Report To: The Chair and Members
Regional Council

Report No.: 2011-MOH-24

Date: July 26, 2011

SUBJECT: EFW Human Health Risk Assessment and $PM_{2.5}$ Emissions

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RECOMMENDATION:

That Regional Council receives this report for information.

REPORT:

1. On June 16, 2011, Ms. Wendy Bracken addressed a Joint Health & Social Services and Finance & Administration Committee meeting regarding $PM_{2.5}$ emissions from the proposed EFW facility and the associated Ambient Air Monitoring and Reporting Plan. Appendix 1 is a copy of Ms. Bracken's remarks.

2. The Joint Committee referred Ms. Bracken's delegation to the Commissioner & Medical Officer of Health (MOH) and requested that he meet with Ms. Bracken to discuss her concerns and to prepare a follow-up report for Council. (The Joint Committee also requested a summary of the MOH's involvement in the EFW Project, which is found in Appendix 2 that was originally prepared for Regional Council's EFW education session). This meeting occurred on June 28. Following the meeting, Ms. Bracken provided the MOH with additional background material.

3. On June 29, Regional Council referred the recommendation of Item 4 of the Eighth Report of the Works Committee back to staff with the request that the report of the MOH requested above be considered at the same time this recommendation is reconsidered by Council.

4. A key request of Ms. Bracken was the need for the dispersion modeling for $PM_{2.5}$ of the human health risk assessment (HHRA) to be updated to include both filterable and condensable $PM_{2.5}$ stack emissions as per the EFW facility's Certificate of Approval (CofA) that was issued by the Ontario Ministry of the Environment (MOE) on June 28, 2011 and for the update to be medically reviewed. These are the focus of this report. The Ambient Air Monitoring and Reporting Plan is addressed in Report #2011-WR-11.

5. The term "particulate matter" (PM) refers to solid or liquid particles in the air. PM has many sources and can be either primary of secondary in origin. Primary PM is emitted directly and can be either course or fine, whereas secondary PM, which tends to be finer in size, is formed in the atmosphere through physical and chemical conversion of gaseous precursors such as nitrogen oxides, sulfur oxides, and volatile organic compounds. The health effects of airborne particles have been vigorously investigated for at least five decades. PM has been linked to numerous adverse health effects including increased hospital admissions and emergency room visits, respiratory symptoms, exacerbation of chronic respiratory and cardiovascular diseases, decreased lung function, and premature mortality (this is discussed further in Appendix 4). PM is a generic term that includes a broad range of physical characteristics and chemical species. For regulatory and scientific purposes, PM is measured according to the mass concentration within a specific size range. $PM_{2.5}$ refers to particles with an aerodynamic diameter no larger than 2.5 microns.

6. Stantec Consulting Ltd. was retained by the Region to update the dispersion modeling for $PM_{2.5}$ of the HHRA. Its report, *Further Evaluation and Updated Risk Assessment for Particulate Matter ($PM_{2.5}$) Facility Emissions* (Stantec report), was reviewed by Intrinsik Environmental Sciences Inc. and is attached as Appendix 3.

7. The specific objectives of the Stantec report were to:

   - Remodel $PM_{2.5}$ ground level concentrations surrounding the proposed facility using the emissions rates from the CofA with the Stantec CALPUFF air model used in the EA.
   - Evaluate potential health risks of updated CofA $PM_{2.5}$ results using the same HHRA methodology used in the EA.
   - Evaluate through quantitative and qualitative methods, the incremental risk associated with environmental loading of $PM_{2.5}$ from the facility.
   - Provide a discussion on the various benchmarks and toxicity reference values that have been used in the EA for $PM_{2.5}$, including those published as the Canadian Council of Ministers of the Environment Canada Wide Standards (CWS) and the World Health Organization (WHO).
   - Provide a comparison of the $PM_{2.5}$ results provided in the HHRA July 2009, December 2009 and those contained within this report and comment on if the updated results would have altered the findings or conclusions of the EA.

11. In addition to including both filterable and condensable $PM_{2.5}$, the updated dispersion modeling included the following updates in the facility design relative to the 2009 HHRA:

- A slight change in the location of the facility (main stack moved ~35 m to the south of the location used in the EA).
- Increase in stack exit velocity (18-23 m/s) due to refinements in the facility design.
- Small changes in background concentration levels for 24-hour and annual average $PM_{2.5}$ due to incorporating MOE comments on the draft report regarding refinements to the data editing and QA/QC process for the ambient measurements.
- Revisions to the process upset scenario assumption to account for the length of time the facility is allowed to operate during a process upset, as specified in the CofA.

9. For the project scenario, the maximum predicted 24-hour period environmental loading from the facility resulted in a worst case increase of only between 2.6% to 4.4% over existing or baseline conditions. The facility would contribute less than 0.3% over baseline conditions on an annual average basis. In addition, the maximum ground level concentration of $PM_{2.5}$ increased slightly from 0.53 $\mu g/m^3$ in the December 2009 EA to 0.90 $\mu g/m^3$ in the CofA for the 24-hour period and from 0.02 $\mu g/m^3$ in the EA to 0.03 $\mu g/m^3$ for the annual average concentrations.

10. For the process upset scenario, there was virtually no change in the annual average $PM_{2.5}$ between the 2009 and 2011 model runs. Environmental loading ranges from 11% to 26% for the 24-hour $PM_{2.5}$ and 0.2% to 0.4% for annual average $PM_{2.5}$, respectively. The CofA upset conditions result in the maximum predicted 24-hour $PM_{2.5}$ concentration decreasing form the 2009 EA value of 5.3 $\mu g/m^3$ to 2.3 $\mu g/m^3$. There was an insignificant increase to 0.4% of baseline conditions in the annual average concentrations using the CofA scenario versus the original 0.2% increase over baseline determined in the EA.

