartz) in PM₁₀

⁽¹⁾ A moisture content of 2% was assumed for coarse aggregate. (Windlectric, 2015)

⁽²⁾ Wind speed is 3.98 m/s (The average wind speed from the MOECC regional meteorological data set).

⁽³⁾ Emission factor equation: $k(0.0016)(U/2.2)^{1.3} / (M/2)^{1.4}$ kg/t, where $k=0.35$ for PM₁₀, M is the moisture % of materials, U (m/s) is wind speed at the material drop point (U.S. EPA, AP-42, Section 13.2.4 "Aggregate Handling and Storage Piles," November 2006).

⁽⁴⁾ Emission Factor Rating from U.S. EPA, AP-42; EF - Emission Factor; EC - Engineering Calculation.

⁽⁵⁾ The maximum daily delivery rate is based on 120 trucks (with each truck carrying a 21 tonne load) per day. The amount of coarse aggregate and sand delivered is proportioned based on a concrete composition of 1024 kg/cubic metre coarse aggregate and 812 kg/cubic metre sand (i.e. 67 coarse aggregate trucks and 53 sand trucks). (Windlectric, 2015)

⁽⁶⁾ Material handling rate through the plant is based on the maximum daily production rate of the plant (600 cubic metres/day) assuming the following composition: 1024 kg/cubic metre coarse aggregate, 812 kg/cubic metre sand, 335 kg/cubic metre cementitious materials. (Windlectric, 2015)

⁽⁷⁾ PM₁₀ Emission factor: 0.00055 kg/t (uncontrolled conveyor transfer), U.S. EPA, AP-42, Section 11.19.2, "Crushed Stone Processing and Pulverized Mineral Processing," August 2004, Table 11.19.2-1 is assumed for the unwashed coarse aggregate.

⁽⁸⁾ A mixture of cementitious material from Silo #1 (75%) and Silo #2 (25%). (Windlectric, 2015)

⁽⁹⁾ The silos are each controlled by a pulse-jet type of baghouse with an outlet flow rate of 0.28 cubic metres/hour (Windlectric, 2015). The baghouses are each conservatively assumed to operate 12 hours per day. (Windlectric, 2015)

⁽¹⁰⁾ The outlet loading rate for the baghouses, is 20 mg/m³ (MOE Procedure for Preparing an Emission Summary and Dispersion Modelling Report, March 2009).

⁽¹¹⁾ PM₁₀ Emission factor for uncontrolled truck loading is 0.155 kg/tonne of cementitious material, (U.S. EPA, AP-42, Section 11.12 "Concrete Batching," January 2012).

⁽¹²⁾ A 75% control efficiency is assumed for enclosure on three sides and top.

⁽¹³⁾ A 50% control efficiency is assumed for a long sock and dust shroud enclosing the drop point (Windlectric, 2015)

⁽¹⁴⁾ A 90% control efficiency is assumed for the ready mix truck backing into an enclosure with 3 sides to ground and a top

⁽¹⁵⁾ According to the MSDS (i.e. limestone, cement, and fly ash), the highest percentage (by weight) (upper limit) of crystalline silica was conservatively assumed for each unwashed material (i.e. coarse aggregate, cement, and fly ash). It was also conservatively assumed that the amount of PM₁₀ is the same as the bulk material concentration.

Combustion Emission Rates - Ready Mix Concrete Batching Plant

Source I.D.	Source	Fuel Consumption		Emission Factors					Emissions (g/s)				Data Quality ⁽¹⁾				Estimation Technique ⁽¹⁾
		Value	Units	NO _x	SO ₂	CO	TSP ⁽⁶⁾	Units	NO _x	SO ₂	CO	TSP	NO _x	SO ₂	CO	TSP	
10	No.2 oil-fired boiler ⁽²⁾⁽³⁾⁽⁵⁾	15	gal/hr	20	71	5	3.3	lb/10 ³ gal	3.79E-02	1.34E-01	9.47E-03	6.25E-03	A	A	A	A	EF
11	Main diesel-fired generator ⁽⁴⁾⁽⁷⁾	198.0	hp	3.10E-02	2.05E-03	6.68E-03	2.20E-03	lb/hp-hr	7.75E-01	5.13E-02	1.67E-01	2.75E-02	D	D	D	D	EF
12	Secondary diesel-fired generator ⁽⁴⁾⁽⁷⁾	109.0	hp	3.10E-02	2.05E-03	6.68E-03	2.20E-03	lb/hp-hr	4.27E-01	2.82E-02	9.19E-02	1.51E-02	D	D	D	D	EF

$$\text{Boiler Emissions (g/s)} = \text{Fuel Consumption (10}^3\text{ gal/hr)} \times \text{Emission Factor (lb/10}^3\text{ gal)} \times (\text{kg/2.2lb}) \times (\text{1000g/kg}) \times (\text{1hr/3600s})$$

$$\text{Generator Gas Emissions (g/s)} = \text{Power Rating (hp)} \times \text{Emission Factor (lb/hp-hr)} \times (\text{kg/2.2lb}) \times (\text{1000g/kg}) \times (\text{1hr/3600s})$$

$$\text{Generator TSP Emissions (g/s)} = \text{Power Rating (hp)} \times \text{Emission Factor (lb/hp-hr)} \times (\text{kg/2.2lb}) \times (\text{1000g/kg}) \times (\text{1hr/3600s}) \times (\text{daily operating hours/24hr})$$

⁽¹⁾ Emission Factor Rating from U.S. EPA, AP-42; EF - Emission Factor.

