Economic Feasibility Report
Hexavalent Chromium Site Specific Standard Request
Owens Corning Composite Materials Canada LP
Guelph Plant

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Executive Summary

This Economic Feasibility Report has been prepared to support the Owens Corning Guelph Glass request for 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). This report is an optional element of the request for the site specific standard and has been prepared in accordance with the Ministry of the Environment and Climate Change (MOECC) publications "*Guide to Requesting an Alternative Air Standard*" (GRAAS), December, 2007, and the "*Guideline for the Implementation of Air Standards in Ontario*" (GIASO), March 2009.

The Owens Corning facility 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 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. Detailed process descriptions and documentation of emission estimates are located in the Emission Summary and Dispersion Modeling (ESDM) Report.

This is one of the companion documents to the ESDM Report where modeling indicates that the facility would not meet the future hexavalent chromium standard and that a site specific standard is necessary. The other primary companion document is the Technical Benchmarking Report which provides an assessment of the available technologies to reduce point of impingement (POI) concentrations of hexavalent chromium using the top down approach prescribed by Appendix A of the MOECC GRAAS guidance document.

This economic analysis is an important component for further evaluation of technically feasible pollution control strategies. The Technical Benchmarking Report and the Economic Feasibility Report are the primary documents for developing the Action Plan for reducing point of impingement concentrations. The economic assessment methodology employed derives a dimensionless value that provides an indicator of Total Resource Effectiveness (TRE) for the POI reduction strategy being evaluated. For each strategy, the TRE calculation considers the potential POI reduction that could be achieved, contrasted with the costs required to obtain, install and operate it.

Owens Corning has followed the general guidelines below as provided by the MOECC as part of the economic feasibility assessment.

- TRE values less than 1 generally indicates a reasonably effective use of resources to achieve the POI improvement

- TRE values between 1 and up to about 10 may suggest further consideration is appropriate and/or refinement of assumptions are required
- TRE values over 10 generally indicate the potential POI reduction technique is not a good use of resources and perhaps other options should be considered

The following table presents the technically feasible pollution control strategies along with the strategy ranking in terms of POI reduction achieved and the total resource effectiveness.

Summary of the Economic Feasibility Assessment of Technically Feasible Pollution Control Strategies

Pollution Control Strategy Description	Rank	TRE Value(s)	Consideration for Implementation
Control Strategies that include an Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks with various other technologies.	1 - 5	68 - 90	Not selected - economic assessment indicates these technologies are not a good use of resources
Incorporating more accurate oxygen/gas combustion control systems and improved superstructure construction techniques for the front end and re-engineering exhaust stacks impacted by reconfiguration	6	11	Incorporate into the Action Plan even though the economic feasibility assessment indicates it may not be a good use of resources
Scrubber on forehearth stack, use of Low Sublimation Chromium (LSC) refractory and forehearth conversion to air/gas combustion	7	124	Not selected - economic assessment indicates these technologies are not a good use of resources
Scrubber on forehearth stack and forehearth conversion to air/gas combustion	8	125	Not selected - economic assessment indicates these technologies are not a good use of resources
Five additional technically feasible pollution control strategies were evaluated.	9 -13	16 - 265	Not selected - economic assessment indicates these technologies are not a good use of resources

Economic feasibility decisions were based upon the TRE values as the accepted methodology by the MOECC. Owens Corning has selected to implement the pollution control strategy that includes installation of state of the art combustion controls systems and use of improved construction techniques on all remaining sections of the process (forehearths). Additionally, 4 exhaust stacks will be re-engineered to overcome dispersion challenges.

This pollution control strategy has a TRE value greater than 10 (which may not be considered a good use of resources) however, this strategy achieves significant reductions in the POI concentration.

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1. Introduction

1.1 Background

In 2011, O.Reg. 419/05 was amended to introduce new air standards for a number of compounds including hexavalent chromium along with a 5 year phase in period for these standards. 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 ($\mu g/m^3$) 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.

O.Reg. 419/05 contains provisions to request a Site Specific Standard for a contaminant listed in Schedule 3 if a facility is unable to demonstrate compliance with the air standard by July 1, 2016. The Owens Corning Guelph facility is requesting a Site Specific Standard for hexavalent chromium. The Economic Feasibility Report is an optional element of an application for a Site Specific Standard.

1.2 Purpose

The purpose of this Economic Feasibility Report is to assess the effectiveness of the use of resources associated with each of the technically feasible pollution control combinations (PCC) and assist in the selection of the preferred control option. This economic analysis is an important component for further evaluation of technically feasible pollution control combinations and development of the Action Plan for reducing point of impingement concentrations

This document is prepared in accordance with the MOE publications "*Guide to Requesting an Alternative Air Standard*" dated December, 2007, "*Guideline for the Implementation of Air Standards in Ontario*" dated March 2009, and "*Air Dispersion Modeling Guideline for Ontario*", March 2009.