11. The Stantec report concluded that:

- Changes in the modeling input parameters from the CofA process from that of the EA resulted in insignificant concentrations of the ground level concentration of PM in the environment.
- $PM_{2.5}$ is likely a non-threshold contaminant and that air quality guidelines or benchmarks are the only approach available to restricting unwanted significant increases in the environment.
- The updated dispersion modeling of $PM_{2.5}$ does not alter the original conclusions of Stantec in that exposure to facility-related air emissions will not result in adverse health effects to human receptors living or visiting the local risk assessment study area (study area).

12. On July 5, Dr. Ray Copes, Scientific Director, Environmental and Occupational Health, Public Health Ontario (Ontario Agency for Health Protection and Promotion) accepted a request by the MOH to medically review the Stantec report. Dr. Copes correspondence is attached as Appendix 4. In addition to

receiving the report, Dr. Copes and his medical review team had full access to all relevant environmental assessment (EA)/HHRA documents, including all of Ms. Bracken's related correspondence. Those used in Dr. Copes' team's review are appended to his correspondence.

13. In Appendix D of Report #2009-COW-01, with respect to a May 2009 draft HHRA (140,000 tonnes scenario only), the MOH posed the following questions: "What are the human health risks? Are the health risks acceptable and if so, according to what standards? If the health risks are acceptable, can the proposed EFW facility be considered "safe"? (Appendix 5).

    Dr. Lesbia Smith and Mr. Ross Wilson, his peer reviewers, concluded that "...this industrial installation, if it performs as specified and assumed in the SSHHRA, will not pose unacceptable risks to persons in the vicinity of the site, and by extension, to those residents beyond. Said differently, this installation as proposed will not pose an unacceptable public health risk." In order to scope his work, the MOH asked Dr. Copes whether the above conclusion is still valid for the updated HHRA for $PM_{2.5}$.

14. To answer this question, Dr. Copes' team reviewed the updated modeling for emissions and ground-level concentrations for $PM_{2.5}$ in the Stantec report. They also reviewed the conclusions of Dr. Smith and Mr. Wilson and those of the December 2009 HHRA with respect to $PM_{2.5}$.

15. Rather than assess risk based on the CWS and WHO benchmarks for $PM_{2.5}$ as per the Stantec report, Dr. Copes' team calculated increased mortality for the project and process upset scenarios. Information provided in the *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide* (2006) was used to derive a factor relating increases in mortality to unit increases in ambient air concentrations of $PM_{2.5}$.

16. For the project scenario (2011), an annual average concentration of $PM_{2.5}$ of 0.01 $\mu g/m^3$ over all receptor locations, increases mortality by 0.004-0.02% or an additional number of deaths of 0.01-0.06 per 100,000 persons or 0.02-0.1 deaths per population in the study area (168,000). For the process upset scenario (2011), an annual average concentration of $PM_{2.5}$ of 0.013 $\mu g/m^3$ over all receptor locations, increases mortality by 0.0026%-0.0143% or an additional number of deaths of 0.01-0.08 per 100,000 persons or 0.02-0.1 deaths per population in the study area. In his correspondence, Dr. Copes discusses several caveats that apply to these figures.

17. With respect to acceptable risk, in answer to the question posed by the MOH, Dr. Copes concluded that the risks cited above are "within the range deemed acceptable by regulatory authorities. In that respect, our assessment and conclusion is consistent with that reached earlier by Dr. L. Smith and Mr. R. Wilson." He cautions, however, that "acceptability is very much in the 'eye of

the beholder' and for some groups and individuals it is unlikely that any degree of risk is acceptable."

18. In conclusion, the updated dispersion modeling for $PM_{2.5}$ by Stantec coupled with the risk characterization by Dr. Copes and his team support the original conclusion of Dr. Smith and Mr. Wilson that the EFW facility as proposed will not pose an unacceptable public health risk.

Respectfully submitted,

R.J. Kyle, MD, MHSc, CCFP, FRCPC
Commissioner & Medical Officer of Health

Delegation to Joint Committee - Health & Social Services and Finance & Administration

By Wendy Bracken

Thank you, Committee Members, for hearing my delegation this morning.

Earlier this year, I appeared before the Health and Social Services and the Finance & Administration Committees as well as Regional Council and I asked that Council Members please do their due diligence and provide proper oversight of the Certificate of Approval applications as there were many important outstanding concerns remaining after the Environmental Assessment (EA) approval. Most recently, I brought to the attention of the Finance and Administration Committee through a delegation, and to all Regional Council members who had copies of that delegation, that the fine particulate (PM2.5) emissions in the C of A applications are almost two and one-half (2.5) times the PM2.5 emissions evaluated and assessed for health risk in the EA. I don't believe any action was taken regarding these concerns.

I am here today to tell you that 1) all of the concerns I brought forward then still stand and more concerns have been identified and 2) the state of the art monitoring Durham Regional Council committed to is NOT in the C of A applications.

Increased Emissions

I will take a few moments and remind you about the major concern of the fine particulate (PM2.5) emissions:

- The EA emissions are materially different from those used in the C of A application.
- The EA emissions were based on a PM2.5 stack concentration of 9 mg/Rm^3; the C of A application emissions were based on a PM2.5 stack concentration of 21 mg/Rm^3.
- In annual terms, the EA assessed risk for 11 tonnes of PM2.5 per year; the C of A application annual emissions calculate to 28 tonnes of PM2.5 per year.
- PM2.5 was a critical pollutant of concern in the EA and the risk assessment of PM2.5 was very controversial and strongly criticized by the Clarington expert peer reviewers, by MOE reviewers (until the facility was downsized) and by the public. The main criticism was that the risk for PM2.5 was characterized using an air quality criteria value instead of an appropriate, health-based toxicity reference value. For PM2.5, the Regions' consultants used the Canada Wide Standard (CWS) air quality benchmark, which is NOT a toxicity reference value and which is NOT a health-based standard. It is simply a number chosen by Canadian authorities as a reasonable benchmark to achieve by a certain date, and which may be revised to a more stringent value later in time as the initial benchmark is met. This benchmark was established as Canadian authorities recognized

there was a problem with current levels of PM2.5 in our air and adverse health effects. The CWS is 30 $\mu g/m^3$. This does not mean that you can get up to 30 with no adverse health effects. PM2.5 is recognized by experts and government bodies, including Health Canada and the CCME (Canadian Council of the Ministers of the Environment) to be a non-threshold pollutant which means adverse health effects may be observed at any level of exposure. Adverse health effects are observed at exposures much lower than 30 $\mu g/m^3$.