⁽²⁾ It was conservatively assumed that the boiler operates 24/7, all year around, for the maximum emission scenario.

⁽³⁾ Emission factor taken from U.S. EPA, AP-42, Section 1.4 "Natural Gas Combustion," July 1998, Table 1.4-1 for small boiler (<100 MMBTU).

⁽⁴⁾ It was assumed that the main diesel-fired generator operates from 7am-7pm (day) only and the secondary diesel-fired generator operates from 7pm-7am (night) only. Both generators were assumed to operate 7 days per week, all year round. The TSP emission rate is a maximum daily emission rate (Windlectric, 2015)

⁽⁵⁾ Emission factor equation for SO₂ = 142S, where S is the sulfur content in fuel. The No.1/No. 2 fuel oil sulphur content was assumed to be 0.5% as per O.Reg. 361.

⁽⁶⁾ The emission factor for total suspended particulate was taken from the sum of the emission factors for filterable particulate and total condensable particulate.

⁽⁷⁾ Emission factor taken from U.S. EPA, AP-42, Section 3.3 "Gasoline and Diesel Industrial Engines", October 1996.

Metals Emission Rates - Ready Mix Concrete Batching Plant

Source I.D.	Activity	M - Moisture Content (%)	U - Wind Speed (m/s)	Maximum Loading Rate (tonne/day) ⁽²⁾⁽⁶⁾	Emission Factor (kg/tonne cementitious material) ⁽⁵⁾										Uncontrolled Emissions (kg/day)	Control Efficiency (%)	Controlled Emissions (g/s)	Data Quality ⁽¹⁾	Estimation Technique ⁽¹⁾
					As	Be	Cd	Total Cr	Pb	Mn	Ni	Se	Highest Emission Factor ⁽⁷⁾						
7	Delivery of cementitious material to silo #1 by tanker truck (cement)	-	-	150.75	2.12E-09	2.43E-10	-	1.45E-08	5.46E-09	5.87E-08	2.09E-08	-	5.87E-08	8.85E-06	0.0%	1.02E-07	E	EF	
7	Delivery of cementitious material to silo #2 by tanker truck/material transfer to cement weigh scale (cement supplement)	-	-	50.25	5.02E-07	4.52E-08	9.92E-09	6.10E-07	2.60E-07	1.28E-07	1.14E-06	3.62E-08	1.14E-06	5.73E-05	0.0%	6.63E-07	E	EF	
9	Material transfer to ready mix truck at the loading point (coarse aggregate / sand / cementitious materials) ⁽⁴⁾⁽⁵⁾	-	-	201.0	6.09E-06	1.22E-07	1.71E-08	5.71E-06	1.81E-06	3.06E-05	5.99E-06	1.31E-06	3.06E-05	6.15E-03	95.0%	3.56E-06	E	EF	
													Metal emissions from RMC Operations:		4.32E-06				

Maximum Daily Production Rate of Truck Mix RMC Plant =	600 m ³ /day
Quantity of coarse aggregate in RMC =	1024 kg/m ³
Quantity of sand in RMC =	812 kg/m ³
Quantity of cementitious materials in RMC =	335 kg/m ³

$\text{Maximum Daily Controlled Emissions (g/s)} = \text{Emission Factor (kg/tonne)} \times \text{Loading Rate (tonnes/day)} \times (1 - \text{Control Efficiency, \%}) \times (1000\text{g/kg}) \times (\text{day}/24\text{hr}) \times (\text{hr}/3600\text{s})$

⁽¹⁾ Emission Factor Rating from U.S. EPA, AP-42; EF - Emission Factor

⁽²⁾ Material handling rate through the plant is based on the maximum daily production rate of the plant (600 cubic metres/day) assuming the following composition: 1024 kg/cubic metre coarse aggregate, 812 kg/cubic metre sand, 335 kg/cubic metre cementitious materials. (Windlectric, 2015)

⁽³⁾ Emission factors for metal, (U.S. EPA, AP-42, Section 11.12 "Concrete Batching," June 2006).

⁽⁴⁾ A 50% control efficiency is assumed for a long sock and dust shroud enclosing the drop point (Windlectric, 2015)

⁽⁵⁾ A 90% control efficiency is assumed for the ready mix truck backing into an enclosure with 3 sides to ground and a top at the loading point with the front of the enclosure blocked by the ready mix truck. (Windlectric, 2015)

⁽⁶⁾ A mixture of cementitious material from Silo #1 (75%) and Silo #2 (25%), (Windlectric, 2015)

⁽⁷⁾ Very conservatively used the highest metal (Arsenic/Beryllium/Cadmium/Chromium/Lead/Manganese/Nickel/Selenium) emission factor for each source.

