Emission Summary and Dispersion Modelling Report For A Site Specific Standard

Owens Corning Composite Materials Canada LP Guelph Plant

Prepared for: Owens Corning Composite Materials Canada LP

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Project No. 144539
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Emission Summary and Dispersion Modelling Report Check-List

Company Name:	Owens Corning Composite Materials Canada LP
Company Address:	247 York Road
Location of Facility:	Guelph, ON

The attached Emission Summary and Dispersion Modelling Report was prepared in accordance with s.32 of O. Reg. 419/05 and the guidance in the MOE documents "*Procedure for Preparing an Emission Summary and Dispersion Modelling Report*" dated March, 2009 "*Air Dispersion Modelling Guideline for Ontario*" dated March 2009, "*Guide to Requesting an Alternative Air Standard*", dated December 2007 and the minimum required information identified in the checklist on the reverse of this sheet has been submitted.

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Emission Summary and Dispersion Modelling Checksheet

	Required Information	Submitted	Explanation / Reference
	Executive Summary		
	1.1 Overview of ESDM Report	☒ **Yes**	Executive Summary
	1.2 Emission Summary Table	☒ **Yes**	Executive Summary
1.0	**Introduction and Facility Description**		
	1.1 Purpose and Scope of the ESDM Report (when report only represents a portion of facility	☒ **Yes**	Section 1
	1.2 Description of Processes and NAICS code(s)	☒ **Yes**	Section 2
	1.3 Description of Products and Raw Materials	☒ **Yes**	Section 2
	1.4 Process Flow Diagram	☒ **Yes**	Appendix A
	1.5 Operating schedule	☒ **Yes**	Section 2
2.0	**Initial Identification of Sources and Contaminants**		
	2.1 Source and Contaminants Table	☒ **Yes**	Section 3
3.0	**Assessment of Significance of Contaminants and Sources**		
	3.1 Identification of Negligible sources and contaminants	☒ **Yes**	Section 4
	3.2 Rationale for assessment	☒ **Yes**	Section 4
4.0	**Operating Conditions, Emission Estimating and Data Quality**		
	4.1 Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒ **Yes**	Sections 6 - 13
	4.2 Explanation of Method used to calculate the emission rate for each contaminant	☒ **Yes**	Sections 6 - 13
	4.3 Sample calculation for each method	☒ **Yes**	Sections 6 – 14, Appendices F to G
	4.4 Assessment of data quality for each emission rate	☒ **Yes**	Sections 6 - 13
5.0	**Source Summary Table and Property Plan**		
	5.1 Source summary table	☒ **Yes**	Appendix C
	5.2 Site Plan (scalable)	☒ **Yes**	Appendix B
6.0	**Dispersion Modelling**		
	6.1 Dispersion Modelling Input Summary Table	☒ **Yes**	Section 15 & 16
	6.2 Land Use Zoning Designation Plan	☒ **Yes**	Appendix B
	6.1 Dispersion Modelling Input and Output Files	☒ **Yes**	Appendices J to N
7.0	**Emission Summary Table and Conclusions**		
	7.1 Emission Summary Table	☒ **Yes**	Section 17
	7.2 Assessment of Contaminants with no MOE POI Limits	☐ **Yes**	Not applicable
	7.3 Conclusions	☒ **Yes**	Section 18
	Appendices (Provide details such as)		
	- Supporting Assessment of Negligible Sources/Contaminants	☒ **Yes**	Appendix E
	- Source and Emissions Summary Tables	☒ **Yes**	Appendix C, Appendix D
	- Technical Benchmarking Modelling Files	☒ **Yes**	Appendices L, M, N

	Required Information	Submitted	Explanation / Reference
	- CAMM Documentation	☒ **Yes**	Appendix P
	- Source Testing Reports	☒ **Yes**	Appendix O
	- URT Comparison Documentation	☒ **Yes**	Section 15, Appendix J

Executive Summary

The Owens Corning Guelph Glass facility is requesting a site specific annual standard for hexavalent chromium under Section 32 of Ontario Regulation 419/05: Air Pollution – Local Air Quality (O. Reg. 419/05). The facility is located at 247 York Road, Guelph, Ontario in the Township of Guelph/Eramosa and Wellington County. This Emission Summary and Dispersion Modeling Report (EDSMR) is a required element of Owens Corning's request.

The facility produces textile glass yarn and fiberglass for reinforcements for commercial and industrial markets worldwide. This facility is the sole producer of fiberglass for reinforcements in Ontario and Canada and has been operating in Guelph since 1951. Due to the nature of the process, the facility operates continuously 24 hours per day, 365 days per year. The facility currently processes approximately 22,000 tonnes of molten glass per year.

Glass fibers are produced by melting raw materials in gas fired furnaces and transporting the molten glass through forehearth channels to "bushings" where it is mechanically pulled to form the fibers. Subsequently, the fibers are used to make glass yarns, mat and reinforcements. The raw materials used to manufacture these high-tech glass fibers consist of dry solids, in powder and granular form, including clay, sand, limestone, dolomite and nepheline syenite (a naturally occurring igneous rock). The glass melting and molten glass transport structures utilize chromic oxide refractory of which an extremely small fraction is transformed into hexavalent chromium and emitted to atmosphere.

Ontario provincial air standards (established by O.Reg. 419/05) are based on scientific data and risk assessments. On July 1, 2016, a new hexavalent chromium air standard will come into effect. The future standard has been set at 0.00014 micrograms per cubic meter (µg/m^3) on an annual average basis. The standard is protective of human health. This new air standard represents a 99% reduction from the current standard for hexavalent chromium.

The MOECC recognizes that some facilities will not meet the standards on the July 1, 2016 effective date because of unique technical challenges and related economic limitations. To address this problem, the regulation allows facilities to establish an interim site specific standard. The MOECC approves the site specific standard and closely oversees the facility's progress using a risk management framework. The Guideline for the Implementation of Air Standards in Ontario (GIASO) and the Guide to Requesting an Alternative Air Standard are the primary Ministry documents that describe the risk-based process for setting a site specific air standard.

An interim site-specific standard is a modelled air concentration at a selected “Point of Impingement” (POI) developed and approved using site-specific emissions, meteorological data, and an approved air dispersion model, combined with a site-specific Action Plan. This compliance approach focuses on actions the facility can take to reduce hexavalent chromium concentrations to the extent possible, taking into consideration available technology, best practices and economic feasibility. A site specific standard is an interim standard established for a specific period of time to ensure continued review of available and feasible technologies.

Several documents are provided as part of the request for a site specific standard. These documents include the:

- Emission Summary and Dispersion Modeling Report (ESDMR)
- Technical Benchmarking Report,
- Economic Feasibility Study, and
- Action Plan for achieving the lowest air concentrations possible considering both technical and economic feasibility.

For the Owens Corning Guelph facility, emission estimates for hexavalent chromium are based on validated source testing conducted in 2014 on all sources of hexavalent chromium including the glass melting furnace, forehearths and furnace hall general ventilation. These emission estimates were then modelled using the AERMOD air dispersion model version 14134 and a 5 year site specific meteorological data set processed by the MOECC in accordance with Section 7 and Section 13 approvals. The results of this modelling indicated that the facility would not meet the future hexavalent chromium standard.

For the purpose of requesting a site specific standard for hexavalent chromium, Section 20 and schedule 3 of Regulation 419/05 are considered to apply for this contaminant.

The Action Plan for the Owens Corning Guelph Glass Plant incorporates a significant re-configuration of the glass melting process in 2016 to address global marketplace requirements. This re-configuration opens a window of opportunity for the expansion of recently prototyped technologies for the forehearths that will result in a reduction of the generation of hexavalent chromium in the process. Additionally, as part of the facility reconfiguration process, several process exhausts will undergo re-engineering in order to optimize dispersion. These improvements will be implemented prior to July 1, 2016.

The following table summarizes the current facility emissions and POI concentrations as well as the post-Action Plan concentrations.

Emission Summary Table Hexavalent Chromium

Contaminant	Location of Point of Impingement (POI) [1]	Avg. Time	Air Dispersion Model	Emission Rate	Max. Modelled Conc.	MOE POI Criteria	Limiting Effect	Regulation Schedule No.	% of Criteria
				(g/s)	**(ug/m^3)**	**(ug/m^3)**			
Hexavalent Chromium (Current)	Off property [2]	24-hr	AERMOD	0.00024	0.0815	0.07	Health	Schedule 6	> URT [3]
	Sensitive receptor	24-hr	AERMOD	0.00024	0.0133	0.07	Health	Schedule 6	< URT
	Off property	Annual	AERMOD	0.00024	0.0208	--	--	--	--
	Sensitive receptor	Annual	AERMOD	0.00024	0.0016	--	--	--	--
Hexavalent Chromium [4] (After Action Plan)	Off property	Annual	AERMOD	0.00017	0.0024	--	--	--	--
	Sensitive receptor	Annual	AERMOD	0.00017	0.0006	--	--	--	--

[1] The maximum concentration for all off property locations occurs on the facility property line.

[2] The maximum POI location is on the property line. Only 2 receptors (on the property line) are above the 24 hr criteria.

[3] URT refers to the upper risk threshold which is not a standard

[4] Owens Corning is applying for a site specific standard for hexavalent chromium

Current Emission Summary Table – All Other Compounds

Contaminant	Avg. Time	Air Dispersion Model	Emission Rate	Max. Modelled Conc.	MOE POI Criteria	Limiting Effect	Regulation Schedule No.	% of Criteria
			(g/s)	(ug/m^3)	(ug/m^3)			
PM - PARTICULATE MATTER	1/2 hr	Reg 346	0.7475	82	100	visibility	Schedule 2	82%
NITROGEN OXIDES	1/2 hr	Reg 346	3.4516	332	500	health	Schedule 2	66%
SULPHUR DIOXIDE	1/2 hr	Reg 346	1.6800	158	830	health	Schedule 2	19%
ZINC OXIDE	1/2 hr	Reg 346	0.1002	9	100	particulate	Schedule 2	9%
HYDROGEN FLUORIDE [1]	1/2 hr	Reg 346	0.0173	2	4.3	vegetation	Schedule 2	38%
HYDROGEN CHLORIDE	1/2 hr	Reg 346	0.0104	1	60	health	Schedule 2	2%
METHANOL (METHYL ALCOHOL)	1/2 hr	Reg 346	0.5396	51	12000	health	Schedule 2	0.4%
ACETIC ACID	1/2 hr	Reg 346	0.5339	50	2500	Odour	Schedule 2	2%
SILICA-RESPIRABLE (<10um)	1/2 hr	Reg 346	0.0302	12	15	health	1/2-hr Guideline	79%
Chromium (Di-,Tri-,metallic)	1/2 hr	Reg 346	0.0007	0	1.5	health	Schedule 2 [2]	4%

[1] Assessed against the most stringent criteria for Gaseous Growing Season

[2] Future (July 1, 2016) standard (more stringent than the current standard)

The emissions from emergency equipment at this facility were modelled using the Reg. 346 model and compared to the MOE NOx screening level concentration. Dispersion modelling has predicted that the emergency equipment will be in compliance with the MOE POI screening level concentration as detailed in Appendix E.