- Ambient levels of PM2.5 measured at the Courtice monitoring station for the EA are:

    - **Annual average PM2.5 measured at Courtice = 10.2 $\mu g/m^3$**
      (*Final Report on Ambient Air Monitoring At the Courtice Road Site, December 4, 2009, Durham/York Residual Waste EA*)
      This level exceeds the World Health Organization Benchmark of 10 $\mu g/m^3$ for annual average PM2.5.
      Annual average concentration measurements reflect chronic exposures (day in, day out).

    - **24-hour, 98th percentile PM2.5 concentration measured at Courtice = 28.6 $\mu g/m^3$**
      (*Air Quality Assessment Technical Study Report, December 2009, Durham/York Residual EA*)
      This level is marginally below the Canada Wide Standard of 30 $\mu g/m^3$, which, again, is not a health based standard. This standard is also a 98th percentile standard, yet the consultant used a 90th percentile predicted concentration to compare against the CWS for compliance.
      Victor Low, Director of Section 9 Approvals at the MOE stated in his review of the EA that the monitored PM2.5 data at Courtice only marginally complies with applicable ministry limits. (Mr. Low's September 25, 2009 comments can be found in the MOE's *Review of the Durham and York Residual Waste Study Amended Environmental Assessment, February 2010)*
      These 24-hour, 98th percentile measurements reflect more acute, shorter term exposures.

- As I was preparing my comments on the C of A applications, I discovered another problem with the EA. There were problems with the raw data in the EA submitted in July, 2009 and amendments were made to the data which affected the baseline measurements. The amended, corrected values are documented in the *Final Report on Ambient Air Monitoring At the Courtice Road Site, December 4, 2009, Durham/York Residual Waste EA.* These updated and corrected values for PM2.5,

NO2 and ozone were NOT however, corrected in the *Final Human Health and Ecological Risk Assessment, December 2009.* This is a major error since, had the correct measurement been used, risk would have been identified for the annual average PM2.5 when WHO benchmarks are used to characterize risk. I would also remind you that potential risk to human health was identified in the EA for Respiratory Irritants. Furthermore, risk was also identified in the EA for PM2.5 in the Process Upset Project Case, and for NO2 in the Baseline Traffic Case when World Health Organization Benchmarks were used as TRVs.

All of the above is BEFORE the PM2.5 emissions in the C of A applications increased to be almost 2.5 times what they were in the EA.

This means that the EA assessed risk for less than half of the PM2.5 emissions.
The EA only assessed risk for filterable PM2.5. It did NOT include condensable PM2.5.

The Ministry of Environment's *Guideline A-7 Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal Treatment Facilities, October 2010*, lists typical tests contaminants at municipal waste thermal treatment facilities in Appendix 1. For Particulate Matter in that list, the Guideline clearly states "Total suspended particulate matter, including condensables". The U.S. EPA manual also clearly specifies that primary particulate matter is the sum of filterable and condensable particulates.

There has been NO risk assessment of these increased emissions. There has been NO medical review of these increased emissions.

Council members must understand that the C of A application only partially assessed these increased emissions *for compliance* against a standard that is not even health based. This is completely different than a *medical* review. The consultant involved with the C of A application can only speak to compliance, and not to the health effects of these increased emissions. These increased emissions have not been put into an inhalation assessment, nor a multi-pathway assessment, and they have not been scrutinized by the government reviewers such as Health Canada and other reviewers as was done in the EA. This is completely unacceptable.

MONITORING

The monitoring proposed in the C of A application does not contain the state of the art monitoring Regional Council committed to.

Section 3-2 of the MOE's *Guideline A-7 Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal Treatment Facilities, October 2010* provides for continuous monitoring for particulate matter, organic matter and mercury. The C of A application however, does NOT include continuous monitoring for these pollutants of high concern. Since they are not down to be continuously monitored, if approved as proposed in the Cof A applications, these pollutants would likely only be monitored once a year during an annual stack test.

Furthermore, in the *Guideline A-7*, the Ministry encourages continuous monitoring of particulate matter and mercury.

It is stated in Section 3-2 that:

> *"**The Ministry encourages the use of high sensitivity continuous particulate matter monitoring systems over opacity monitoring since particulate emissions have a direct environmental impact.**"*

The C of A application, however, only proposes opacity monitoring. Opacity monitoring is a very crude way of measuring particulates.

Section 3.2 of the Guideline also contains the statement:

> *"**Proponents for thermal treatment of municipal waste are encouraged** to explore technical developments with respect to **continuous or long-term sampling/monitoring techniques** and consider installation of such devices for measurement of emissions of **mercury** and **dioxins/furans**."*

Mercury is a pollutant of high toxicity and of great concern with a municipal incinerator, especially since there is no pre-sort of the waste planned.

I will remind Councillors of the January 28, 2008 Durham Regional Council resolution commitment to protect the health of Clarington and Durham residents " by incorporating into the design and installation of the EFW facility the most modern and state of the art emission control technologies that meet or exceed the European Union EU monitoring and measuring standards" and that Council requested that the parties involved "commit to including in the Request for Proposals **and Certificate of Approval**, Maximum Achievable Control Technology (MACT) for the emission standards and monitoring of the EFW facility".

Continuous emissions monitoring devices for particulate matter, organic matter and mercury do exist. The technology is available, it is recognized by the MOE and, in the case of particulate

matter and mercury, continuous emissions monitoring is clearly ENCOURAGED by MOE. Continuous monitoring of these pollutants should have been included in the C of A applications.