Appendix F

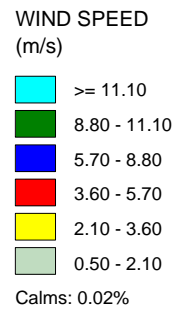
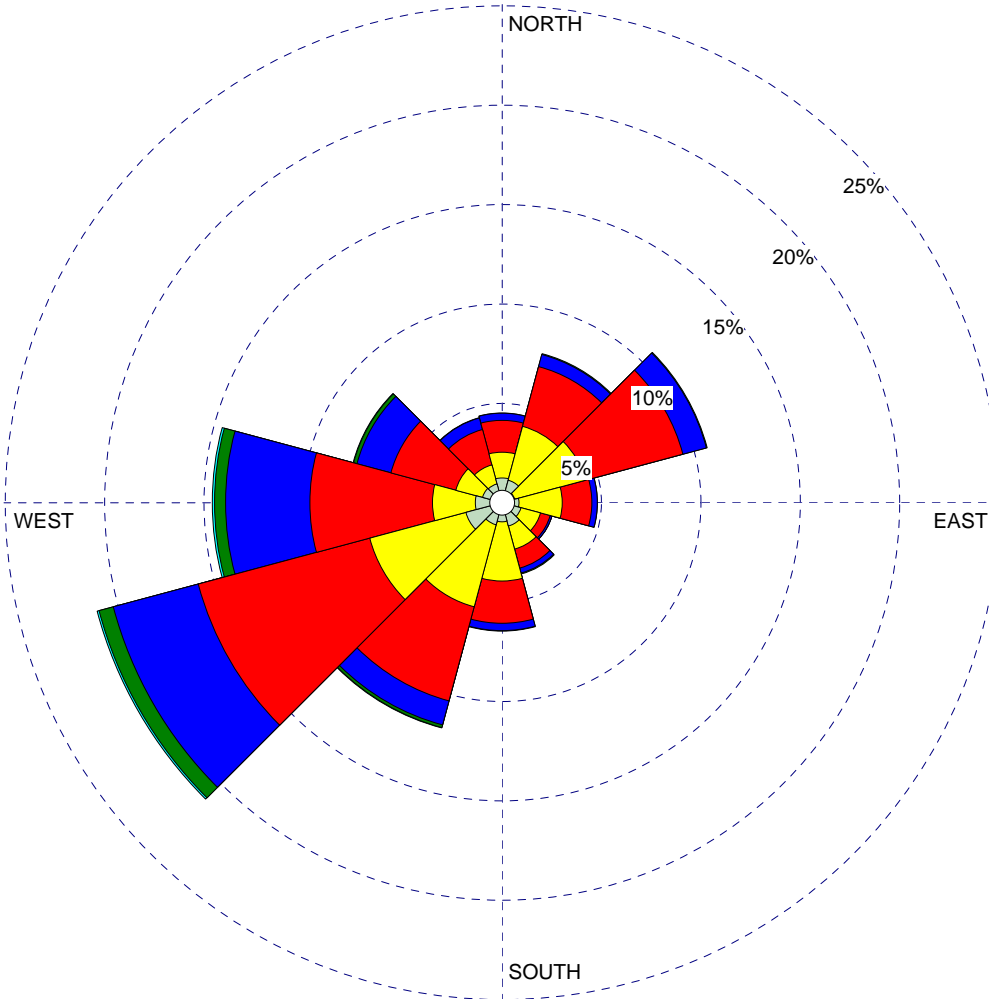
AERMOD Supporting Files

WIND ROSE PLOT:

Windrose - Eastern Region (Kingston, Cornwall) 1996-2000
MOE Regional Meteorological Data

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 01/01/1996 - 00:00 End Date: 31/12/2000 - 23:00	MODELER:	
	CALM WINDS:	TOTAL COUNT:	
	0.02%	43821 hrs.	
AVG. WIND SPEED:	DATE:	PROJECT NO.:	
3.98 m/s	21/02/2015		