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1. Introduction

The purpose of this Emission Summary and Dispersion Modelling Report is to provide an accurate and representative estimate of emissions from the Owens Corning facility located in Guelph, Ontario. This document was developed in accordance with s.32 of O. Reg. 419/05 and the guidance in the MOE documents "*Procedure for Preparing an Emission Summary and Dispersion Modelling Report*" dated March, 2009 "*Air Dispersion Modelling Guideline for Ontario*" dated March 2009, and "*Guide to Requesting an Alternative Air Standard*", dated December 2007.

The objectives of this ESDMR are to:

- Assess compliance with Section 19 of O.Reg. 419 – General Air Pollution by modelling using the Reg. 346 model
- Support an application for a site specific standard for hexavalent chromium under Section 32 of O.Reg. 419 – General Air Pollution using the AERMOD model

1.1 Site Specific Standard

In 2011, O.Reg. 419/05 was amended to introduce future (Schedule 3) air standards for a number of compounds, including hexavalent chromium. This regulation contains provisions to request a site specific standard for a contaminant listed in Schedule 3 if a facility cannot demonstrate compliance with the air standard. The Owens Corning Guelph facility is requesting a site specific standard for hexavalent chromium emissions. The intention of this report is to communicate current and future emission rate estimates from the sources of hexavalent chromium for the purpose of a Site Specific Standard Application and comparison to the future annual standard.

Owens Corning has conducted an assessment of all available pollution control options and established a control strategy for hexavalent chromium to achieve the best technically and economically feasible reductions at this time. This assessment was based upon a jurisdictional review of air pollution requirements, available pollution control methods, potential process changes and the results outlined in this report.

1.2 Scope of ESDMR

This report covers all current activities at this site including:

- All raw and intermediate material handling and transfer sources

- All process-related sources, including:
  - Furnaces
  - Forehearths
  - Binder preparation and application
  - Curing ovens
  - Cooling processes
  - CFM Process
  - CSM Process

- All Pollution Control equipment, including:
  - Owens Corning RTO (1)
  - NGF RTO (1)
  - Cyclones (2)
  - Filter Box
  - PRD on CSM line

- All non-process related sources, including:
  - Cooling towers
  - Boilers
  - Comfort heating and cooling

Additionally, this report includes assessment of the proposed future activities and configuration related to hexavalent chromium to support the application for the site specific standard. All other contaminants are assessed in this report as the current (maximum) operating scenario.

1.3 Revision History

This is the original version of the ESDMR prepared to support the application for a site specific standard.

2. Facility Description

2.1 General Description

The Owens Corning Composite Materials Canada LP - Guelph Glass Plant (Owens Corning) is located at 247 York Road in Guelph, Ontario. The facility produces textile glass yarn and fiberglass for reinforcements for commercial and industrial markets worldwide. This facility is the sole producer of Continuous Filament Mat in Canada. Owens Corning in Guelph has been in operation since 1951 and is recognized as the world's leading producer of high quality Continuous Filament Mat (CFM) and Chopped Strand Mat (CSM).

The NAICS code for the Owens Corning Guelph facility is 327214, Glass Manufacturing, which does not fall under schedule 4 or 5 of O.Reg 419. All sources at this location are stationary. The adjacent lands have mixed zoning, including industrial, commercial, residential and parkland. This facility operates 24 hours a day, 7 days a week, 52 weeks a year. The facility currently processes approximately 22,000 tonnes of molten glass per year.

Glass fibers are produced by melting raw materials in gas fired furnaces and transporting the molten glass through forehearth channels to "bushings" where it is mechanically pulled to form the fibers. Subsequently, the fibers are used to make glass yarns, mat and reinforcements. The raw materials used to manufacture these high-tech glass fibers consist of dry solids, in powder and granular form, including clay, sand, limestone, dolomite and nepheline syenite (a naturally occurring igneous rock). The glass melting and molten glass transport structures utilize chromic oxide refractory of which an extremely small fraction is transformed into hexavalent chromium and emitted to atmosphere.

The main manufacturing operations currently include:

- Raw materials handling and storage
- Glass melting operations
- Production of textile glass
- Production of textile glass products
- Packaging of products
- Production of oxygen for glass melting

A process flow diagram is provided in Appendix A. The individual process operations are briefly described in the following sections.

Scaled drawings showing air emission sources and the extent of the property line is included in Appendix B.

2.2 Production Rate

This facility has slightly variable operations due to customer demand, however, glass melting and fiber forming activities must operate continuously. The maximum approved molten glass pull rate is 7038 kg/hr, in accordance with CofA No. 8-2181-91-999. The current molten glass pull rate is approximately 4000 kg/hr. The future molten glass pull rate after the facility reconfiguration in the first half of 2016 will be 1815 kg/hr.

2.3 Current Operations

2.3.1 Raw Materials Storage and Handling

Raw materials, including clay, silica sand and limestone, are received in bulk and stored in silos. These materials are automatically weighed and mixed to form a mixed batch. The mixed batch is then pneumatically conveyed to storage hoppers located above the melting units (furnaces). The transfer of raw materials and mixed batch generates particulate, which is controlled through the use of dust collectors.

2.3.2 Glass Melting & Transfer

The glass melting itself takes place in natural gas-fired furnaces. These furnaces are operated using oxygen/natural gas-fired systems. The facility CofA (No. 8-2181-91-999) includes the operation of four (4) furnaces. Currently only one, the T107 furnace, is operational.

The batch of mixed raw material is fed into the rear of the furnace and it melts to form a molten homogenous glass. Chemical components in the batch cause gas bubbling in the mixture, and result in particulate and gaseous emissions.

The molten glass flows from the melters via channels into the forehearth leading to the fiber forming area. The forehearth areas are also heated with oxygen/ natural gas to maintain the molten state of the glass.

2.3.3 VSA Plant for Oxygen Production

Currently oxygen is generated on-site via a Vacuum Swing Adsorption (VSA) plant. This facility generates a continuous supply of oxygen at approximately 90-94% purity, which replaces air in the combustion systems for the furnaces, channels and forehearths.

2.3.4 Production of Glass Fibers and Yarns

The molten glass flows to electrically heated bushings, which contain a large number of small holes through which the glass is drawn.

After the continuous glass fibers are drawn through the bushings they are cooled, and drawn over a roller applicator, which applies a coating of a water-soluble sizing and/or coupling agent. The coated fibers are gathered and wound onto a cardboard spindle.

The spindles of glass fiber are conveyed to drying ovens, where moisture is removed from the sizing and coupling agents and the coatings cured. The fibers are further mechanically processed (winding and/or chopping) to produce yarns, mats (CFM and CSM) and loose product.

2.3.5 Production of Continuous Filament Mats (CFM Line)

A continuous filament mat product is manufactured on the CFM Line. For the CFM line, glass strands are drawn right from the bushing and laid down continuously as a mat. The mat is coated with a powdered polyester resin dispersed in water and conveyed through a gas-fired oven, where the resin is cured to bind the fibers into a mat. The mat is then cut to length, rolled up and packaged for transport to a customer.

2.3.6 Production of Chopped Strand Mats (CSM Line)

A chopped strand mat product is manufactured on the CSM Line. After the drying ovens, glass strands are unwound from the spindles, chopped and coated with a powdered polyester resin and conveyed through a gas-fired oven, where the resin cures to bind the fibers into a mat. The mat is cut to length, rolled up and packaged for transport to a customer.

2.4 Proposed Future Operations

Several changes are anticipated for the facility as a result of both production streamlining as well as the Technical Benchmarking and Action Plan development for hexavalent chromium. The facility will undergo a reconfiguration in part due to the T107 furnace approaching the end of its life. The T107 furnace will be removed from service and replaced with a rebuild of the smaller T105 furnace. Additionally, a section of the conventional forehearth (7B) will be taken out of service. The CSM (chopped strand mat) production line and associated processes will be removed from service at the facility with the current CFM line remaining.

This reconfiguration is planned for the spring of 2016 with the entire facility production shutting down in order to take the T107 furnace out of service, as well as to rebuild and start up the T105 furnace. Due to the nature of the continuous glass melting operation, these shutdowns occur once every 10 years, which is the expected life span for an oxygen/natural gas-fired glass melting furnace.Opportunities for significant changes to the process after the T105 furnace begins operation are very limited.

Additional proposed changes to the facility will be completed to achieve reductions in Point of Impingement (POI) concentrations of hexavalent chromium as detailed in the Action Plan Report.

Proposed future changes related to the reconfiguration and hexavalent chromium action plan will affect other contaminants emissions at the facility. Changes to the emissions of other contaminants will be addressed as part of an ECA amendment application at a later date.

2.5 Site Plans and Area Maps

The mandated plans and map are located in Appendix B. These plans and maps satisfy the requirement in sub-paragraph 9 of Section 26 of O. Reg. 419/05 (as per subparagraph 1 of Section 33). These include:

- Site plan including co-ordinate system for dispersion modelling

- Site plan drawn to scale showing the locations of all emission sources, buildings (including elevations above grade) and property lines. Note that all penetrations of the building shell have been included on the source drawing because of the large number on this site. This reduces the effort in future of any person wishing to audit or verify the completeness of the source inventory. All sources at this location are stationary.

- Area map to a distance of 1000 meters.

- Land use zoning maps. The adjacent lands are zoned industrial, commercial, residential, and parkland.

3. Initial Identification of Sources and Contaminants

A review of all processes and operations at the site was conducted to identify all emission points to the atmosphere as required by subparagraphs 2 to 4 of Section 26 of O. Reg. 419/05 (as per subparagraph 1 of Section 33). The table below details all sources at the facility with the contaminants expected to be emitted from each.

Table 1 Sources and Contaminants Identification

Source Information		**Expected Contaminants**	**Include in Model?**	**Rationale**
Description	**General Location**	**Contaminants**	**(Y/N)**	
Batch House Dust Collectors	Batch House Area	PM, silica	Y	
T107 Furnace Stack (Source ID B01)	South West Quadrant	PM, NOx, SO_2, CO, acid Gases, zinc, di-trivalent chromium hexavalent chromium	Y	
Final Transfer Dust Collectors (Source ID B05, B06)	South West Quadrant	PM, silica	Y	
T107 Forehearth Stack (Source ID B11)	South West Quadrant	NOx, di-trivalent chromium, hexavalent chromium	Y	
		PM	N	7.1.1
T107 Forming Scrap Tunnel Exhausts (Source ID B15, B16)	South West Quadrant	VOC	Y	
FUTURE T105 Furnace Stacks (Source ID B24, B25)	South West Quadrant	PM, NOx, SO_2, CO, acid Gases, zinc, di-trivalent chromium hexavalent chromium	Y	
T105 Forehearths (Source ID B38)	South West Quadrant	NOx, di-trivalent chromium, hexavalent chromium	Y	
		PM	N	7.1.1
T105 Forming Scrap Tunnel (Source ID B40)	South West Quadrant	VOC	Y	
Premix Level Exhaust (Source ID A12 and A13)	Binder Room Lower Level	VOC	Y	

Source Information		**Expected Contaminants**	**Include in Model?**	**Rationale**
Description	**General Location**	**Contaminants**	**(Y/N)**	
Binder Circ. Tank Exhaust (Source ID C60)	South Central Area	VOC	Y	
CFM Forming Tunnels (Source ID C100, C101, C72, C99)	South West Quadrant	NOx, VOC	Y	
CFM Binder Cyclone (Source ID C73)	North West Quadrant	PM, VOC	Y	
CFM RTO Oven (Source ID C75)	North West Quadrant	NOx, VOC	Y	
No. 11 – No. 17 Ovens (Source ID C65-C70)	West Central Area	NOx, VOC	Y	
CSM Mat Line Ovens (Source ID C48, C49, C50)	North West Quadrant	NOx, PM	Y	
CSM Mat Line PRD Stack (Source ID C51)	North West Quadrant	PM	Y	
Filter Box Louvre Exhausts (Source ID D63, D64)	North East Quadrant	PM	Y	
NGF Tire Cord Line #1 RTO (Source ID G13)	NGF Bldg (near center)	NOx	Y	
Q/C Checker Hood Exhaust (Source ID C47)	Central Area	VOC, PM	N	7.2.1
CSM Heat Sealer Ventilation Exhaust (Source ID C71)	North West Quadrant	VOC	N	7.2.2
CFM End-of-Line Checker Oven Exhaust (Source ID C77)	North West Quadrant	NOx, PM	N	7.2.1
QA Muffle Oven Exhaust (Source ID F14)	South West Quadrant	PM	N	7.2.1
Cooling Towers (Source ID A06 – A08, A58)	South Central Area	PM	Y	
Natural Gas Space Heaters	Various	NOx	Y	
Parts Washer (A59)	South East Quadrant	VOC	N	7.2.1
3 Emergency Generators (Source ID B51)	South West Quadrant	NOx	N	App E

The rationale reference numbers refer to sections of the *“Procedure for Preparing an ESDM Report, Version 3.0, March 2009”*.