The objectives of this Economic Feasibility Report are to:

- Identify all capital costs associated with each pollution control combination
- Identify all operating and maintenance costs associated with each pollution control combination
- Utilize the documented MOECC methodology for establishing the Total Resource Effectiveness (TRE) values for each combination
- Assess the TRE values and select a preferred pollution control combination

2. Facility Description

2.1 Current Facility Description

The Owens Corning Guelph Plant 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 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 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 molten glass channel siderails. Chromium containing refractory is used 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 furnace and forehearths prior to emission. The sources of hexavalent chromium are:

- Furnace & Forehearth Stacks
- Furnace Hall General Ventilation Exhausts

The Owens Corning Guelph facility produces a type of E glass known as Advantex.®. Advantex® has a very low environmental footprint compared to other traditional boron containing E glasses. The Owens Corning Guelph facility produces continuous filament fiberglass that is used as a reinforcement in plastic parts.

2.2 Planned Reconfiguration

In addition to the assessment of reduction options related to the hexavalent chromium emissions as part of the technology benchmarking and Site Specific Standard Request, the facility has a planned facility reconfiguration. In the first half of 2016, the facility will be investing approximately $10 million dollars to rebuild a furnace that has been out of service for several years, and to focus their operations on the Continuous Filament Mat (CFM) line. This $10 million investment is not included in the economic feasibility assessment for the individual options presented here.

3. Economic Feasibility Assessment Methodology

This economic analysis is an important component for further evaluation of technically feasible pollution control strategies. The Technical Benchmarking Report and the Economic Feasibility Report are the primary documents for developing the Action Plan for reducing point of impingement concentrations. The economic assessment methodology employed derives a dimensionless value that provides an indicator of Total Resource Effectiveness (TRE) for the POI reduction strategy being evaluated. For each combination, the TRE calculation considers the potential POI reduction that could be achieved, contrasted with the costs required to obtain, install and operate it.

Owens Corning has followed the general guidelines below as provided by the MOECC as part of the economic feasibility assessment. The TRE values provide an indication of the relative effectiveness of potential POI reduction methods, and is useful to assess the relative effectiveness of one option versus another. It is not intended to be a bright-line test.

- TRE values less than 1 generally indicates a reasonably effective use of resources to achieve the POI improvement

- TRE values between 1 and up to about 10 may suggest further consideration is appropriate and/or refinement of assumptions are required

- TRE values over 10 generally indicate the potential POI reduction technique is not a good use of resources and perhaps other options should be considered

4. Total Resource Effectiveness Summary

The following table provides a summary of the Pollution Control Combinations from the Technology Benchmarking Report and their associated rankings along with the TRE values.

Table 1 Options Ranked by TRE Values

Pollution Control Strategy Description	Rank (by POI Reduction)	TRE Value
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	1	90
Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks combined with conversion of the forehearths to air/gas combustion	2	90
Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks combined with the use of LSC refractory and the installation of more accurate combustion controls in combination with front end superstructures to prevent air ingress	3	74
Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks combined with incorporating more accurate combustion control skids and construction of front end superstructures	4	73
Electrostatic Precipitator (DEP/WEP) or Dust Collector on furnace and forehearth stacks	5	68
Installation of state of the art oxygen/gas combustion controls systems and use of improved superstructure construction techniques for the front end (forehearths). Additional re-engineering of 4 stacks to overcome dispersion challenges.	6	11
Scrubber on forehearth stack, use of Low Sublimation Chromium (LSC) refractory and forehearth conversion to air/gas combustion	7	124
Scrubber on forehearth stack and forehearth conversion to air/gas combustion	8	125
Forehearth conversion to air/gas combustion	9	32
Scrubber on forehearth and LSC and incorporating more accurate combustion control skids and construction of front end superstructures	10	155

Pollution Control Strategy Description	Rank (by POI Reduction)	TRE Value
Scrubber on forehearth stack and incorporating more accurate combustion control skids and construction of front end superstructures	11	160
Incorporating more accurate combustion control skids and construction of front end superstructures	12	16
Scrubber on forehearth	13	265

The details of the economic feasibility assessment, including cost estimate inputs and the calculation of the Total Resource Effectiveness (TRE) are located in Appendix A.

5. Conclusion

The TRE assessment indicates that none of the options would be considered a reasonably effective use of resources to achieve the POI improvement based on MOECC guidelines. However, the following option had the lowest calculated TRE and achieves significant reductions in the POI concentration:

Installation of state of the art oxygen/gas combustion controls systems and use of improved superstructure construction techniques on the front end (forehearths). Additional re-engineering of 4 stacks to overcome dispersion challenges.

The facility has selected this option for implementation and therefore it is the Preferred Option. Further details are provided in the Action Plan.

6. Closure

The economic feasibility assessment presented in this report, in conjunction with the Technology Benchmarking Report, provides the basis for the Action Plan. These separate documents are included in the application requesting a site specific standard for hexavalent chromium.

7. 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.

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Appendix A TRE Calculations (CONFIDENTIAL)

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