Lastly, I want to express my concern that the Emissions Monitoring Plan and Ambient Air Monitoring Plan, both of which are required to satisfy conditions of the Minister's approval, have not been finalized and were not available prior to the C of A application submission. I believe the Regions have requested that they be allowed to submit these important plans one month following C of A approval (if granted). This seems very backwards to me. Councillors and the public needed to see these plans in advance of the C of A applications. Commitments to ambient air and soil monitoring which are not captured in the C of A applications may not be legally binding. This is a concern since Durham, York and Covanta all filed separate applications. What happens if the facility is sold to private interests, as is the case with the Brampton incinerator? Durham commitments, not captured in the C of A applications, could go by the wayside. This is complicated and needs much oversight.

Thank you for your attention to my delegation and I hope you will act to address these concerns.

Energy From Waste (EFW) and Human Health

Durham Region Health Department (DRHD) and Health & Social Services Committee (HSSC)

Dr. Robert Kyle
Commissioner & Medical Officer of Health

July 26, 2011

General Considerations

- Durham Region Long Term Waste Management Strategy Plan: 2000 - 2020
- Legislation, Regulation and Standards
- Independence
- In-House Scientific and Technical Expertise
- Durham Nuclear Health Committee

Timeline

Phase I	• June – October 2007 • Generic Human Health Risk Assessment and Halton EFW Business Case
Phase II	• July 2008 – March 2009 • International EFW Environmental Surveillance Best Practices Review (IBPR)
Phase III	• April 2009 – February 2010 • Site Specific Human Health Risk Assessment (SSHHRA)

Phase I

- Generic Human Health Risk Assessment and Halton EFW Business Case

June 20, 2007
- Medical Officer of Health (MOH) asked to comment on the above

June 28, 2007
- Dr. Lesbia Smith contracted to review the above and to provide advice on environmental surveillance

Sept 6, 2007
- Report 2007-MOH-20, including Dr. Smith's report, presented to HSSC

Phase I

- Generic Human Health Risk Assessment and Halton EFW Business Case

Sept 28, 2007

- Dr. Smith's report is amended to clarify her remarks regarding plastics in the waste stream

October 18, 2007

- 2004 Fast Facts on Asthma (updated in December 2007) presented to HSSC

Phase II

- International EFW Environmental Surveillance Best Practices Review (IBPR)

July 8, 2008

- Dr. Smith contracted to review the Draft Study Protocol, IBPR, and the Site Specific Human Health Risk Assessment

Sept 30, 2008

- DRHD comments on Draft Study Protocol forwarded to Jacques Whitford (JW)

Oct 7, 2008

- Draft Study Protocol presented to HSSC by JW

Nov 2, 2008

- DRHD comments on Final Study Protocol forwarded to JW

Phase II • IBPR

- Nov 3, 2008: • Memo from JW re Annual Emissions from the GHHRA Facility Model presented to HSSC
- Jan 1, 2009: • DRHD comments on Draft IBPR forwarded to JW
- March 24, 2009: • Report 2009-J-17 re: EFW Environmental Surveillance Best Practices Review presented to HSSC & Works Committee

Phase III • Site Specific Human Health Risk Assessment (SSHHRA)

- Apr 24, 2009: • Ross Wilson, Toxicologist, retained to assist with the MOH's peer review of SSHHRA
- May 15, 2009: • Draft SSHHRA publicly released
- May 29, 2009: • Final Draft SSHHRA publicly released

Phase III • SSHHRA

- June 16, 2009: Report 2009-COW-1: EFW Risk Assessment and Environmental Surveillance presented to the Committee of the Whole and
- June 24, 2009: Report 2009-COW-1 presented to Regional Council
- June 25, 2009: Durham/York Residual Waste Study (DYRWS) EA approved by Regional Council
- July 15, 2009: Dr. Smith's/Ross Wilson's comments on the June 11 version of the SSHHRA forwarded to JW

Phase III • SSHHRA

- July 31, 2009: DYRWS EA submitted to the Ontario Ministry of the Environment
- Aug 25, 2009: MOH comments on the DYRWS EA forwarded to the Government Review Team (GRT)
- Feb 26, 2010: GRT review of the DYRWS EA completed

Summary and Next Steps

- DRHD and H&SSC have been continually involved in the human health risk assessment and environmental surveillance components of the DYRWS EA
- DRHD is participating in the development of the EFW C of A and Ambient Air Monitoring and Reporting Plan
- DRHD will participate on the proposed Integrated Waste Management Committee

Stantec

Further Evaluation and Updated Risk Assessment for Particulate Matter ($PM_{2.5}$) Facility Emissions

DURHAM YORK RESIDUAL WASTE STUDY

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July 20, 2011

Project No. 1009497

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1 INTRODUCTION AND BACKGROUND

The Durham/York Residual Waste Study was initiated jointly by the Regions of Durham and York in 2005 to identify a long-term sustainable solution to manage the solid waste remaining after reuse, reduction and recycling (including composting) initiatives. Due to the limited landfill capacity in Ontario and the growing opposition to landfill sites by residents, Durham and York Regions decided to pursue innovative alternatives to waste disposal methods in an environmentally safe and sustainable manner. The Regions partnered to initiate a comprehensive study that addressed the social, economic and environmental concerns of residents through an Environmental Assessment (EA) process under the Environmental Assessment Act.

The EA was initiated after the terms of reference were approved on March 31, 2006. During the EA process it was established that an Energy-From-Waste (EFW) Thermal Treatment Facility (the Facility) was the preferred option for dealing with the Regions' residual solid waste. The EA and accompanying Technical Study Reports were submitted to the Ministry of the Environment (MOE) on July 31, 2009 after approval from both Durham and York Regional Councils. Following an extensive public consultation process and review period by the MOE, a final amended EA was submitted to the MOE for review on November 27, 2009.

The Human Health and Ecological Risk Assessment (HHERA) Technical Study Report of the EA, which was prepared to evaluate the potential human health and ecological related impacts associated with the development of the Facility, was first submitted to the MOE in July 2009 (Stantec, 2009a) and was updated based on public and MOE input on December 10, 2009 (Stantec, 2009b).

The Ministry announced the acceptance of the EA on November 19, 2010, which allowed the project to proceed to the permitting, design, construction and operation of the facility. Subsequent to the EA approval, the Certificate of Approval (CofA) application for Air for the Facility was submitted to the Ministry of the Environment (MOE) on March 3, 2011 and approved on June 28, 2011. Construction of the 140,000 ton/year Facility is scheduled to begin in 2011and be fully operational by 2014.