For a complete listing of sources with Source ID numbers, please refer to the Source Inventory Table in Appendix C. The location of the sources is presented on the site plan in Appendix B.

3.1 Source Inventory

The Source Inventory Tables are provided in Appendix C. These include:

- source ID number
- description
- site coordinates
- exhaust stack diameter, flow rate, temperature, HAR, HAG
- type of source

Sources of "uncontaminated" air exhausting into the atmosphere, for example roof exhausters, room vents, cooling water towers, and air intakes, are included in the summary table; however, no emission data is provided.

Separate summary tables have been provided in Appendix C for the Section 32 contaminant (current and future) to highlight sources that are significant to the site specific standard request.

In combination with the Emission Inventory in Appendix D, the Source Inventory satisfies sub-paragraph 8 of Section 26 of O. Reg. 419/05 (as per sub-paragraph 1 of Section 33).

3.2 Emission Inventory

The Emission Inventory is provided in Appendix D. For all significant sources and contaminants, it presents:

- contaminant name and CAS#
- source ID number and description
- maximum contaminant emission rate
- estimation method
- data quality classification
- percentage of overall facility emissions
- averaging period

In combination with the Source Inventory in Appendix C, the Emission Inventory satisfies sub-paragraph 8 of Section 26 of O. Reg. 419/05 (as per sub-paragraph 1 of Section 33).

4. Assessment of the Significance of Contaminants and Sources

There are a number of sources and contaminants that are considered to be “emitted in negligible amounts” or “insignificant relative to total emissions”. They are described in more detail in the following sections as required by sub-paragraph 5 of Section 26 of O. Reg. 419/05.

The calculations can be found in Appendix E.

4.1 Natural Gas Combustion

Section 7.1.1 of the Guidance document specifies that NOx is the only significant contaminant from natural gas-fired combustion equipment. Therefore, all other products of combustion are negligible.

4.2 Sources that Emit Contaminants in Negligible Amounts

4.2.1 Insignificant Sources Based on Table B-3

Table B-3 of MOE *“Procedure for Preparing an ESDM Report, Version 3.0, March 2009*”, lists sources that can be considered to be insignificant because they “emit contaminants in negligible amounts”. The following sources at the facility are listed on Table B-3.

- Fumehoods that are used for quality control and quality assurance purposes:
    - Q/A Muffle Oven Fumehood (Source ID F14)
    - Q/C Checker Hood Exhaust (Source ID C47)
    - CFM End-of-Line Q/C Checker Oven Exhaust (Source ID C77)
- Standby power generators firing liquid or gaseous fuels that are used for standby power only with periodic testing:
    - Two (2) Diesel Emergency Generators (Source ID B51)

In accordance with Section 8 of O. Reg. 419/05, emission rate calculations and dispersion modelling does not have to be performed for emissions from negligible sources. These sources are listed, however, in the Source Inventory in Appendix C for completeness.

4.3 Sources that are Insignificant Relative to Total Emissions

4.3.1 Roof Exhausts

Roof exhausts remove air from a number of non-production areas including the warehouse. The likelihood of the concentration of particulate, combustion products and volatile organic contaminants being elevated above ambient levels is minimal. According to the rationale presented in Section 7.3 of the guidance document, contaminant emissions from these sources are considered negligible.

4.3.2 Room Vents

Room vents are non-powered louver vents found throughout the plant. Contaminant concentrations in these areas are low and as such would be insignificant with respect to the stack exhaust and natural gas fired equipment. According to the rationale presented in Section 7.3 of the guidance document, contaminant emissions from these sources are considered negligible.

In accordance with Section 8 of O. Reg. 419/05, dispersion modelling does not have to be performed for emissions of contaminants in negligible amounts. This source is listed in the Source Inventory in Appendix C for completeness.

4.4 Insignificant Contaminants Based Upon Emission Threshold Calculations

Section 7.1.2 of the Guidance Document describes the methodology for identifying negligible emissions using emission thresholds.

The first step is to convert the 1 hour rural dispersion factor from Table B-1, Appendix B for a length of approximately 20 m from a source to a receptor (property line) to the other applicable averaging times.

The conversion was performed using the following equation:

$$C_0 = C_1 \text{ x } F$$

Where,

C_0 = the concentration at the averaging period t_0
C_1 = the concentration at the averaging period t_1
F = factor to convert from averaging period t_1 to t_0 = $(t_1/t_0)^n$
n = 0.28

From Table B-1, the rural dispersion factor for a receptor that is 20 m from a source is 10000 µg/m^3 per g/s emission. The converted factors are shown in the table below.

Averaging Time	Dispersion Factor
30 minute	12 000
1 hour	10 000

The second step is to utilize the calculation provided in Section 7.1.2 of the Guidance to evaluate insignificance. The original formula is shown below.

Emission Threshold (g/s) =	0.5 x MOE POI Limit (µg/m^3)
	Dispersion Factor (µg/m^3 per g/s)

When the actual facility-wide emission rate is less than the calculated Emission Threshold, the contaminant emission is insignificant as shown below:

Actual Emission Rate (g/s) **must be less than**	0.5 x MOE POI Limit (µg/m^3)
	Dispersion Factor (µg/m^3 per g/s)

This formula can be manipulated to demonstrate insignificance as follows:

[Actual Emission Rate (g/s) * DF (µg/m^3 per g/s)] **must be less than** [MOE POI Limit (µg/m^3) * 0.5]	
or	
[Actual Emission Rate (g/s) * DF (µg/m^3 per g/s) * 2] **must be less than** MOE POI Limit (µg/m^3)	

The left side of this mathematical statement has been labelled “Screening Concentration” as follows:

Screening Concentration (ug/m^3) =	Actual Emission Rate (g/s) * DF (µg/m^3 per g/s) * 2

LEHDER has calculated **Screening Concentrations** for all contaminants and **compared directly to the MOE POI Limit** in order to assess significance. When the Screening Concentration (ug/m^3) is less than the POI limit, the contaminant is defined as insignificant in accordance with Section 7.1.2. The insignificant contaminants are listed in Appendix E.

4.5 Emergency Generators – Source B51

There are two (2) diesel powered emergency generators located at this facility. Both generators exhaust through a single stack (Source ID B51). Each generator is 1000 hp and all of the generators can be tested simultaneously for approximately 20 minutes. Emissions of nitrogen oxides (NO_x) were calculated for this equipment based on emission factors and the predicted NO_x POI concentration was determined using the dispersion factor obtained from modelling with the Reg. 346 model.

Since this equipment is for emergency use only, the MOE Emergency Generator Guidance indicates that emergency equipment should be compared to the screening level concentration. Dispersion modelling has predicted that this piece of emergency equipment will be in compliance with the MOE POI screening level concentration of 500 µg/m^3 at sensitive receptors. Therefore, the emissions generated by this equipment are insignificant and have not been included in the worst case scenario.

5. Operating Conditions and Data Quality

The operating conditions for each contaminant are outlined at the beginning of each section. The methodology used to develop the emission estimates is discussed in the following sections. The discussion includes a statement concerning data quality and estimation techniques for each process and associated source(s). This section satisfies subparagraphs 6 and 7 of Section 26 of O. Reg. 419/05 (as per subparagraph 1 of Section 33).

Several terms and acronyms are used repeatedly throughout this section. Definitions are provided below:

Term	Definition
Conversion Factor	In most cases, emission factors and process throughput are provided in units that require conversion to get to g/s. The conversion factor is used to convert the units to the desired output.
Flexibility Factor	A flexibility factor is occasionally applied to emission rates of emitted species that do not have a MOE defined point of impingement criteria.
Data Quality	Highest Above Average Average Marginal
Estimation Technique	EF = Emission Factor EC = Engineering Calculations VST = Validated Source Test MB = Mass Balance

As noted in Section 2 the NAICS code for the facility is 327214, Glass Manufacturing. This NAICS code is not listed in Schedule 4 or Schedule 5 of O. Reg. 419/05. Owens Corning Guelph is not a new facility; therefore, the Schedule 2 Standards currently apply. Schedule 3 criteria only apply for the comparison of hexavalent chromium for planning purposes.

Two operating conditions (current and future) for hexavalent chromium are presented in this ESDM Report. In the case of hexavalent chromium, the current operating condition is the same as the maximum operating condition and therefore only two scenarios have been provided.

The maximum operating condition has been presented for all other compounds emitted from the facility.

6. Hexavalent Chromium

6.1 Process Overview

The furnace and forehearth structures that contain and transport molten glass are lined with various types of refractory brick. Chromium-containing refractory is universally used by the fiberglass industry as the material to construct the channels that contain molten glass due to its superior corrosion resistance which significantly reduces waste and provides acceptable operational efficiency. This refractory is a source of di- and tri-valent chromium which is partially converted to the hexavalent form in the furnace and forehearths prior to emission.

6.2 Operating Condition - Maximum POI (Current Operating Scenario)

The maximum operating condition for hexavalent chromium is the current operating scenario. The processes creating the hexavalent chromium emissions are continuous and steady-state. Evaluation of several testing programs supports the conclusion that the production rate (molten glass throughput) is not a significant variable in the generation of hexavalent chromium emissions. The data was discussed with the MOECC, and they are in agreement with that conclusion. Therefore, the operating condition for the maximum POI concentration for hexavalent chromium is the current scenario where all sources are operating simultaneously. The current sources of hexavalent chromium at this facility include:

- Furnace Exhaust Stack (Source ID B01)
- Forehearth Stacks (Source IDs B11 and B38)
- Furnace Hall General Ventilation (Source IDs B08, B10, B32, B24, ,B35, C79 and C80)

A drawing showing the location of these current sources of hexavalent chromium emissions is located in Appendix B.