*** THE MAXIMUM 400 24-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***

TSP								
RANK BY YI	YEAR	RANK	CONC	YYYYMMDD	XR	YR	TYPE	MOE Reg. 419/05
1	1996	5	96.79554	2E+09	364002.4	4891246	DC	Discarded
1	1997	132	64.13132	2E+09	364018.4	4891221	DC	Discarded
1	1998	1	110.7905	2E+09	363970.3	4891297	DC	Discarded
1	1999	58	73.1189	2E+09	363954.2	4891322	DC	Discarded
1	2000	37	76.35117	2E+09	363991.7	4891263	DC	Discarded
2	1996	6	94.8915	2E+09	363997	4891254	DC	Discarded
2	1997	143	63.4893	2E+09	364023.7	4891212	DC	Discarded
2	1998	2	106.3476	2E+09	363964.9	4891305	DC	Discarded
2	1999	62	72.39426	2E+09	363959.6	4891313	DC	Discarded
2	2000	38	76.25798	2E+09	363986.3	4891271	DC	Discarded
3	1996	9	91.21952	2E+09	364007.7	4891238	DC	Discarded
3	1997	148	63.1975	2E+09	364013.1	4891229	DC	Discarded
3	1998	3	105.8027	2E+09	363975.6	4891288	DC	Discarded
3	1999	66	71.8211	2E+09	363957.6	4891322	DC	Discarded
3	2000	39	76.22867	2E+09	363997	4891254	DC	Discarded
4	1996	13	86.71599	2E+09	363997.6	4891262	DC	Discarded
4	1997	154	62.84966	2E+09	363975.6	4891288	DC	Discarded
4	1998	4	104.6521	2E+09	363977.6	4891302	DC	Discarded
4	1999	76	70.69257	2E+09	363948.9	4891330	DC	Discarded
4	2000	40	75.83307	2E+09	363954.2	4891322	DC	Discarded
5	1996	14	86.57989	2E+09	364017.6	4891242	DC	Discarded
5	1997	173	62.10774	2E+09	364029.1	4891204	DC	Discarded
5	1998	7	94.02816	2E+09	363981	4891280	DC	Discarded
5	1999	85	69.69019	2E+09	363932.8	4891356	DC	Discarded
5	2000	41	75.66919	2E+09	364002.4	4891246	DC	Discarded
6	1996	15	85.2567	2E+09	363991.7	4891263	DC	Discarded
6	1997	190	61.27719	2E+09	363970.3	4891297	DC	Discarded
6	1998	8	93.96694	2E+09	363959.6	4891313	DC	Discarded
6	1999	86	69.68964	2E+09	363927.5	4891364	DC	Discarded
6	2000	43	75.48836	2E+09	363959.6	4891313	DC	Discarded
7	1996	16	84.09962	2E+09	364017.6	4891262	DC	Discarded
7	1997	207	60.3634	2E+09	363997	4891254	DC	Discarded
7	1998	10	89.84209	2E+09	363997.6	4891302	DC	Discarded
7	1999	87	69.32	2E+09	363981	4891280	DC	Discarded
7	2000	46	75.27012	2E+09	364002.4	4891246	DC	Discarded
8	1996	17	84.06912	2E+09	363943.5	4891339	DC	Highest
8	1997	210	60.29287	2E+09	364034.4	4891195	DC	Discarded
8	1998	11	89.28204	2E+09	363977.6	4891322	DC	Discarded
8	1999	97	68.064	2E+09	363986.3	4891271	DC	Discarded
8	2000	47	75.08438	2E+09	364007.7	4891238	DC	Discarded
9	1996	18	83.99655	2E+09	363938.2	4891347	DC	Discarded
9	1997	211	60.28577	2E+09	363991.7	4891263	DC	Discarded
9	1998	12	89.18118	2E+09	363997.6	4891322	DC	Discarded
9	1999	105	67.16463	2E+09	363922.1	4891372	DC	Discarded
9	2000	50	74.62642	2E+09	363957.6	4891322	DC	Discarded
10	1996	19	81.79375	2E+09	363932.8	4891356	DC	Discarded
10	1997	215	60.13943	2E+09	363981	4891280	DC	Discarded
10	1998	21	80.613	2E+09	364017.6	4891322	DC	Discarded
10	1999	106	66.91595	2E+09	363964.9	4891305	DC	Discarded
10	2000	56	73.15733	2E+09	363997.6	4891262	DC	Discarded
11	1996	20	81.55374	2E+09	363948.9	4891330	DC	Discarded
11	1997	222	59.95229	2E+09	364002.4	4891246	DC	Discarded
11	1998	22	80.07774	2E+09	363954.2	4891322	DC	Discarded
11	1999	108	66.8073	2E+09	363938.2	4891347	DC	Discarded
11	2000	57	73.15664	2E+09	363948.9	4891330	DC	Discarded
12	1996	23	79.97454	2E+09	364013.1	4891229	DC	Discarded
12	1997	224	59.84193	2E+09	364007.7	4891238	DC	Discarded
12	1998	24	79.93949	2E+09	363957.6	4891322	DC	Discarded
12	1999	109	66.75482	2E+09	363937.6	4891362	DC	Discarded
12	2000	70	70.94435	2E+09	363997	4891254	DC	Discarded
13	1996	28	78.3424	2E+09	364037.6	4891262	DC	Discarded
13	1997	237	59.05935	2E+09	364037.6	4891202	DC	Discarded
13	1998	25	79.47729	2E+09	363959.6	4891313	DC	Discarded
13	1999	116	66.16158	2E+09	363943.5	4891339	DC	Discarded
13	2000	71	70.93943	2E+09	363997.6	4891262	DC	Discarded
14	1996	29	78.15936	2E+09	363927.5	4891364	DC	Discarded
14	1997	239	58.6534	2E+09	363986.3	4891271	DC	Discarded
14	1998	26	79.32296	2E+09	363986.3	4891271	DC	Discarded
14	1999	124	65.42683	2E+09	363959.6	4891313	DC	Discarded
14	2000	72	70.93242	2E+09	364017.6	4891242	DC	Discarded
15	1996	31	77.96573	2E+09	363937.6	4891362	DC	Discarded
15	1997	249	58.28259	2E+09	363997.6	4891262	DC	Discarded
15	1998	27	78.58107	2E+09	363957.6	4891322	DC	Discarded
15	1999	125	65.19392	2E+09	363975.6	4891288	DC	Discarded
15	2000	73	70.7478	2E+09	363964.9	4891305	DC	Discarded
16	1996	33	77.25032	2E+09	364018.4	4891221	DC	Discarded
16	1997	250	58.27254	2E+09	364039.8	4891187	DC	Discarded
16	1998	30	78.01024	2E+09	363954.2	4891322	DC	Discarded