2 OBJECTIVES AND SCOPE OF WORK

Throughout this multi-year process there have been a number of minor alterations or changes in variables used in the air modelling exercises between the EA and the CofA. Although this is common in such a regulatory process as more facility-specific information becomes available, it has resulted in questions being raised by a concerned citizen about the validity of the risk assessment findings for Particulate Matter <2.5 µm ($PM_{2.5}$). There also appears to have been some confusion as to the chronology of information on $PM_{2.5}$ contained within the various risk assessment versions that were prepared for review by the Regions and the MOE.

The specific objectives of this report were to:

1. Remodel $PM_{2.5}$ ground level concentrations surrounding the proposed facility using the emissions rates from the CofA with the Stantec CALPUFF air model used in the EA.

2. Evaluate potential health risks of updated CofA $PM_{2.5}$ results using the same HHRA methodology used in the EA.

3. Evaluate through quantitative and qualitative methods, the incremental risk associated with environmental loading of $PM_{2.5}$ from the Facility.

4. Provide a discussion on the various benchmarks and toxicity reference values that have been used in the EA for $PM_{2.5}$, including those published as the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standards (CWS) and the World Health Organization (WHO).

5. Provide a comparison of the $PM_{2.5}$ results provided in the HHERA July 2009, December 2009 and those contained within this report and comment on if the updated results would have altered the findings or conclusions of the EA.

Overall, the intention is to provide Durham Region Council, the Medical Officer of Health (MOH) of Durham Region, and the public clarity on the potential health issues surrounding potential $PM_{2.5}$ emissions from the Facility.

3 RISK ASSESSMENT OF $PM_{2.5}$ FACILITY EMISSIONS

Overall, the risk assessment and air quality evaluations presented in this report follow those that were provided in the Technical Study Reports prepared during the EA. Therefore, for further details on approach and models one should reference the original reports at http://www.durhamyorkwaste.ca/amended_ea_study_doc.htm.

3.1 Updated Ground Level Air Concentrations of $PM_{2.5}$

The Stantec Air Quality Team has updated the dispersion modelling of $PM_{2.5}$ as its emission rate changed since the Air Quality Assessment Technical Study Report in July, 2009 (Stantec, 2009c) and December, 2009 (Stantec, 2009d). This was primarily due to subsequent refinements in the Facility design and additional data becoming available during the completion of the CofA.

During the EA, filterable $PM_{2.5}$ stack emissions (particulate that is directly emitted from the stack) were assessed and modelled. This approach is consistent with the A-7 Guideline and was agreed upon with the MOE reviewers at the time of modeling. However, during preparation of the CofA, based on the availability of additional information both the filterable $PM_{2.5}$ emissions and condensable particulate emissions (particulate that forms in the atmosphere as vapours in the stack plume cool and condense) were modeled. Therefore, the updated modelled emission of $PM_{2.5}$ in this report includes both the filterable and the condensable particulates (assumed to be primarily in the <2.5 µm size fraction).

The updated dispersion modelling of $PM_{2.5}$ also included the following updates in the facility design relative to the 2009 EA assessment:

- A slight change in the location of the facility (main stack moved about 35-m to the south of the location used in the EA);
- Increase in stack exit velocity (18 to 23 m/s) due to refinements in the facility design. This is a beneficial change as it increases plume momentum rise resulting in lower ground level concentrations;
- Small changes in background concentration levels for 24-hour and annual average $PM_{2.5}$ due to incorporating MOE comments on the draft report regarding refinements to the data editing and QA/QC process for the ambient measurements; and,
- Revisions to the process upset scenario assumption to account for the length of time the facility is allowed to operate during a process upset, as specified in the Facility CofA.

Dispersion modelling of $PM_{2.5}$ was conducted for the following emissions scenarios:

- Facility operating at 110% of the Maximum Continuous Rate (MCR); and,
- Process upset conditions.

Dispersion modeling was conducted using the CALPUFF model to predict ground level concentrations (GLC) of $PM_{2.5}$ and is appropriate for short and long range dispersion predictions (U.S. EPA, 2007; Scire et al., 2000). The results of the dispersion modelling determined that the predicted maximum ground level concentration (MGLC) of $PM_{2.5}$ were still below its applicable air quality criteria for all emission scenarios examined. The MGLC predicted for 24-hour average cumulative air quality level (facility plus background) for the 110% MCR operating condition increased by 3% over that assessed in the 2009 EA, while the maximum predicted change in annual average concentration continued to be negligible relative to baseline (current) air quality levels. The detailed dispersion modelling results including maximum predicted levels over a 30-km by 40-km domain surrounding the proposed Facility, as well as concentration levels at 391 sensitive receptors were provided to the risk assessment group for use in this updated HHRA.

Health risks were evaluated for both short-term (i.e., 24-hour) and long term (annual) exposure scenarios at the maximum ground level concentration. Predicted air concentrations for all 391 sensitive receptors are provided in Appendix A.

3.2 Background Air, Facility Emissions and Loading to the Environment

When characterizing emissions from the Facility it is important to have an established baseline (background) to determine loading on to the environment. As described in Section 3.4.1.1 of Stantec (2009), ambient air (i.e., baseline air) was collected at an air monitoring station within the vicinity of the proposed facility. A number of criteria air contaminants, including $PM_{2.5}$, were collected at this station. As described in Section 3.1 above, minor refinements to the data editing and QA/QC process for the ambient measurements were completed at the time the final risk assessment (Stantec, 2009b) was submitted resulting in a slight increase in $PM_{2.5}$ baseline annual average concentration to 10.2 $\mu g/m^3$. This was not quantitatively carried forward in the final HHERA as it was a minor change in baseline concentration and not from Facility emissions.

The sections below outline the minor changes in air concentrations for $PM_{2.5}$ in baseline air and facility-related emissions between the July 2009, December 2009 and July 2011 dispersion modelling events. In addition, percentage loading of emitted $PM_{2.5}$ from the Facility to the background environment is presented.