6.3 Emission Estimates – Current Operating Scenario

6.3.1 Combined Ambient Modelling/Monitoring (CAMM)

As outlined in the "*Guide to Requesting an Alternative Air Standard*" dated December 2007, a Plan for a Combined Modelling/Monitoring (CAMM) Results Assessment must be submitted prior to completing an ESDM Report as part of a Section 32 request.

It is understood that the purpose of a Combined Modelling/Monitoring Program is to obtain emission estimates with the highest data quality. These emission estimates are then incorporated into a refined ESDM Report. However, CAMM programs are intended for (and more ideally suited for) facilities with fugitive emissions that cannot accurately be measured for subsequent use in air dispersion models.

Pre-consultation was conducted with MOECC personnel from the Regional Technical Support Section and the Standards Development Branch throughout 2014. The pre-consultation began with a facility tour and develop a more thorough understanding of the processes and emission points in February, 2014.

Owens Corning submitted several documents to the MOECC to assist in the pre-consultation process for a Combined Modelling/Monitoring (CAMM) Assessment. Source testing programs were completed in May and June of 2014 to collect data in support of an Application for a Site Specific Standard.

Owens Corning received feedback from the MOECC on September 22, 2014 that a CAMM program was not required because they were of the opinion that an emission rate determined using validated source testing in accordance with sub-paragraph 1 of Section 11 of O.Reg. 419/05 will accurately determine concentrations of hexavalent chromium. This documentation can be found in Appendix P.

6.3.2 Emission Estimation Methodology – Current Operating Scenario

The facility has conducted several voluntary, validated emissions testing programs to establish refined hexavalent chromium emission estimates for sources emitting hexavalent chromium. The results of the programs have been used to support this Application for a Site Specific Standard for hexavalent chromium at the facility.

The sampling programs involved measuring hexavalent chromium emissions from three (3) sources servicing the T107 glass melting and transfer process and three (3) sources from Furnace Hall General Ventilation. Specifically, the following sources were sampled:

- T107 Furnace West Stack (Source ID B01)
- T107 West Forehearth Stack (Source ID B11)
- T107 East Forehearth Stack (Source ID B38)
- General Exhaust above the melter/ furnace (Source ID B08)
- General Exhaust above the T107B forehearth Source ID B10)
- General Exhaust above the T107 East (CFM) forehearth (Source ID C80)

All supporting sample calculations and data are located in Appendix F. Source Testing reports have been included in Appendix O.

6.4 Operating Conditions – Future Operating Scenario

The future operating condition was defined by the outcomes of the Technology Benchmarking assessment and Economic Feasibility assessment and is referred to in the application as the Preferred Option.

6.4.1 Technology Benchmarking

Technology benchmarking is a key component of the Site Specific Standard Application. The purpose of the Technology Benchmarking Report is to identify all possible pollution control options and determine a default or preferred pollution control strategy. The feasibility of all pollution control options must be assessed and all feasible options ranked to determine the most effective option for the facility. This document along with the Economic Feasibility Report will be used to determine the most appropriate options for the facility.

The objectives of the Technology Benchmarking Report are to:

- Identify and quantify all significant source of hexavalent chromium emissions
- Identify all pollution control options categorized as:
    - Material Substitution
    - Process Change
    - Add-on Controls
- Evaluate, rank and select the pollution control strategy most appropriate for this facility

Each option was reviewed for technical feasibility. For all technically feasible options, emission calculations were completed, and then each option scenario was ranked based on the reduction efficiency. Combinations of options were then determined starting with the default combination of the first ranked option from each of the three categories. All pollution control combinations were modelled to determine the resultant POI concentration. Calculations for all options are included in Appendix N. All combinations were then ranked according to point of impingement (POI) reduction to determine the overall default combination (lowest POI concentration). The Technology Benchmarking Report is a separate document, however, the modelling assessment can be found in Appendix L, M and N of this ESDMR. Further modelling details are also included in Section 15.12 of this ESDMR.

An economic feasibility assessment was also completed to determine the preferred option that will be implemented by the facility. Further details are contained in the Economic Feasibility Assessment Report which is a separate document. The preferred option is presented is this ESDMR as the future operating scenario of the facility.

6.5 Emission Estimates – Future Operating Scenario

The facility has a planned reconfiguration in the first half of 2016 where the operating 107 furnace will be decommissioned and replaced with the smaller 105 furnace.

However, since the 105 Furnace is not currently operational and source testing has shown that hexavalent chromium emissions are not related to glass pull rate, the emission rates from the 107 furnace testing will be used for the future 105 furnace for the purpose of applying for a Site Specific Standard. The emission estimates were derived from the baseline stack testing as described in Section 6.3.2, in conjunction with estimates of reductions that will be achieved with the implementation of the Action Plan. Calculations specific to the future operating scenario are included in Appendix M.

A drawing showing the location of the future (after implementation of the Action Plan) sources of hexavalent chromium emissions is located in Appendix B.

6.6 Assessment of Data Quality

The emissions from the hexavalent chromium sources are calculated using validated source testing. These emission rate estimates are considered to be of the highest data quality.

7. Particulate Matter

7.1 Operating Condition for Maximum POI

The maximum operating condition for particulate matter (PM) is the scenario where all significant sources of PM are operating simultaneously at their individual maximum rates of production/throughput. All calculations were based on a maximum half hour average operating condition.

The sources of PM at this facility include:

- Material Handling, Mixing and Transfer Dust collectors (Source IDs B05, B06, G39, G40, G45 - G48, G50, G52, G63, G68)
- Furnace Exhaust Stacks (Source IDs B01, B24 and B25)
- CFM Line (Source ID C73)
- CSM Line (Source ID C48 - C51) (to be removed from service)
- Cooling Towers (Source IDs A06 – A08 and A58)

7.2 Material Handling, Mixing and Transfer

Raw materials, mainly in powder or granular form, such as clay, silica sand and limestone are received in bulk and stored in silos. These materials are automatically weighed and discharged into a mixer. The mixed batch is then pneumatically conveyed to storage hoppers located above the melting furnaces.

The major emissions from raw materials handling are fugitive dust and particles generated at each of the material transfer points. At this facility, fabric filter dust collectors control emissions from these points with a removal efficiency of 99.9%.

Particulate emissions rates are calculated based on transfer rate, filter efficiency and emission factors from AP-42 Chapter 11.13, Table 11.13-1 for unloading and conveying.

$$ER,\frac{g}{s}=\left(Transfer\ \ Rate,\frac{kg}{\min}\right)\times\left(1-Efficiency\right)\times Conversion\ \ Factors\times Flexibility\ \ Factor$$

An example calculation is provided below for particulate emissions from the pneumatic offloading of a clay railcar, Source ID G50:

$$ER,\frac{g}{s}=\left(Transfer\ \ Rate,\frac{kg}{\min}\right)\times\left(1-Efficiency\right)\times\left(Emission\ \ Factor,\frac{g}{kg}\right)\times\left(\frac{1\min}{60\sec}\right)\times\left(\frac{1000\,g}{kg}\right)$$

$$ER,\frac{g}{s}=\left(167\frac{kg}{\min}\right)\times\left(1-0.999\right)\times\left(\frac{1.5\,g\ PM}{kg}\right)\times\left(\frac{1\min}{60\sec}\right)\times 1.25$$

$$ER, \frac{g}{s} = 0.0052$$

The emission rate estimates for the dust collectors are considered an engineering calculation because they are based on both efficiency and AP42 emission factors with a rating of B. These emission estimates were also multiplied by an uncertainty factor of 25% to ensure conservatism. The data quality is considered above average and conservative.

7.3 Glass Melting

The glass melting takes place in natural gas fired furnaces. The batch of mixed raw material is fed into the rear of the furnace and melts to form a molten homogeneous glass. The emissions from the glass melting process include PM entrained in the furnace flue gas.

The PM from glass melting discharges through the 107 furnace stack (Source ID B01).

The emission factor used for the 107 Furnace was developed from source testing. All supporting calculations and data are located in Appendix G. For additional information on the development of the emission factors, refer to Appendix O for source testing reports.

The general methodology for estimating PM from glass melting is shown in the equation below:

$$ER, \frac{g}{s} = \left(Max\,Glass\,Pull, \frac{kg}{hr} \right) \times \left(Emission\ Factor, \frac{g\,PM}{kg\ glass\ pull} \right) \times \left(Flexibility\ Factor \right) \times \left(Conversion\ Factors \right)$$

An example calculation is provided for the 107 Furnace, west stack (Source ID B01):

$$ER, \frac{g}{s} = \left(4991 \frac{kg}{hr} \right) \times \left(0.068\ \frac{g\,PM}{kg\ glass\ pull} \right) \times (1.25) \times \left(\frac{1\,hr}{3600\,s} \right)$$

$$ER, \frac{g}{s} = 0.1172$$

The particulate emissions from the furnaces are estimated using engineering calculations based upon source testing. These emission rate estimates are considered to be of marginal data quality, but conservative because an uncertainty factor was applied. Additional conservatism exists in this calculation due to the use of a glass pull rate larger than currently possible.

7.4 Scrap Processing (Baler)

The scrap rolls of mat and the edge trim are collected, shredded and sent to the baler. A pollution reduction device (PRD) and a filter box are used to reduce particulate emissions from this process (Source IDs D63 and D64).

The PM emissions rate calculation methodology is based on baler throughput and reduction efficiencies of the associated control devices. The PM emissions rate calculation methodology is:

$$ER, \frac{g}{s} = \left(Glass\ Loading\ to\ Baler, \frac{kg}{hr}\right) \times \left(1 - Eff.of\ \ Baler\right) \times \left(1 - Eff.PRD\right) \times \left(1 - Eff.Filter\ Box\right) \times \left(Conversion\ \ Factors\right)$$

An example calculation is provided for the combined D63 and D64 particulate emission rate:

$$ER, \frac{g}{s} = \left(132\ \frac{kg}{hr}\right) \times \left(1 - 0.93\right) \times \left(1 - 0.90\right) \times \left(1 - 0.60\right) \times \left(\frac{1hr}{3600\,s}\right) \times \left(\frac{1000\,g}{1kg}\right)$$

$$ER, \frac{g}{s} = 0.103$$

All supporting calculations and data are located in Appendix G.

The PM emissions from the filter box louvers are calculated using engineering calculations based upon mass loading rates and manufacturer specifications for removal efficiencies. The data quality is considered marginal, but conservative.

7.5 Cooling Towers

Cooling towers (Source IDs A06 – A08 and A58) remove excess heat from process water by trickling the heated water over “fins” in the towers. The emissions from this process are heat and water vapour (which are not considered contaminants), and particulate.

The PM emission rate is calculated based the “total liquid drift”, tower recirculation rate and the concentration of dissolved solids. The emissions are primarily PM_{10}, however for this application the PM_{10} is reported as total PM and is modelled as such. The AP42 emission factor from Chapter 13, Table 13.4-1 was used in the calculation.

$$ER, \frac{g}{s} = (\#of\ \ Cooling\ \ Towers) \times \left(\mathrm{Re}circulation\, Rate, \frac{gal}{\min} \right) \times \left(AP42\ \ Emission\, Factor, \frac{lb\, PM}{1000\ gal} \right)$$
$$\times (Conversion\ \ Factors) \times (Dissolved\ \ Solids\ \ Fraction)$$

The following assumptions are used to calculate emissions from all 4 cooling towers at this facility.