*** THE MAXIMUM 400 24-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***

RCS	RANK BY YI	YEAR	RANK	CONC	YYYYMMDD	XR	YR	TYPE	MOE Reg. 419/05
	1	1996	5	4.38091	2E+09	364002.4	4891246	DC	Discarded
	1	1997	125	2.99999	2E+09	363975.6	4891288	DC	Discarded
	1	1998	1	5.23893	2E+09	363970.3	4891297	DC	Discarded
	1	1999	43	3.4823	2E+09	363959.6	4891313	DC	Discarded
	1	2000	28	3.58927	2E+09	363959.6	4891313	DC	Discarded
	2	1996	6	4.37259	2E+09	363997	4891254	DC	Discarded
	2	1997	150	2.90135	2E+09	363970.3	4891297	DC	Discarded
	2	1998	2	5.07263	2E+09	363974.9	4891298	DC	Discarded
	2	1999	46	3.44428	2E+09	363954.2	4891322	DC	Discarded
	2	2000	29	3.5856	2E+09	363997	4891254	DC	Discarded
	3	1996	11	4.2422	2E+09	363994.9	4891258	DC	Discarded
	3	1997	151	2.89947	2E+09	364018.4	4891221	DC	Discarded
	3	1998	3	4.96803	2E+09	363964.9	4891305	DC	Discarded
	3	1999	63	3.32722	2E+09	363932.8	4891356	DC	Discarded
	3	2000	32	3.57815	2E+09	363986.3	4891271	DC	Discarded
	4	1996	13	4.00866	2E+09	364007.7	4891238	DC	Discarded
	4	1997	152	2.89738	2E+09	364013.1	4891229	DC	Discarded
	4	1998	4	4.96021	2E+09	363975.6	4891288	DC	Discarded
	4	1999	69	3.28688	2E+09	363938.2	4891347	DC	Discarded
	4	2000	35	3.54514	2E+09	363991.7	4891263	DC	Discarded
	5	1996	14	3.9724	2E+09	364014.9	4891258	DC	Discarded
	5	1997	159	2.8571	2E+09	363981	4891280	DC	Discarded
	5	1998	7	4.31226	2E+09	363981	4891280	DC	Discarded
	5	1999	73	3.2659	2E+09	363934.9	4891358	DC	Discarded
	5	2000	36	3.5398	2E+09	363954.2	4891322	DC	Discarded
	6	1996	15	3.9356	2E+09	363991.7	4891263	DC	Discarded
	6	1997	160	2.85668	2E+09	364023.7	4891212	DC	Discarded
	6	1998	8	4.28186	2E+09	363974.9	4891318	DC	Discarded
	6	1999	77	3.24606	2E+09	363964.9	4891305	DC	Discarded
	6	2000	39	3.53259	2E+09	364002.4	4891246	DC	Discarded
	7	1996	16	3.92065	2E+09	363943.5	4891339	DC	Highest
	7	1997	166	2.84112	2E+09	363974.9	4891298	DC	Discarded
	7	1998	9	4.27713	2E+09	363994.9	4891318	DC	Discarded
	7	1999	78	3.23915	2E+09	363948.9	4891330	DC	Discarded
	7	2000	40	3.53239	2E+09	363994.9	4891258	DC	Discarded
	8	1996	17	3.86081	2E+09	363938.2	4891347	DC	Discarded
	8	1997	181	2.81453	2E+09	363997	4891254	DC	Discarded
	8	1998	10	4.24553	2E+09	363959.6	4891313	DC	Discarded
	8	1999	79	3.23199	2E+09	363981	4891280	DC	Discarded
	8	2000	47	3.43998	2E+09	364002.4	4891246	DC	Discarded
	9	1996	18	3.82169	2E+09	363948.9	4891330	DC	Discarded
	9	1997	190	2.80188	2E+09	364007.7	4891238	DC	Discarded
	9	1998	12	4.20015	2E+09	363994.9	4891298	DC	Discarded
	9	1999	84	3.21078	2E+09	363927.5	4891364	DC	Discarded
	9	2000	50	3.42027	2E+09	364007.7	4891238	DC	Discarded
	10	1996	20	3.76214	2E+09	364014.9	4891238	DC	Discarded
	10	1997	199	2.78275	2E+09	364029.1	4891204	DC	Discarded
	10	1998	19	3.77628	2E+09	364014.9	4891318	DC	Discarded
	10	1999	94	3.14656	2E+09	363986.3	4891271	DC	Discarded
	10	2000	53	3.38553	2E+09	363994.9	4891258	DC	Discarded
	11	1996	23	3.6841	2E+09	363932.8	4891356	DC	Discarded
	11	1997	204	2.77162	2E+09	363994.9	4891258	DC	Discarded
	11	1998	21	3.74822	2E+09	363954.2	4891322	DC	Discarded
	11	1999	113	3.0472	2E+09	363974.9	4891318	DC	Discarded
	11	2000	56	3.36575	2E+09	363964.9	4891305	DC	Discarded
	12	1996	25	3.6153	2E+09	363934.9	4891358	DC	Discarded
	12	1997	218	2.72502	2E+09	364002.4	4891246	DC	Discarded
	12	1998	22	3.74521	2E+09	363959.6	4891313	DC	Discarded
	12	1999	119	3.02142	2E+09	363959.6	4891313	DC	Discarded
	12	2000	60	3.34031	2E+09	363997	4891254	DC	Discarded
	13	1996	26	3.60995	2E+09	363954.2	4891322	DC	Discarded
	13	1997	222	2.71888	2E+09	363991.7	4891263	DC	Discarded
	13	1998	24	3.63202	2E+09	364014.9	4891338	DC	Discarded
	13	1999	122	3.01631	2E+09	363975.6	4891288	DC	Discarded
	13	2000	62	3.33383	2E+09	363991.7	4891263	DC	Discarded
	14	1996	27	3.59081	2E+09	363954.9	4891338	DC	Discarded
	14	1997	223	2.71746	2E+09	364014.9	4891238	DC	Discarded
	14	1998	31	3.57923	2E+09	363948.9	4891330	DC	Discarded
	14	1999	123	3.01424	2E+09	363954.9	4891338	DC	Discarded
	14	2000	64	3.31611	2E+09	363948.9	4891330	DC	Discarded
	15	1996	30	3.58154	2E+09	364013.1	4891229	DC	Discarded
	15	1997	238	2.69029	2E+09	364034.4	4891195	DC	Discarded
	15	1998	34	3.54521	2E+09	363986.3	4891271	DC	Discarded
	15	1999	124	3.01234	2E+09	363943.5	4891339	DC	Discarded
	15	2000	66	3.30576	2E+09	363994.9	4891278	DC	Discarded
	16	1996	33	3.57333	2E+09	364034.9	4891258	DC	Discarded
	16	1997	239	2.68516	2E+09	364034.9	4891198	DC	Discarded
	16	1998	37	3.53971	2E+09	363964.9	4891305	DC	Discarded