3.2.1 Project Scenario

For the Project Scenario (see Section 3.4.3 in Stantec, 2009d), Table 3.1 provides the background or baseline concentration of $PM_{2.5}$ and the MGLC modeled from Facility emissions and the percentage increase represented by the addition of the Facility levels over baseline.

Table 3.1 Concentrations of Baseline $PM_{2.5}$, Maximum Ground Level Concentrations from the Facility Emissions and Percent Loading to the Environment – Project Scenario

	July, 2009			December, 2009			July, 2011		
PM2.5	Baseline $\mu g/m^3$	Project $\mu g/m^3$	Loading %	Baseline $\mu g/m^3$	Project $\mu g/m^3$	Loading %	Baseline $\mu g/m^3$	Project $\mu g/m^3$	Loading %
24-hour	20.4	0.53	2.6	20.4	0.53	2.6	20.6	0.90	4.4
Annual	9.80	0.02	0.2	10.2	0.02	0.2	10.2	0.03	0.3

These minimal loadings of $PM_{2.5}$ are further illustrated in Figures 1 and 2. The maximum predicted 24-hour period environmental loading from the Facility resulted in a worst case increase only between 2.6 to 4.4% over existing or baseline conditions. The Facility would contribute less than 0.3% over baseline conditions on an annual average basis.

In addition, the MGLC of $PM_{2.5}$ increased slightly from 0.53 $\mu g/m^3$ in the December 2009 EA to 0.90 $\mu g/m^3$ in the CofA for the 24-hour period and from 0.02 $\mu g/m^3$ in the EA to 0.03 $\mu g/m^3$ in the CofA for the annual average concentrations. These increases are considered to be insignificant in comparison to the existing baseline or background concentrations of $PM_{2.5}$.

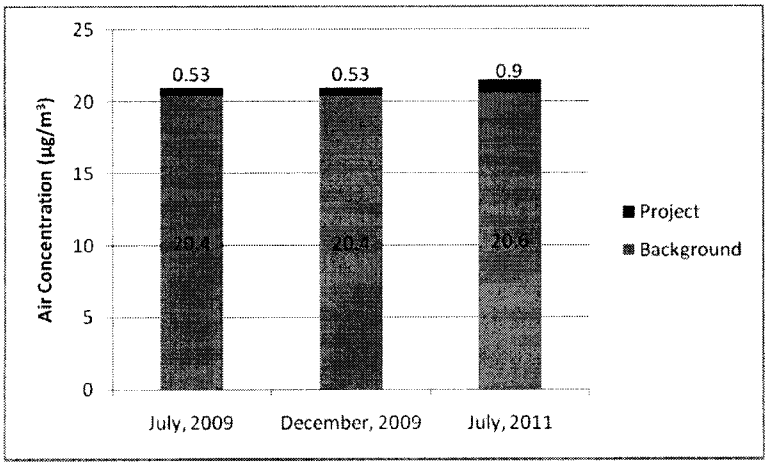

Figure 1. 24-hour average air concentrations from background sources and the Facility – Project Scenario

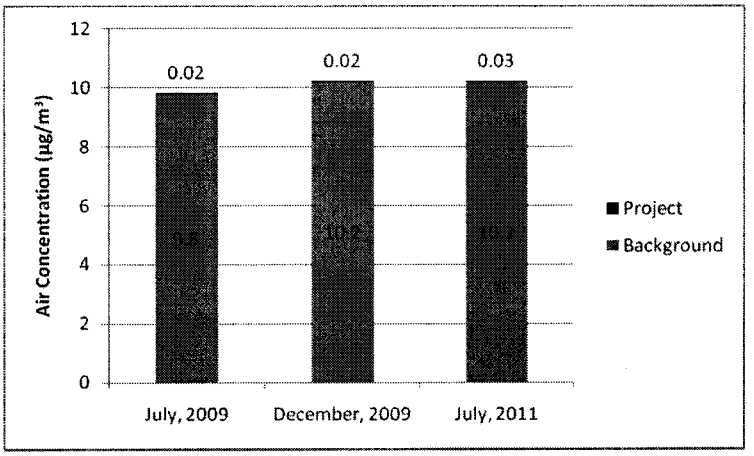

Figure 2. Annual average air concentrations from background sources and the Facility– Project Scenario

3.2.2 Process Upsets Scenario

As described in Section 3.4 of Stantec (2009), the "process upset" case represents emissions from the Facility running at upset conditions for 20% of the year (i.e., no operating pollution control). Table 3.2 shows total facility emissions of $PM_{2.5}$ (under upset conditions) at the MGLC compared to background air concentrations for each of the dispersion modelling events; predicted loading to the environment is also provided.

The process upset scenario was updated for the July 2011 analysis based on the CofA condition that the facility cannot operate above Guideline A-7 limits for more than 3 hours without being shutdown. The July 2011 scenario continued to conservatively assume that that process upsets could occur 20% of the days of the year (i.e., 73 days), but for daily and annual emissions the scenarios are now based on the process upset occurring for 3 hours (followed by an hour to shut down) rather than uncontrolled release of pollutants for the whole 24-hours.

There was virtually no change in the annual average $PM_{2.5}$ between the 2009 and 2011 model runs.

Table 3.2 Background air, Facility Emissions Maximum Ground Level Concentrations and Loading to the Environment – Process Upsets Scenario

	July, 2009			December, 2009			July, 2011		
PM2.5	Background µg/m³	Upset µg/m³	Loading %	Background µg/m³	Upset µg/m³	Loading %	Background µg/m³	Upset µg/m³	Loading %
24-hour	20.4	5.3	26.0%	20.4	5.3	26.0%	20.6	2.3	11.2%
Annual	9.8	0.02	0.2%	10.2	0.02	0.2%	10.2	0.04	0.4%

Similar to the project case described above, there is minimal loading to the environment, when comparing emissions from the Facility, during upset conditions, to background air concentrations. As depicted in Figures 3 and 4, environmental loading ranges from 11 to 26% for 24-hour $PM_{2.5}$ and 0.2 to 0.4% for annual average $PM_{2.5}$, respectively. These increases are considered to be quite low given that they are upset conditions during which pollution control equipment may not be in operation.