- Recirculation rate for each tower = 1440 US gal/min
- Dissolved solids concentration = 800 ppm

$$ER, \frac{g}{s} = (4) \times \left(1440\ \frac{gal}{\min} \right) \times \left(1.7 \frac{lb\, PM}{1000\ gal} \right) \times \left(\frac{454\, g}{lb} \right) \times \left(\frac{800}{10^6} \right) \times \left(\frac{1\min}{60\, s} \right)$$

$$ER, \frac{g}{s} = 0.059$$

All supporting calculations and data are located in Appendix G.

The emission estimates for particulate from the cooling towers is based upon AP42 emission factors with a rating of “C”. Therefore, these estimates are of average data quality and conservative.

7.6 CFM Binder Cyclone

During the CFM process, a dry binder is applied and then the mat and chain are flooded to impregnate the mat with the binder. Air is drawn through the mat to remove the excess binder. This air stream is passed through a cyclone that recovers the binder solids and liquids for reuse. The treated exhaust air is discharged to atmosphere through the CFM Binder Cyclone stack (Source ID C73).

For the purposes of estimating particulate emissions from the cyclone, engineering calculations are used. It is assumed that the particles and droplets will be relatively large with a diameter greater than 50 microns. At this size range the cyclone efficiency is approximately 97%. The particulate emission rate calculation is shown below:

$$ER,\frac{g}{s}=\left(Inlet\,Loading,\frac{grains}{ft^3}\right)\times(1-\mathrm{Re}moval\;\;Efficiency)\times\left(Exhaust\,Flow\,Rate,\frac{ft^3}{\min}\right)$$
$$\times(Conversion\,Factors)$$

The particulate emission rate calculation is shown below:

$$ER,\frac{g}{s}=\left(Inlet\,Loading,\frac{grains}{ft^3}\right)\times(1-\mathrm{Re}moval\;\;Efficiency)\times\left(Exhaust\,Flow\,Rate,\frac{ft^3}{\min}\right)$$
$$\times(Conversion\,Factors)$$

$$ER,\frac{g}{s}=\left(1\frac{grain}{ft^3}\right)\times(1-0.97)\times\left(2.1\,\frac{m^3}{s}\right)\times\left(\frac{0.0648\,grams}{grain}\right)\times\left(\frac{35.3\,ft^3}{m^3}\right)$$

$$ER,\frac{g}{s}=0.144$$

All supporting calculations and data are located in Appendix G.

Emissions of particulate from the CFM Binder Cyclone are estimated using an engineering calculation. The data quality is considered average and conservative.

7.7 CSM Line

A chopped strand mat product is manufactured on the CSM Line. After the drying ovens, glass strands are unwound from the spindles, chopped and coated with a powdered polyester resin and conveyed through a gas-fired oven, where the resin cures to bind the fibers into a mat. The mat is cut to length, rolled up and packaged for transport to a customer. After the 2016 reconfiguration, this process will be eliminated.

Emissions of particulate are exhausted through three (3) sources that are associated with the CSM Ovens (Source IDs C48, C49 and C50). Particulate emissions from these sources are estimated based on source testing. A flexibility factor of 1.25 was applied to emission rates to add conservatism.

The following equation was used to estimate the emission rate:

$$ER,\frac{g}{s}=\left(Source\;Testing\;Emission\;\;Factor,\frac{g}{s^3}\right)\times(Flexibility\;\;Factor)$$

An example calculation is provided below for the Mat Line Oven Charge Stack, Source ID C48:

$$ER, \frac{g}{s} = \left(0.01\frac{g}{s}\right) \times (1.25)$$

$$ER, \frac{g}{s} = 0.0125$$

The Mat Line PRD Stack (Source ID C51) discharges air from the CSM Cooling process. The particulate emissions are estimated based upon source testing data, the maximum exhaust flow rate and an estimated efficiency for the PRD. The following equation was used to estimate the emission rate:

$$ER, \frac{g}{s} = \left(Source\ Testing\ Emission\ Factor, \frac{grains}{ft^3}\right) \times \left(Flow\ Rate, \frac{m^3}{s}\right) \times (Conversion\ Factors) \times (1 - PRD\ Efficiency) \times (Flexibility\ Factor)$$

An example calculation is provided below:

$$ER, \frac{g}{s} = \left(0.00526\ \frac{grains}{ft^3}\right) \times \left(9.44\ \frac{m^3}{s}\right) \times \left(\frac{35.3\ ft^3}{m^3}\right) \times \left(\frac{0.064799\ g}{grain}\right) \times (1 - 0.5) \times (1.25)$$

$$ER, \frac{g}{s} = 0.0709$$

All supporting calculations and data are located in Appendix G.

Emissions of particulate from the CSM process are estimated using engineering calculations based on source testing. The data quality is considered average and conservative due to the application of a flexibility factor of 1.25.

8. Metals

The emissions from the glass melting process include particulate components from the raw materials entrained in the furnace flue gas. Based on the composition of the batch materials used, the metals anticipated to be present in significant quantities in the particulate emissions are zinc and di-trivalent chromium.

The maximum operating condition for metals is the scenario where all significant sources of metals are operating simultaneously at their individual maximum rates of production/throughput. All calculations were based on a maximum half hour average operating condition.

The sources of metal in particulate emissions at this facility include:

- Furnace Exhaust Stack (Source ID B01) – zinc and di-trivalent chromium
- Forehearth Exhaust Stacks (Source IDs B11, B38) – di-trivalent chromium

8.1 Zinc

The emission rate estimates are based upon source measurements from 1998 and adjusted for the maximum furnace throughput capacity. The general formula for the calculation is presented below:

$$ER_{ZnO} = \left(Furnace\ Pull\ Rate, \frac{kg}{hr} \right) \times \left(Emission\ Factor, \frac{g}{kg\ glass\ pull} \right) \times (Conversion\ Factors) \times (Flexibility\ Factor)$$

An example calculation for zinc oxide from the 107 Furnace is presented below:

$$ER_{ZnO} = \left(4991 \frac{kg}{hr} \right) \times \left(0.0578 \frac{g\ ZnO}{kg\ glass\ pull} \right) \times \left(\frac{1\,hr}{3600\,s} \right) \times (1.25)$$

$$ER_{ZnO} = 0.100 \frac{g}{s}$$

All supporting calculations and data are located in Appendix G.

The emission rates for zinc oxide from the furnaces were estimated using source testing and adjusted for the historical maximum glass pull rate. In addition, a flexibility factor of 25% was applied to account for fluctuations in the composition of the batch raw materials. Therefore, the emission estimates are of average data quality and conservative.

8.2 Chromium (di-trivalent)

The emission rate estimates are based on source measurements collected in 2011 and 2013. The emission rate data obtained from the source testing was used directly.

The calculation methodology is outlined in the formula presented below:

$$ER = \left(Average\, ER, \frac{g}{s} \right) \times \left(Uncert.\, factor \right)$$

All supporting calculations and data are located in Appendix G. For additional information on the source measurements, refer to Appendix O for source testing reports.

The emission rates for chromium were estimated based on source testing. Therefore, the data quality of the emission estimates is average.

9. Silica

9.1 Operating Condition for Maximum POI

The maximum operating condition for silica is the scenario where all significant sources of silica containing materials (flint and mixed batch) are operating simultaneously at their individual maximum rates of production/throughput. All calculations were based on a maximum half hour average operating condition.

The sources of silica (as part of particulate) at this facility include:

- Material Handling, Mixing and Transfer Dust collectors (Source IDs B05, B06, G40, G45, G46)

9.2 Material Handling, Mixing and Transfer

The raw material flint is also known as silica. Flint is received in bulk and stored in a silo. Flint along with other materials are automatically weighed and discharged into a mixer. The mixed batch is then pneumatically conveyed to storage hoppers located above the melting furnaces.

The major emissions from raw materials handling are fugitive dust and particles generated at each of the material transfer points. At this facility, fabric filter dust collectors control emissions from these points with a removal efficiency of 99.9%.

The emission rates for silica are calculated in a method identical to particulate emissions rates - based on transfer rate, filter efficiency and emission factors from AP-42 Chapter 11.13, Table 11.13-1 for unloading and conveying. In the case of the transfers for the mixed batch, the % flint in the mixed batch is considered in the calculation.

$$ER, \frac{g}{s} = \left(Transfer\ \ Rate, \frac{kg}{\min} \right) \times (1 - Efficiency) \times Conversion\ \ Factors \times Flexibility\ \ Factor \times \%Silica$$

The example calculation is provided in Appendix Q.

10. Nitrogen Oxides

The maximum operating condition for nitrogen oxides (NOx) is the scenario where all significant sources of NOx are operating simultaneously at their individual maximum rates of production/throughput. All calculations were based on a maximum half hour average operating condition.

The sources of NOx at this facility include:

- Furnace Exhaust Stacks (Source IDs B01, B24 and B25)
- Forehearth burners (Source IDs B11 and B38)
- CFM forming tunnels (Source IDs C72, C99 - C101)
- Curing Ovens (Source IDs C65 - C70) (to be removed from service)
- CSM Ovens (Source ID C48 - C50) (to be removed from service)
- Thermal Oxidizers (Source IDs G13, C75)
- Natural Gas Fired Heaters

10.1 Glass Melting Furnaces

The 105 and 107 Furnaces use oxygen instead of air for combustion to reduce NOx emissions. The oxygen is generated by an onsite Vacuum Swing Adsorption (VSA) unit. The oxygen from the VSA unit (90-94%) is less pure than trucked oxygen (99%+).

The emission estimates are based upon furnace 107 operating at 4,991 kg/hr. The following methodology has been used to calculate the NOx emission estimates:

$$ER,\frac{g}{s}=(Base\,Emission\,Rate)\times\frac{[(Gas\,to\,heat\;furnace)+(New\,Pull\times Incremental\times 0.0011)]}{[(Gas\,to\,heat\;furnace)+(Base\,Pull\times Incremental\times 0.0011)]}$$

$$\times(Oxidizing\;Factor)\times(Uncert.\,factor)\times\left(\frac{Gas\;Consumption\;without\;eboost}{Gas\;Consumption\;with\;eboost}\right)$$

An example calculation for 107 furnace is provided below:

$$ER,\frac{g}{s}=\left(0.32\frac{g}{s}\right)\times\frac{\left[\left(11400\frac{scf}{hr}\right)+\left(4991\frac{kg}{hr}\times1500\frac{scf}{ton}\times0.0011\frac{ton}{kg}\right)\right]}{\left[\left(11400\frac{scf}{hr}\right)+\left(2852\frac{kg}{hr}\times1500\frac{scf}{ton}\times0.0011\frac{ton}{kg}\right)\right]}\times(35)\times(1.25)$$

$$\times\left(\frac{22230\frac{scf}{hr}}{17562\frac{scf}{hr}}\right)$$

$$ER,\frac{g}{s}=2.16$$

All supporting calculations and data are located in Appendix G.

The NOx emissions estimates for the furnaces are an engineering calculation based on scale-up factors and historical source testing.