*** THE MAXIMUM 400 1-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***

NOx

RANK BY		YYYYMMDD						MOE Reg.
YEAR	YEAR	RANK	CONC	DHH	XR	YR	TYPE	419/05
1	1996	8	366.7096	2E+09	363866.8	4890946	DC	Discarded
1	1997	1	408.5017	2E+09	363776.3	4890905	DC	Discarded
1	1998	3	404.8432	2E+09	363821.5	4890925	DC	Discarded
1	1999	23	347.0018	2E+09	363830.6	4890929	DC	Discarded
1	2000	24	346.696	2E+09	363821.5	4890925	DC	Discarded
2	1996	9	364.8166	2E+09	363875.8	4890950	DC	Discarded
2	1997	2	404.9022	2E+09	363785.4	4890909	DC	Discarded
2	1998	5	394.5491	2E+09	363821.7	4890919	DC	Discarded
2	1999	29	343.8144	2E+09	363821.5	4890925	DC	Discarded
2	2000	27	345.0787	2E+09	363803.4	4890917	DC	Discarded
3	1996	11	359.476	2E+09	363881.7	4890939	DC	Discarded
3	1997	4	401.0334	2E+09	363794.4	4890913	DC	Discarded
3	1998	12	358.1729	2E+09	363812.5	4890921	DC	Discarded
3	1999	32	343.5853	2E+09	363812.5	4890921	DC	Discarded
3	2000	28	344.3294	2E+09	363821.5	4890925	DC	Discarded
4	1996	14	353.4077	2E+09	363803.4	4890917	DC	Discarded
4	1997	6	374.9534	2E+09	363866.8	4890946	DC	Discarded
4	1998	13	354.0534	2E+09	363830.6	4890929	DC	Discarded
4	1999	38	340.1573	2E+09	363785.4	4890909	DC	Discarded
4	2000	44	338.2365	2E+09	363776.3	4890905	DC	Discarded
5	1996	17	351.5031	2E+09	363866.8	4890946	DC	Discarded
5	1997	7	373.9213	2E+09	363785.4	4890909	DC	Discarded
5	1998	16	351.5815	2E+09	363841.7	4890919	DC	Discarded
5	1999	43	338.7829	2E+09	363857.7	4890942	DC	Discarded
5	2000	47	337.0953	2E+09	363857.7	4890942	DC	Discarded
6	1996	18	350.5829	2E+09	363803.4	4890917	DC	Discarded
6	1997	10	361.8416	2E+09	363848.7	4890937	DC	Discarded
6	1998	20	349.8362	2E+09	363830.6	4890929	DC	Discarded
6	1999	46	337.148	2E+09	363821.7	4890919	DC	Discarded
6	2000	51	335.6061	2E+09	363767.3	4890900	DC	Discarded
7	1996	25	346.548	2E+09	363821.5	4890925	DC	Discarded
7	1997	15	352.011	2E+09	363791.7	4890869	DC	Discarded
7	1998	21	349.5733	2E+09	363794.4	4890913	DC	Discarded
7	1999	49	336.5768	2E+09	363821.5	4890925	DC	Discarded
7	2000	52	335.4885	2E+09	363866.8	4890946	DC	Discarded
8	1996	31	343.6253	2E+09	363830.6	4890929	DC	Discarded
8	1997	19	350.1435	2E+09	363839.6	4890933	DC	Discarded
8	1998	22	347.4719	2E+09	363803.4	4890917	DC	Discarded
8	1999	50	336.4762	2E+09	363758.2	4890896	DC	Discarded
8	2000	53	335.3818	2E+09	363821.7	4890919	DC	Discarded
9	1996	33	343.3325	2E+09	363794.4	4890913	DC	Discarded
9	1997	34	343.2174	2E+09	363821.5	4890925	DC	Discarded
9	1998	26	345.7636	2E+09	363758.2	4890896	DC	Discarded
9	1999	55	334.4463	2E+09	363861.7	4890939	DC	Discarded
9	2000	56	333.7401	2E+09	363821.7	4890919	DC	Discarded
10	1996	40	339.9788	2E+09	363758.2	4890896	DC	Discarded
10	1997	36	341.1575	2E+09	363881.7	4890919	DC	Discarded
10	1998	30	343.6339	2E+09	363767.3	4890900	DC	Discarded
10	1999	59	332.9611	2E+09	363767.3	4890900	DC	Discarded
10	2000	57	333.3359	2E+09	363861.7	4890939	DC	Discarded
11	1996	41	339.6165	2E+09	363875.8	4890950	DC	Discarded
11	1997	42	339.6163	2E+09	363861.7	4890939	DC	Discarded
11	1998	35	342.0043	2E+09	363839.6	4890933	DC	Discarded
11	1999	62	332.4462	2E+09	363749.2	4890892	DC	Discarded
11	2000	66	330.1408	2E+09	363821.5	4890925	DC	Discarded
12	1996	45	337.9252	2E+09	363821.7	4890919	DC	Discarded
12	1997	58	332.9937	2E+09	363785.4	4890909	DC	Discarded
12	1998	37	341.1321	2E+09	363812.5	4890921	DC	Highest
12	1999	68	329.5345	2E+09	363803.4	4890917	DC	Discarded
12	2000	69	329.4909	2E+09	363821.5	4890925	DC	Discarded
13	1996	48	336.8557	2E+09	363830.6	4890929	DC	Discarded
13	1997	61	332.4679	2E+09	363830.6	4890929	DC	Discarded
13	1998	39	340.0889	2E+09	363861.7	4890939	DC	Discarded
13	1999	70	329.4784	2E+09	363812.5	4890921	DC	Discarded
13	2000	74	327.123	2E+09	363893.9	4890958	DC	Discarded
14	1996	63	332.0299	2E+09	363881.7	4890939	DC	Discarded
14	1997	65	330.4901	2E+09	363875.8	4890950	DC	Discarded
14	1998	54	335.1519	2E+09	363767.3	4890900	DC	Discarded
14	1999	77	326.8559	2E+09	363812.5	4890921	DC	Discarded
14	2000	78	326.5923	2E+09	363821.7	4890919	DC	Discarded
15	1996	64	331.5045	2E+09	363821.5	4890925	DC	Discarded
15	1997	71	329.0149	2E+09	363839.6	4890933	DC	Discarded
15	1998	60	332.8482	2E+09	363866.8	4890946	DC	Discarded
15	1999	86	325.1426	2E+09	363848.7	4890937	DC	Discarded
15	2000	85	325.3984	2E+09	363785.4	4890909	DC	Discarded
16	1996	80	326.2132	2E+09	363794.4	4890913	DC	Discarded