It can also be seen that incorporation of the updated CofA Upset Conditions results in the maximum predicted 24-hour average $PM_{2.5}$ concentration decreasing from the 2009 EA value of 5.3 µg/m^3 to 2.3 µg/m^3. There was an insignificant increase to 0.4% of baseline conditions in the annual average concentrations using the CofA scenario versus the original 0.2% increase over baseline determined in the EA.

Overall, the remodeling of $PM_{2.5}$ concentrations using the CofA emission rates and operating conditions, rather than those presented in the final Air Quality Assessment Technical Study Report of December 2009 did not change any of the findings or conclusions drawn in the EA process.

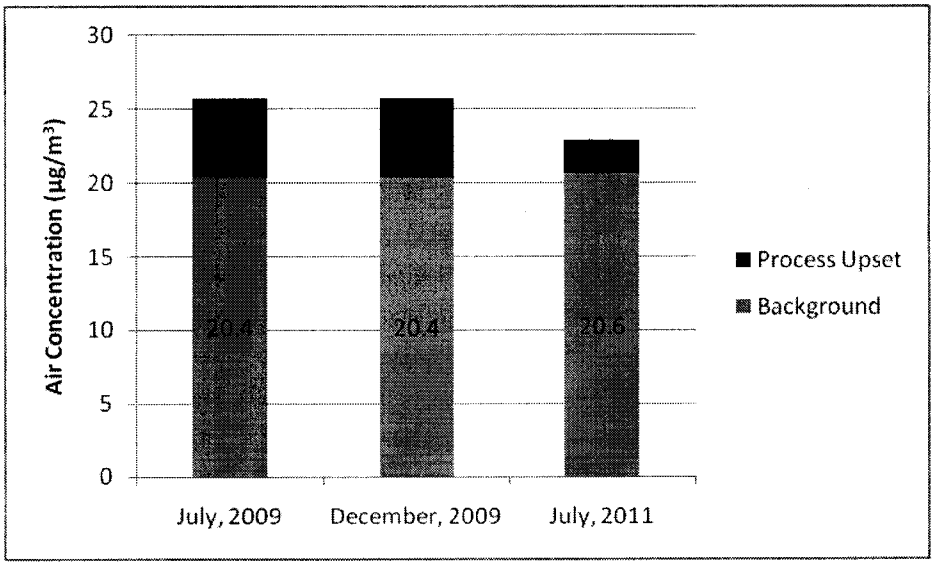

Figure 3. 24-hour average air concentrations from background sources and the Facility – Process Upset Scenario

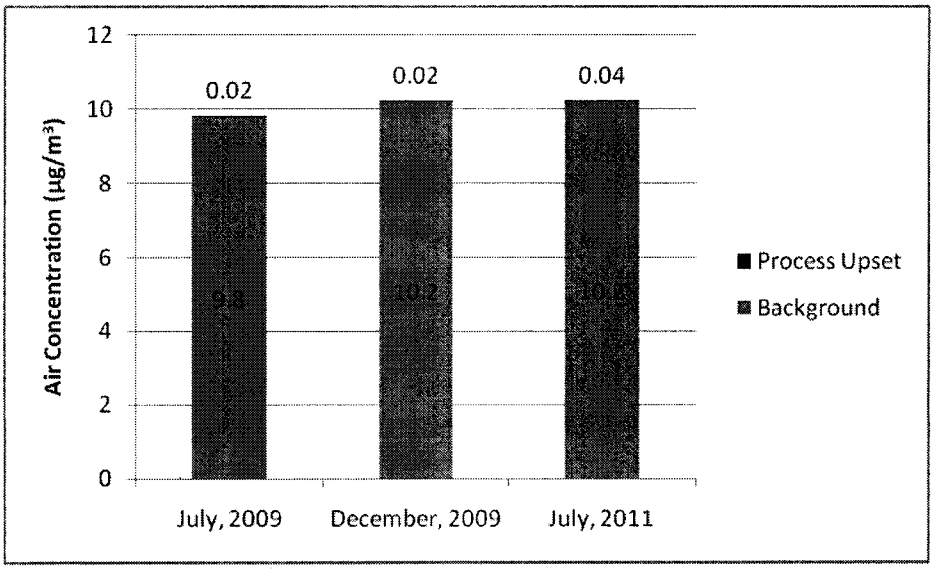

Figure 4. **Annual average air concentrations from background sources and the Facility – Process Upset Scenario**

3.2.3 Area Average Concentrations

At the request of Public Health Ontario (PHO), Stantec calculated maximum 24-hour and annual PM2.5 concentrations spatially averaged over a 10-km radius from the proposed Facility site (Table 3.3). In the dispersion model, a series gridded receptors with spacings ranging from 20-m to 1000-m were used (with densely spaced receptors located close to the proposed site in order to capture maximum ground level concentrations). To calculate the spatially averaged concentration within 10 km of the Project site, the maximum predicted ground level PM2.5 concentration at each receptor point within 10 km of the site was multiplied by a factor corresponding to its area of influence (which varied depending on the receptor spacing) normalized by the total area in the 10-km radius (i.e. area weighting of each receptor prediction). The area weighted concentrations at each receptor were then aggregated to arrive at the spatially averaged $PM_{2.5}$ concentration within the 10 km radius.

Table 3.3 **Maximum 24-hour and annual PM2.5 concentrations spatially averaged over a 10-km radius from the proposed Facility site.**

Averaging Period	Project Case	Process Upset Case
Max 24-hour PM2.5 Concentration (ug/m3)	0.3	0.8
Max Annual PM2.5 Concentration (ug/m3)	0.01	0.013

3.3 Population Estimates for 10 km Radius Surrounding Facility

At the request of PHO Stantec provided an estimate of the number of people that live within a 10 km radius of the Facility. The Canadian 2006 census data and local population data sources were used to estimate the number of people in the 10 km radial area. This area includes those living Bowmanville, Courtice and the southeast part of Oshawa (i.e. from the census the Oshawa Electoral District) (Table 3.4).