10.2 Forehearth Burners

The forehearths are channels used to transport the molten glass from the furnace to the fiberizers (bushings). These channels have natural gas burners to maintain the glass temperature (Source IDs B11 and B38). The NOx emission estimates from these natural gas burners are estimated using the AP42 emission factors for small boilers without NOx controls. The forehearth burners use VSA oxygen instead of air. The emission estimates do not take this into account and are therefore conservative.

The NOx calculation methodology is outlined below:

$$ER,\frac{g}{s}=\left(Natural\ Gas\ Consumption,\frac{m^3}{s}\right)\times\left(Emission\ Factor,\frac{lb_{NOx}}{10^6\ ft^3}\right)\times\left(Conversion\ Factors\right)$$

An example is provided for the T105 Forehearth Exhaust (Source ID B38):

$$ER,\frac{g}{s}=\left(0.09\ \frac{m^3}{s}\right)\times\left(100\frac{lb_{NOx}}{10^6\ ft^3}\right)\times\left(\frac{35.3\ ft^3}{m^3}\right)\times\left(\frac{454\,g}{lb}\right)$$

$$ER,\frac{g}{s}=0.1442$$

NOx emission rates for the CFM forming tunnels, (Source IDs C72, C99 - C101) were calculated in an identical manner.

All supporting calculations and data are located in Appendix G.

10.3 Drying/Curing Ovens

The spindles of glass fiber are conveyed to drying ovens, where moisture is removed from the sizing and coupling agents and the coatings cured. The drying ovens are equipped with natural gas fired burners. NOx emissions are estimated using the AP42 emission factors for small boilers without NOx controls. The NOx calculation methodology is outlined below:

$$ER,\frac{g}{s}=\left(Name\ Plate\ Capacity,\frac{MMBTU}{hr}\right)\times\left(Emission\ Factor,\frac{lb_{\ NOx}}{10^{6}\ ft^{3}}\right)\times\left(Conversion\ Factors\right)$$

An example is provided for the No. 12 Oven (Source ID C65):

$$ER,\frac{g}{s}=\left(2.33\ \frac{MMBTU}{hr}\right)\times\left(100\frac{lb_{\ NOx}}{10^{6}\ ft^{3}}\right)\times\left(\frac{10^{6}\ ft^{3}}{1020\,MMBTU}\right)\times\left(\frac{454\,g}{lb}\right)\times\left(\frac{1\ hr}{3600\,s}\right)$$

$$ER,\frac{g}{s}=0.0288$$

The emission rates from the CSM line ovens (Source IDs C48 - C50) and curing ovens (Source IDs C65 – C70), were calculated in an identical manner. All of these ovens will be removed from service when the CSM line is removed.

All supporting calculations and data are located in Appendix G.

10.4 Thermal Oxidizers

10.4.1 Thermal Oxidizer operated by Owens Corning

The CFM Line uses a regenerative thermal oxidizer (RTO) to reduce VOC emissions from the CFM ovens (Source ID C75). The NOx emission estimates from the RTO is based upon the natural gas nameplate capacities and AP42 emission factors.

$$ER,\frac{g}{s}=\left(NamePlate\ Capacity,\frac{MMBTU}{hr}\right)\times\left(Emission\ Factor,\frac{lb_{\ NOx}}{10^{6}\ ft^{3}}\right)\times\left(Conversion\ Factors\right)$$

All supporting calculations and data are located in Appendix G.

10.4.2 Thermal Oxidizer operated by NGF

NOx emissions are generated from the NGF RTO (Source ID G13) which is located within the Owens Corning property line. The NOx emission rate is calculated based upon the natural gas nameplate capacity of 12 MMBTU/hr provided in the NGF Canada CofA Amendment Application dated October, 2006. This application was approved by CofA # 5214-6XTSFD, January 31, 2007.

All supporting calculations and data are located in Appendix G.

10.5 Natural Gas Process Sources

The facility has a number of natural gas fired sources including heaters, boilers etc. NOx has been calculated from all natural gas fired heaters because the total nameplate capacity exceeds 20 million KJ/hr. As per MOE guidance, only NOx emissions were calculated for these sources. The emissions were calculated based on the name plate heating capacity (BTUs/hr) and AP-42 emission factors. The NOx emission rate calculation methodology is identical to the thermal oxidizer (Source ID C75).

10.5.1 Assessment of NOx Data Quality

All other NOx emission estimates are based upon AP42 emission factors. The data quality is considered to be above average, based upon the Emission Factor rating of “B”.

11. Sulphur Dioxide

Sulphur dioxide (SO_2) emissions from the furnace occur due to the presence of sulfur bearing species in the mixed batch. The only significant source of SO_2 at this facility is the 107 furnace (Source ID B01).

The maximum operating condition for SO_2 is the scenario where the 107 furnace is operating at maximum (current) capacity. All calculations were based on a maximum half hour average operating condition. The sulphur dioxide emissions from the batch were calculated using the following equation:

$$ER_{SO2} = \left(Furnace\ Pull\ Rate, \frac{kg}{hr} \right) \times \sum \left[(\%\ Each\ RM\ in\ Batch) \times (\%\ of\ S,\ as\ SO_3, in\ each\ RM) \right]$$

$$\times \left(\frac{MW\ SO_2}{MW\ SO_3} \right) \times (Conversion\ Factors) \times \left(\frac{100}{\%\ Furnace\ Yield} \right) \times (Flexibility\ Factor)$$

An example calculation of sulfur dioxide emissions from the batch used in Furnace 107 is provided below:

$$ER_{SO2} = \left(4991 \frac{kg}{hr} \right) \times \begin{bmatrix} (40.771\%\,RM_1 \times 0.01\%\,SO_3) + (30.762\%\,RM_2 \times 0.02\%\,SO_3) \\ +(18.592\%\,RM_3 \times 0.055\%\,SO_3) + (6.229\%\,RM_4 \times 0.334\%\,SO_3) \\ +(3.502\%\,RM_5 \times 0.008\%\,SO_3) + (0.141\%\,RM_6 \times 52.7\%\,SO_3) \end{bmatrix}$$

$$\times \left(\frac{64.06\,g/gmol}{80.06\,g/gmol} \right) \times \left(\frac{1\,hr}{3600\,s} \right) \times \left(\frac{1\,kg}{1000\,g} \right) \times \left(\frac{100}{95.59} \right) \times (1.25))$$

$$ER_{SO2} = 1.675\ \frac{g}{s}$$

The emission rates for SO_2 from the furnaces were estimated using a mass balance with 100% of sulphur in the batch raw materials being converted to SO_2 and emitted to atmosphere. In addition, a flexibility factor of 1.25 was applied to account for fluctuations in the composition of the batch raw materials. Therefore, the emission estimates for SO_2 are of the highest data quality and very conservative.

No additional data is provided in the Appendices as they involve confidential data related to the glass formulation.

12. Carbon Monoxide

Carbon monoxide (CO) is emitted in from the glass melting process.

The maximum operating condition for CO is the scenario where the 107 furnace is operating at maximum (current) capacity. All calculations were based on a maximum half hour average operating condition. The only significant source of CO at this facility is the 107 furnace (Source ID B01).

The emission rate estimates are based upon source testing from 1998 and adjusted for the maximum furnace throughput capacity. The general formula for the calculation is presented below:

$$ER, \frac{g}{s} = \left(1998\ Emission\ Rate, \frac{g}{s}\right) \times \left(Flexibility\ Factor\right)$$

The emission rate used for the 107 Furnace was the measured emission rate multiplied by an uncertainty factor of 2.

All supporting calculations and data are located in Appendix G. For additional information on the development of the emission factors, refer to Appendix O for source testing reports.

The CO emissions from the furnaces are estimated using engineering calculations (based upon source testing). These emission rate estimates are considered to be of marginal data quality, but conservative because an uncertainty factor was applied.

13. Volatile Organic Compounds

The emissions from the preparation, application and curing of binder and size materials include volatile organic compounds (VOCs).

The maximum operating condition for these components is the scenario where all significant sources of VOCs are operating simultaneously at their individual maximum rates of production/throughput. All calculations are based on a maximum variable averaging time operating conditions. The sources of contaminants are as follows:

- Binder Pre-mix Exhausts and the Binder Re-circulation Tank (Source IDs A12, A13, C60)
- Main Forming Scrap Tunnel Exhausts (Source IDs B15, B16, B39, B40)
- Ovens (Source IDs C25 – C30 & C65 – C70)
- CFM Line – (Source IDs C72, C73, C75, C99 - C101)

13.1 Binder VOC Emission Factors

The calculation of the contaminant emission rates is based upon the maximum percentage of any contaminant in the various binders used. This maximum percentage is used in combination with the application efficiency and the application rate (g binder/kg glass pull). The following equation represents the methodology used to develop the emission rates used for all VOC binder losses.

$$Emission\ \ Factor,\ \frac{g\,binder}{kg\ glass\ pull} = (Max\,Fraction\ of\ Component)\times(Application\ Efficiency\,\%)$$
$$\times(Flexibility\ \ Factor)\times\left(Application\ Rate,\ \frac{g\,binder}{kg\ glass\ pull}\right)$$

The application rate for most of the binders is in the range of 100 – 200 g binder/kg glass pull. For the purpose of developing conservative emission estimates, a higher application rate of 420 g/ of binder per kg of glass pull has been applied.

These emission factors are applied to all of the sources that may release VOCs from the binders. Each portion of the process is allocated a percentage of the emissions based upon knowledge of the process and the volatility of the contaminant.

All supporting calculations and data are located in Appendix G.

13.2 Assessment of Data Quality

The calculation methodology for the binder emission rates assumes that all of the VOCs in the binder are lost to atmosphere. In reality, some of this binder remains in the product and some remains in the process water. The calculation methodology is an engineering calculation which is based upon the concept of 100% VOC losses. The emission estimates are considered to be of average data quality and very conservative.

14. Acid Gases

The emissions from the glass melting process include acid gases from the raw materials entrained in the furnace flue gas. Based on the composition of the batch materials used, the acid gases anticipated to be present in significant quantities are hydrogen chloride (HCl) and hydrogen fluoride (HF). The only significant source of HCl and HF at this facility is the 107 furnace (Source ID B01).

The maximum operating condition for acid gases is the scenario where the 107 furnace is operating at maximum (current) capacity. All calculations were based on a maximum half hour average operating condition.

The emission rate estimates are based upon source testing from 1998 and adjusted for the maximum furnace throughput capacity. The general formula for the calculation is presented below:

$$ER, \frac{g}{s} = \left(1998\ Emission\ Rate, \frac{g}{s}\right) \times \left(Flexibility\ Factor\right)$$

An example calculation for hydrogen chloride (HCl) from the 107 Furnace is presented below:

$$ER_{HCl} = \left(4991\,\frac{kg}{hr}\right) \times \left(0.006\,\frac{g\ HCl}{kg\ glass\ pull}\right) \times \left(\frac{1\,hr}{3600\,s}\right) \times \left(1.25\right)$$

$$ER_{HCl} = 0.0104\,\frac{g}{s}$$

All supporting calculations and data are located in Appendix G. For additional information on the development of the emission factors, refer to Appendix O for source testing reports.