*** THE MAXIMUM 200 24-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***

NOx

RANK BY YI	YEAR	RANK	CONC	YYYYMMD	XR	YR	TYPE	MOE Reg. 419/05
1	1996	31	45.28414	2E+09	363794.4	4890913	DC	Discarded
1	1997	1	68.55686	2E+09	363776.3	4890905	DC	Discarded
1	1998	3	64.59471	2E+09	363713	4890876	DC	Discarded
1	1999	12	49.74013	2E+09	363731.1	4890884	DC	Discarded
1	2000	28	45.7529	2E+09	363794.4	4890913	DC	Discarded
2	1996	42	42.78304	2E+09	363794.4	4890913	DC	
2	1997	2	67.08264	2E+09	363785.4	4890909	DC	Discarded
2	1998	5	60.59884	2E+09	363703.9	4890872	DC	Discarded
2	1999	16	48.73289	2E+09	363722	4890880	DC	Discarded
2	2000	36	44.15506	2E+09	363785.4	4890909	DC	Discarded
3	1996	53	41.6442	2E+09	363803.4	4890917	DC	
3	1997	4	62.76035	2E+09	363767.3	4890900	DC	Discarded
3	1998	6	58.6514	2E+09	363722	4890880	DC	Discarded
3	1999	17	48.51923	2E+09	363758.2	4890896	DC	
3	2000	39	43.45578	2E+09	363964.9	4891305	DC	
4	1996	54	41.6372	2E+09	363785.4	4890909	DC	
4	1997	7	57.48922	2E+09	363758.2	4890896	DC	Discarded
4	1998	11	50.10331	2E+09	363694.9	4890868	DC	Discarded
4	1999	18	47.88627	2E+09	363803.4	4890917	DC	
4	2000	43	42.56207	2E+09	363970.3	4891297	DC	
5	1996	74	39.43663	2E+09	363703.9	4890872	DC	
5	1997	8	56.65393	2E+09	363794.4	4890913	DC	Discarded
5	1998	14	49.13549	2E+09	363691.7	4890819	DC	Discarded
5	1999	21	46.39296	2E+09	363812.5	4890921	DC	
5	2000	45	42.32121	2E+09	363803.4	4890917	DC	
6	1996	76	39.37637	2E+09	363694.9	4890868	DC	
6	1997	9	55.10875	2E+09	363791.7	4890869	DC	Discarded
6	1998	22	46.3472	2E+09	363691.7	4890769	DC	Discarded
6	1999	23	46.17259	2E+09	363776.3	4890905	DC	
6	2000	46	42.26479	2E+09	363731.1	4890884	DC	
7	1996	78	38.98401	2E+09	363803.4	4890917	DC	
7	1997	10	54.22354	2E+09	363749.2	4890892	DC	Discarded
7	1998	33	44.82842	2E+09	363731.1	4890884	DC	Discarded
7	1999	24	46.11476	2E+09	363794.4	4890913	DC	
7	2000	47	42.16552	2E+09	363959.6	4891313	DC	
8	1996	89	38.41612	2E+09	363785.4	4890909	DC	
8	1997	13	49.40463	2E+09	363866.8	4890946	DC	Highest
8	1998	61	40.77643	2E+09	363713	4890876	DC	
8	1999	29	45.63053	2E+09	363749.2	4890892	DC	
8	2000	58	40.97947	2E+09	363975.6	4891288	DC	
9	1996	92	38.16456	2E+09	363703.9	4890872	DC	
9	1997	15	48.92143	2E+09	363740.1	4890888	DC	
9	1998	62	40.65943	2E+09	363667.8	4890855	DC	
9	1999	32	44.93319	2E+09	363740.1	4890888	DC	
9	2000	66	40.31596	2E+09	363875.8	4890950	DC	
10	1996	103	37.28099	2E+09	363866.8	4890946	DC	
10	1997	19	47.6292	2E+09	363713	4890876	DC	
10	1998	69	40.10213	2E+09	363691.7	4890719	DC	
10	1999	34	44.42635	2E+09	363785.4	4890909	DC	