The emission rate for acid gases from the furnace were estimated using source testing performed in 1998, and adjusted for the maximum glass pull rate. In addition, a flexibility factor of 25% was applied to account for fluctuations in the composition of the batch raw materials. Therefore, the emission estimates are of average data quality and conservative.

15. Dispersion Modelling - AERMOD

This section provides a description of how the modelling was conducted as required by subparagraphs 10 to 13 of Section 26 and sub-paragraph 3 of Section 33 of O. Reg. 419/05. The USEPA AERMOD dispersion model was used to assess hexavalent chromium. All contaminants except hexavalent chromium were modelled using the Reg. 346 model and further related details are included in Section 16 for Reg. 346 modelling. The methodologies used in this study are discussed in the following sections.

The AERMOD modelling interface employed was Lakes AERMOD View, which incorporates AERMAP. Site specific meteorological data was provided by the MOECC. Copies of the Section 7 and Section 13 approvals for AERMOD and AERMET version 14134 and site specific meteorological data are located in Appendix I.

15.1 AERMOD Modelling

AERMOD is an advanced air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain. The latest versions of AERMOD incorporate the Plume Rise Model Enhancements (PRIME) building downwash algorithms, which provide a more realistic handling of downwash effects than previous approaches. It is capable of computing ground level concentrations at specific downwind receptors under a variety of meteorological conditions, emission scenarios and changes in topography.

Modelling was conducted using the USEPA AERMOD Version 14134 as per the Section 7 Notice No. 5616-9R9L9V. Site specific meteorological data was provided by the MOECC as per Section 13 approval on November 27, 2014. Only hexavalent chromium has been modelled in AERMOD.

The results are anticipated to provide a reasonable estimate of the facility’s impact on the surrounding area under local meteorological conditions. The current and future (after Action Plan) scenarios have been assessed. The following sections describing how the model was set up and run and applies to both the current and future scenarios.

15.2 Source and Emissions Data

The source parameters and contaminant emission estimates used two dispersion modelling scenarios are listed in Appendix C and Appendix D. The methods used to calculate the emissions have been described in previous sections of this report. All sources of hexavalent chromium were modelled as point sources.

15.3 Topography

The Owens Corning Guelph facility is adjacent to park areas and a river approximately 240 m east of the facility. Digital terrain data was obtained from the MOECC for the region surrounding the facility. This data was used to generate base elevations for sources, buildings and receptors in the model.

15.4 Land Use

The Owens Corning facility is situated at 247 York Road in Guelph, Ontario. The adjacent lands have mixed zoning including industrial, commercial, residential and parkland. Neighbouring facilities are primarily involved in chemical distribution, packaging and welding. The nearest sensitive receptors are dwellings adjacent to the west property line, however all sensitive receptors surrounding the facility were considered in the modelling.

The AERMOD model requires specification of urban or rural meteorological algorithms. The urban algorithm is based upon the influence of a ‘heat island’ produced typically by a heavily populated area. The land use within a 3-kilometer radius of the plant was analyzed using the Land Use Procedure. Rural roughness is assumed if less than 50% of the land use falls within the following categories: industrial, commercial and multi-family residential. Based upon the analysis of this area and discussion with the Environmental Monitoring and Approvals Branch (EMRB) of the MOECC, the surrounding land use is deemed rural for the purposes of dispersion modelling based on the predominance of residential areas, open fields and green space the within the 3-kilometer radius. Documentation is provided in Appendix I.

15.5 Meteorology

The AERMOD model requires a meteorological data set consisting of hourly wind speed and direction, Pasquill stability class, and mixing heights. It is recommended that five years of meteorological data be used.

For the purposes of completing this modelling assessment with the most refined and up to date data and tools available, the facility requested a site-specific meteorological data-set for the facility. The MOECC was pre-consulted regarding the application of site-specific land use parameters and received the Section 13(1) approval.

The MOECC provided a fully processed meteorological data set for the 5 years from 2009 to 2013 with wind-sector dependent land use specific to the Owens Corning area, using wind and temperature data from the Guelph Turfgrass Institute and other variables from Waterloo, Kitchener/Waterloo and Toronto Pearson International airports as needed. All these station are operated and maintained by Environment Canada.

Details on the determination of the site specific land use parameters can be found in Appendix I.

15.6 Building and Source Dimensions

LEHDER extracted the source and building dimensions and coordinates using a site plan which included:

- The facility property line
- Location of buildings and structures on the property
- Source locations and parameters

Source coordinates and dimensions are located in Appendix C and D.

15.7 Building Downwash

Turbulence induced by nearby buildings/structures can cause an elevated plume to be rapidly mixed towards the ground, causing high ambient concentrations. For sources within five times the lesser of the building height or width (up to a maximum of 800 meters), the building downwash algorithms in the AERMOD model were used. Building downwash effects were assessed using the EPA BPIP program (Building Profile Input Program) for 1440 wind directions (every ¼ degree from true north) and the wind direction specific information was then provided to the AERMOD model as input data.

15.8 Receptor Grid

The AERMOD model requires the user to select the points (receptors) at which ground level concentrations are to be calculated. The receptor grid was defined in accordance with the MOE guidance as follows:

- a fence line grid with 10 m spacing
- a grid with 20 m spacing extending 200 m out from the sources
- a grid with 50 m spacing from 200 m to 500 m
- a grid with 100 m spacing from 500 m to 1000 m
- a grid with 200 m spacing from 1000 m to 2000 m
- a grid with 500 m spacing from 2000 m to 5000 m

Hexavalent chromium was also assessed at nearby sensitive receptors for the annual averaging times. The facility is located in an area with a large number of sensitive receptors to the north, west and east of the facility. In additional to residential areas, there are two schools nearby to the north. The nearest sensitive receptors are dwellings are adjacent to the west property line of the facility. Sensitive receptors are defined in O.Reg.419/05 (the Regulation) section 30(8) as:

- Dwellings
- Educational facilities
- Health care facilities
- A senior citizens' residence or long term care facilities
- Child care facilities

Parkland and recreational facilities are not considered sensitive receptors for the purposes of evaluating averaging times for Upper Risk Threshold comparisons. However, the MOECC has requested that the baseball diamond to the south of the facility be assessed for the purposes of the 24 hour average modelling.

In addition to modelling ground level concentrations at sensitive receptors, the modelling included assessment of concentrations at elevated locations representing open windows at multi-story buildings.

15.9 Presentation of Annual Modelling Results

For the purpose of conservatism and as preferred by the Ministry, the annual modelling has been conducted by running each meteorological year individually and using the highest value predicted from any of the 5 year runs. Therefore the maximum predicted concentration will be reported from the associated year of meteorological data. For the purposes of documentation and presentation of concentration contour plots, only the year with the maximum concentration is presented. However, all electronic modelling files are included in the submission to the Ministry.

15.10 24-Hour Modelling Assessment

As a result of efforts to prepare a Site Specific Standard Application for hexavalent chromium, air dispersion modelling was required using AERMOD as specified under Section 32 of O.Reg.419/05 in order to determine the current baseline conditions. During this modelling exercise, 24 hour average modelling was completed and identified a modelled value above the Schedule 6 Upper Risk Threshold (URT) on the south property line.

The modelling was conducted using the emission rates from validated source testing at the facility. The current regulatory model for the Owens Corning Guelph facility remains the Reg. 346 model as the facility NAICS code (327214) is not listed in Schedule 4 or 5. The facility is not required to demonstrate compliance with the 24 hour comparator as they are still a Schedule 19 facility. Modelling in accordance with the Reg. 346 model estimates a maximum half hour ground level concentration of 0.022 µg/m^3 which is well below the half hour URT of 0.21 µg/m^3.

The 24 hour predicted concentrations of hexavalent chromium at all nearby sensitive receptors as defined in O.Reg.419 Section 30(8) are below the 24 hour Upper Risk Threshold.

The results of the AERMOD modelling of hexavalent chromium at the maximum POI and sensitive receptors and the baseball diamond are outlined in the table below:

Table 2 24 Hour Average Concentration Summary

Location	POI Concentration (µg/m^3)	24 hr URT (µg/m^3)	# of days of exceedance in 5 years	Notes
Maximum POI Receptor	0.0874	0.07	11	Along south property line
Maximum Sensitive Receptor	0.0133	0.07	0	Dwelling on west property line
Ball Diamond	0.0163	0.07	0	South west of facility

Detailed modelling information for the 24 hour average can be found in Appendix J.

Table 3 AERMOD Dispersion Modelling Input Summary Table

Section of Reg.	Section Title	Description of How the Approved Dispersion Model was used.
8	Negligible Sources	All sources of hexavalent chromium were considered significant and were included in the modelling.
9	Same Structure Contamination	The facility is the only tenant in the building; therefore same structure contamination does not apply to this site.
10	Operating Conditions	Operating conditions that generate the maximum POI concentrations are outlined in the Emission Estimate Sections of the Report for each contaminant (See sections)
11	Source of Contaminant Emission Rates	The methods used to calculate the emission rates are provided in the corresponding Emission Estimate sections, along with a comment regarding the accuracy of the methods.
12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The operating conditions were estimated in accordance with Section 10(1)1 and Section 11(1)1 of O. Reg. 419/05 and are therefore considered to result in the highest concentration at POI that the facility is capable of.
13	Meteorological Conditions	Site specific meteorological data set provided by the MOECC and approved by a Section 13(1) letter.
14	Area of Modeling Coverage	The receptor grid for this modeling extended to 5000m. All

Section of Reg.	Section Title	Description of How the Approved Dispersion Model was used.
		concentrations were decreasing prior to that distance
15	Stack height for Certain New Sources of Contaminant	Not applicable, Section 15 of O. Reg. 419/05 does not apply to the facility.
16	Terrain Data	Digital terrain data was obtained from the MOECC terrain tiles.
17	Averaging Periods	24 hour and Annual averaging times were assessed using AERMOD.

15.11 Source Contributions to Current Case POI Concentration

The tables in this section have been prepared in accordance with Section 3.3 of the “*Guide to Requesting an Alternative Air Standard*”, dated December 2007, to outline the AERMOD modelling results of this assessment.

The following table outlines the source contribution to the current case maximum POI concentration, as well as the source contribution at three (3) specific sensitive receptors, which in this case are dwellings. These receptors were selected by first determining all sensitive receptors in the surrounding area and selecting the most impacted receptors in each direction. The maximum POI location is along the south-east fenceline.