Appendix G

Checklist

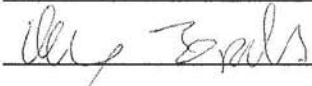
EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST


Company Name: Windlectric Inc.

Company Address: 354 Davis Road
Oakville, Ontario, L6J 2X1

Location of Facility: PTLOT 35 - 37 Concession 1 and PTLOT 34 Concession
Amherst Island, Ontario

The attached Emission Summary and Dispersion Modeling Report was prepared in accordance with s.26 of O. Reg. 419/05 and the guidance in the MOE 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:	<u>Alex Tsopelas</u>
Title:	<u>Project Manager, Renewables, Algonquin Power Co.</u>
Phone Number:	<u>905-829-6388</u>
Signature:	<u></u>
Date:	<u>Feb 25, 2015</u>

Technical Contact:	_____
Name:	<u>Neil Chan, P.Eng.</u>
Representing:	<u>BCX Environmental Consulting</u>
Phone Number:	<u>905-235-4218 ext. 114</u>
Signature:	<u></u>
Date:	<u>February 25, 2015</u>

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Required Information		Submitted	Explanation/Reference
Executive Summary and Emission Summary Table			
1.1	Overview of ESDM Report	<input checked="" type="checkbox"/> Yes	Executive Summary
1.2	Emission Summary Table	<input checked="" type="checkbox"/> Yes	Table ES-1
1.0 Introduction and Facility Description			
1.1	Purpose and Scope of ESDM Report (when report only represents a portion of facility)	<input checked="" type="checkbox"/> Yes	Section 1.0
1.2	Description of Processes and NAICS code(s)	<input checked="" type="checkbox"/> Yes	Section 1.0
1.3	Description of Products and Raw Materials	<input checked="" type="checkbox"/> Yes	Section 1.2
1.4	Process Flow Diagram	<input checked="" type="checkbox"/> Yes	Figure 1 (App. A)
1.5	Operating Schedule	<input checked="" type="checkbox"/> Yes	Section 1.1
2.0 Initial Identification of Sources and Contaminants			
2.1	Sources and Contaminants Identification Table	<input checked="" type="checkbox"/> Yes	Section 2.0, Table 1
3.0 Assessment of the Significance of Contaminants and Sources			
3.1	Identification of Negligible Contaminants and Sources	<input checked="" type="checkbox"/> Yes	Section 3.0, Table 1
3.2	Rationale for Assessment	<input checked="" type="checkbox"/> Yes	Section 3
4.0 Operating Conditions, Emission Rate Estimating and Data Quality			
4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	<input checked="" type="checkbox"/> Yes	Section 4.0 (App. E)
4.2	Explanation of Method used to calculate the emission rate for each contaminant	<input checked="" type="checkbox"/> Yes	Appendix E
4.3	Sample calculation for each method	<input checked="" type="checkbox"/> Yes	Appendix E
4.4	Assessment of Data Quality for each emission rate	<input checked="" type="checkbox"/> Yes	Table 2 and App. E
5.0 Source Summary Table and Property Plan			
5.1	Source Summary Table	<input checked="" type="checkbox"/> Yes	Table 2
5.2	Site Plan (scalable)	<input checked="" type="checkbox"/> Yes	Figure 2 and 3 (App. A)
6.0 Dispersion Modelling			
6.1	Dispersion Modelling Input Summary Table	<input checked="" type="checkbox"/> Yes	Table 4
6.2	Land Use Zoning Designation Plan	<input checked="" type="checkbox"/> Yes	Appendix A
6.3	Dispersion Modelling Input and Output Files	<input checked="" type="checkbox"/> Yes	Provided to MOECC
7.0 Emission Summary Table and Conclusions			
7.1	Emission Summary Table	<input checked="" type="checkbox"/> Yes	Table 5
7.2	Assessment of Contaminants with no MOE POI Limits	<input type="checkbox"/> Yes	N/A
7.3	Conclusions	<input checked="" type="checkbox"/> Yes	Section 7
Appendices (Provide supporting information or details such as...)			
	Figures	<input checked="" type="checkbox"/> Yes	Appendix A
	MSDS	<input checked="" type="checkbox"/> Yes	Appendix B
	Admixtures	<input checked="" type="checkbox"/> Yes	Appendix C
	Emission Calculations	<input checked="" type="checkbox"/> Yes	Appendix E
	AERMOD Supporting Files	<input checked="" type="checkbox"/> Yes	App. F
		<input type="checkbox"/> Yes	

Print Form