Table 4 Relative Source Contributions to POI Concentration

Source ID	Emission Rate (g/s)	Percent of Total Emissions (%)	Contribution to Point of Impingement Concentrations: At Point of Maximum Concentration (ug/m^3)	At Receptor 1 (ug/m^3)	At Receptor 2 (ug/m^3)	At Receptor 3 (ug/m^3)
ALL	2.35E-04	100%	2.08E-02	1.62E-03	1.36E-03	8.07E-04
B01	3.55E-05	15%	3.50E-04	6.67E-05	6.50E-05	3.06E-05
B11	1.51E-04	64%	1.82E-02	1.30E-03	1.03E-03	5.75E-04
B38	3.32E-05	14%	4.04E-03	2.08E-04	2.05E-04	1.56E-04
GENEXHTS	1.57E-05	7%	1.13E-03	5.87E-05	6.29E-05	4.49E-05
Date and Time of Maximum (year)[1]			2012	2011	2009	2013

15.12 Exceedance Frequency Current Annual Modelling

The frequency, average and median of the concentrations which exceed the POI provides additional context to the POI concentration and assists with understanding the potential impact on nearby receptors. The following table outlines this data for the current case maximum POI location and the three (3) most impacted sensitive receptors:

Table 5 Frequency and Average Concentration of Exceedances

All Sources	Units	Maximum Receptor	Receptor 1	Receptor 2	Receptor 3
Frequency above Standard (% of time exceedance occurs at receptor)	**(%)**	100%	100%	100%	100%
Average Concentration above Standard	**(ug/m^3)**	2.02E-02	1.48E-03	1.23E-03	7.32E-04
Median or Range of Concentrations above the Standard	**(ug/m^3)**	2.00E-02	1.51E-03	1.30E-03	7.52E-04

The default and preferred pollution control combinations were assessed and ranked according to the POI concentration results from the AERMOD assessment. The maximum POI concentration at the location of the maximum concentration, as well as the impacted receptors, were assessed for each option along with the frequency of exceedance at the receptors with the highest POI concentration. The following table also includes the current scenario as a comparator for the POI concentration reductions.

Table 6 Frequency of Exceedances

Ranking	Combination Description	Overall % of Sch 3 Future Standard	POI Exceedence Frequency (Receptor with the highest % Frequency)[2]	% of Max POI at Specified Receptor
Current	Current facility configuration	14851%	100%	1158%
Best (Default) Technically Feasible PCC[1]	Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks combined with the use of Low Sublimation Chromium (LSC) refractory and conversion of the forehearths to air/gas combustion	709%	0% [3]	42%

Ranking	**Combination Description**	**Overall % of Sch 3 Future Standard**	**POI Exceedence Frequency (Receptor with the highest % Frequency)[2]**	**% of Max POI at Specified Receptor**
Preferred Technically Feasible PCC	Incorporating more accurate combustion control skids and construction of front end superstructures and re-engineering exhaust stacks impacted by reconfiguration	1703%	100%	451%

[1] PCC is Pollution Control Combination

[2] Receptor with the highest percent frequency of exceedance is always a nearby dwelling.

[3] No exceedance at sensitive receptor

16. Dispersion Modelling - Reg.346

This section provides a description of how the modelling was conducted as required by sub-paragraphs 10 to 13 of Section 26 and sub-paragraph 3 of Section 33 of O. Reg. 419/05. Modelling was conducted using the Reg. 346 model for all contaminants except hexavalent chromium. The methodologies used in this study are discussed in the following sections.

For this modelling exercise, all sources that emitted contaminants in significant amounts were modelled using a staged approach. In the Reg.346 model all sources were modelled as virtual sources as shown on the Wind Center Drawing in Appendix B. Owens Corning is a Schedule 19 facility and therefore the Regulation 346 air dispersion model is applicable for compliance assessments until 2020.

In Stage 1, a conservative approach to modelling was applied by using a dispersion factor for each source, multiplying it by the emission rate of each contaminant from that source and summing the product for each contaminant. The dispersion factor was generated by modelling each source at an emission rate of 1 g/s. Any contaminant 50% or more of a MOE standard, guideline or over a Jurisdictional Screening Level (JSL) using this very conservative approach was assessed in the Stage 2 modelling.

Stage 2 modelling consisted of assigning the worst case emission for each significant contaminant to the appropriate source and then modelling using Reg. 346. Stage 2 modelling was conducted in Reg. 346 for particulate and nitrogen oxides.

All documentation including input and output data for the REg. 346 model is located in Appendix H.

16.1 Emissions Data

The contaminant emission estimates used in the dispersion model are listed in Appendix D (Emission Inventory) as well as summarized in the input files in Appendix H. The methods used to calculate the emissions have been described in previous sections of this report.

16.2 Building and Source Dimensions

The virtual source parameters are outlined on the Reg. 346 Wind center drawing. LEHDER extracted the source and building dimensions and coordinates using on-site surveys and plant drawings including:

- a site plan showing property lines and location of structures on the property
- a wind center drawing
- building drawings showing roof plan, and elevations
- an emission source inventory

A site drawing is located in Appendix B.

Table 7 Reg. 346 Dispersion Modelling Input Summary Table

Section of Reg.	**Section Title**	**Description of How the Approved Dispersion Model was used.**
8	Negligible Sources	Negligible and insignificant sources are outlined in Section 4 and have not been included in the modelling.
9	Same Structure Contamination	The facility is the only tenant in the building; therefore same structure contamination does not apply to this site.
10	Operating Conditions	Operating conditions that generate the maximum POI concentrations are outlined in the Emission Estimate Sections of the Report for each contaminant (See sections)
11	Source of Contaminant Emission Rates	The methods used to calculate the emission rates are provided in the corresponding Emission Estimate sections, along with a comment regarding the accuracy of the methods.
12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The operating conditions were estimated in accordance with Section 10(1)1 and Section 11(1)1 of O. Reg. 419/05 and are therefore considered to result in the highest concentration at POI that the facility is capable of.
13	Meteorological Conditions	Not applicable for O.Reg. 346 model
14	Area of Modelling Coverage	Not applicable for O.Reg. 346 model
15	Stack height for Certain New Sources of Contaminant	Not applicable, Section 15 of O. Reg. 419/05 does not apply to the facility.
16	Terrain Data	Not applicable for O.Reg. 346 model
17	Averaging Periods	Half hour averaging times were modelled using the O. Reg. 346 model.

17. Emission Summary Tables

The Emission Summary Table is provided below as required by sub-paragraph 14 of Section 26 of O. Reg. 419/05.

The data presented includes:

- Contaminant name
- CAS number
- Total emission rate for each contaminant (aggregate for facility) in g/s
- Aggregate Point Of Impingement concentration predicted by Reg. 346 model or AERMOD
- Half Hour or Variable Averaging Time Point Of Impingement limits
- Limiting Effect
- Percentage of Criteria, which is the percentage ratio of the aggregate point of impingement concentration estimate to the point of impingement criteria

Table 8 Emission Summary Hexavalent Chromium

Contaminant	Location of Point of Impingement (POI) [1]	Avg. Time	Air Dispersion Model	Emission Rate	Max. Modelled Conc.	MOE POI Criteria	Limiting Effect	Regulation Schedule No.	% of Criteria
				(g/s)	(ug/m^3)	(ug/m^3)			
Hexavalent Chromium (Current)	Off property [2]	24-hr	AERMOD	0.00024	0.0815	0.07	Health	Schedule 6	> URT [3]
	Sensitive receptor	24-hr	AERMOD	0.00024	0.0133	0.07	Health	Schedule 6	< URT
	Off property	Annual	AERMOD	0.00024	0.0208	--	--	--	--
	Sensitive receptor	Annual	AERMOD	0.00024	0.0016	--	--	--	--
Hexavalent Chromium [4] (After Action Plan)	Off property	Annual	AERMOD	0.00017	0.0024	--	--	--	--
	Sensitive receptor	Annual	AERMOD	0.00017	0.0006	--	--	--	--

[1] The maximum concentration for all off property locations occurs on the facility property line.

[2] The maximum POI location is on the property line. Only 2 receptors (on the property line) are above the 24 hr criteria.

[3] URT refers to the upper risk threshold which is not a standard

[4] Owens Corning is applying for a site specific standard for hexavalent chromium

Table 9 Emission Summary - ½ Hour Average – All Other Compounds

Contaminant	Avg. Time	Air Dispersion Model	Emission Rate	Max. Modelled Conc.	MOE POI Criteria	Limiting Effect	Regulation Schedule No.	% of Criteria
			(g/s)	(ug/m^3)	(ug/m^3)			
PM - PARTICULATE MATTER	1/2 hr	Reg 346	0.7475	82	100	visibility	Schedule 2	82%
NITROGEN OXIDES	1/2 hr	Reg 346	3.4516	332	500	health	Schedule 2	66%
SULPHUR DIOXIDE	1/2 hr	Reg 346	1.6800	158	830	health	Schedule 2	19%
ZINC OXIDE	1/2 hr	Reg 346	0.1002	9	100	particulate	Schedule 2	9%
HYDROGEN FLUORIDE [1]	1/2 hr	Reg 346	0.0173	2	4.3	vegetation	Schedule 2	38%
HYDROGEN CHLORIDE	1/2 hr	Reg 346	0.0104	1	60	health	Schedule 2	2%
METHANOL (METHYL ALCOHOL)	1/2 hr	Reg 346	0.5396	51	12000	health	Schedule 2	0.4%
ACETIC ACID	1/2 hr	Reg 346	0.5339	50	2500	Odour	Schedule 2	2%
SILICA-RESPIRABLE (<10um)	1/2 hr	Reg 346	0.0302	12	15	health	1/2-hr Guideline	79%
Chromium (Di-,Tri-,metallic)	1/2 hr	Reg 346	0.0007	0	1.5	health	Schedule 2 [2]	4%

[1] Assessed against the most stringent criteria for Gaseous Growing Season

[2] Future (July 1, 2016) standard (more stringent than the current standard)

18. Conclusions

Table 8 summarizes the output from the AERMOD modelling to predict the maximum ground level concentration for hexavalent chromium emissions related to the preferred technically feasible pollution control combination at the Owens Corning Guelph facility. The summary in Table 8 supports the application for an alteration of a Schedule 3 standard under Section 32 of Ontario Regulation 419/05: Air Pollution – Local Air Quality (O. Reg. 419/05).

Owens Corning Guelph is requesting a 10 year site-specific air standard for hexavalent chromium of 0.0024 µg/m^3 (annual average) at any off-site location. Modelling predicts this would result in a maximum annual average concentration of 0.00063 µg/m^3 at any sensitive receptor.

Table 9 summarizes the output from the Reg. 346 modelling to predict the maximum ground level concentration for all other significant contaminant emissions related to the Owens Corning Guelph facility operations along the property lines and off site. The results indicate that all contaminants in Table 9 at the facility will be in compliance with the O.Reg. 419/05 Schedule 2 standards and guidelines at the maximum operating scenario.

19. Statement of Limitations

LEHDER Environmental Services Limited ("LEHDER") prepared this report ("Report"), for the sole benefit and exclusive use by Owens Corning Composite Materials Canada LP, Guelph Facility.

LEHDER has performed the work as described in the Scope of Work and made the findings and conclusions set out in the Report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

In preparing this Report, LEHDER has relied in good faith on information provided by others as noted in this Report and has assumed the information provided by those individuals is both factual and accurate.

The material in this report reflects LEHDER's best judgement in light of the information available to it at the time of preparing the Report. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. LEHDER accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on the Report.

20. References

The following references were used in preparation of this document:

MOE	Guideline for Air Dispersion Modelingin Ontario MOE, July 2009
MOE	Procedure for Preparing an ESDM Report MOE, July 2009
MOE	Seminar: Documenting “Negligible Sources of Contaminants” Sean Capstick, MOE October 18, 2005
EPA	USEPA AP-42: Section 1.4 – Natural Gas Combustion (July 1998) Section 3.3 – Gasoline and Diesel Industrial Engines (October 1996)
LEHDER	Source Testing Program Reports – multiple 1998-Present **See Appendix O (CONFIDENTIAL)**