Table 3.4 Population Statistics for surrounding the Facility.

Area	Population	Population Density/square Km	Source
Durham Region	561,258	222.4	Statistics Canada, 2006 Census of Canada
Clarington	77,820	127.3	Statistics Canada, 2006 Census of Canada
Bowmanville	31,600	Not available	Clarington, 2010 (Table 6)
Courtice	23,200	Not available	Clarington, 2010 (Table 6)
Oshawa Electoral District	113,662	Not available	Oshawa Electoral District, 2008

Notes:
Clarington 2010. Clarington Community Forecast – Population and Employment Projects. Online: http://www.clarington.net/ourplan/discussion-papers/HEMSON%20-%20Consolidated%20Clarington%20Community%20Forecast.pdf
Oshawa Electoral District, 2008. Online: http://www.durhamregion.typepad.com/oshawa_riding/

Based on the above population statistics and considering the study area (10 km), the population in the study area was approximated as follows:

- Bowmanville + Courtice + Oshawa Electoral District = 31,600 + 23,200 + 113,662 = **168,462**

3.4 Toxicity and Air Quality Guidelines/Benchmark Assessment of $PM_{2.5}$

For the purpose of this assessment, Toxicity Reference Values (TRVs) are defined as doses of chemicals or regulatory benchmarks that receptors can be exposed to without the development of unacceptable health effects. However, for some chemicals and some jurisdictions health-based inhalation TRVs were not available and only air quality benchmark concentrations were available. Benchmark concentrations are set by regulatory authorities as limits that may, or may not include consideration of potential to affect human health. The type of value used in the HHRA was clearly identified in the December 2009 version of the HHERA report.

The toxicity of a chemical often depends on whether or not exposure has been acute (short-term) or chronic (long-term) and TRVs need to be differentiated accordingly.

- **Acute:** The amount or dose of a chemical that can be tolerated without evidence of adverse health outcomes on a short-term basis. These limits are routinely applied to conditions in which exposures extend from minutes through several hours or several days only (ATSDR, 2006). For HHRA, acute $PM_{2.5}$ risks were evaluated based upon 24-hour exposure periods. No regulatory criterion for $PM_{2.5}$ on a 1-hour basis could be located.

- **Chronic:** The amount of a chemical that is expected to be without health outcomes, even when exposure occurs continuously or regularly over extended periods, possibly lasting for periods of at least a year, and possibly extending over an entire lifetime (ATSDR, 2006). For the current assessment, $PM_{2.5}$ risks will be evaluated based upon annual exposure periods.

TRVs and inhalation benchmarks for $PM_{2.5}$ were available from multiple regulatory agencies, all of which were reviewed and professional judgment of an experienced toxicologist was used to select the most appropriate TRV. The most critical considerations in selecting TRVs were the source (it must be derived by a reputable agency), the data used to derive the limit, the date the TRV was derived and its relevance in terms of duration and route of exposure.

$PM_{2.5}$ is a unique contaminant of concern with regards to its toxicology. Epidemiological studies have indicated that there is little evidence that the dose-response curve for PM includes a threshold (Health Canada, 1998). The lack of a threshold at low concentrations suggests that it is difficult to identify a level at which no adverse effects would be expected to occur as a result of exposure to particulate matter.

Exposure studies have shown that inhalation of particulate matter may have direct effects on the respiratory tract including (WHO, 2005):

- Production of an inflammatory response;
- Hyperreactivity (exacerbation of existing airway disease);
- Impairment of pulmonary defense mechanisms;
- Increase production of antigen-specific immunoglobulins; and,
- Affect the ability of the lungs to handle bacteria.

It is recognized by the authors that $PM_{2.5}$ is a contaminant that may not be characterized as a standard threshold toxicant. Thus, published health-based standards should be considered more as

benchmarks, rather than TRVs. The two primary sources of regulatory benchmarks used in the HHERA of the EA included those published by the CCME and the WHO.

In terms of chronology of events, the original DRAFT Human Health and Ecological Risk Assessment, May 2009 that was provided to the peer reviewers and the MOE included only consideration of the CWS benchmark. This was deemed appropriate at the time given that the WHO benchmarks defer to those set by individual countries. However, Senes Consulting Ltd. indicated in their review that they would prefer that the WHO benchmarks for all relevant contaminants be considered in the HHERA. Therefore, the final version of the HHERA that was presented to Durham Regional Council on June 22, 2009 included comparison of the $PM_{2.5}$ modelled air concentrations to the WHO benchmarks. This comparison was subsequently carried forward in the July 2009 and the December 2009 versions of the HHERA provided to the MOE. There appears to be continued confusion that the WHO benchmarks and analysis were not provided to Durham Council prior to approval to the EA in June, 2009, when indeed they were.

3.4.1 Discussion of the CCME CWS for $PM_{2.5}$

Given that the project will be undertaken in Canada, consideration was provided to the use of the Canada Wide Standard (CWS) for $PM_{2.5}$. The CCME spent considerable time, effort and funds in the late 1990s to establish a benchmark target for airshed $PM_{2.5}$ concentrations that were desirable in Canada.

From the 2000 CCME report Canada-Wide Standards for Particulate Matter (PM) and Ozone:

> *The long-term air quality management goal for PM and ozone is to minimize the risks of these pollutants to human health and the environment. However, recent scientific evidence indicates that there is no apparent lower threshold for the effects of these two pollutants on human health.*
>
> *These CWSs for PM and ozone are an important step towards the long-term goal of minimizing the risks they impose to human health and the environment. They represent a balance between the desire to achieve the best health and environmental protection possible in the relative near-term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated levels of PM and ozone in ambient air. As such, while they will significantly reduce the effect of PM and ozone on human health and the environment, they may not be fully protective and may need to be re-visited at some future date. There are also additional benefits to reducing and maintaining ambient levels below the CWSs where possible.*

The CCME set upon a 24-hour $PM_{2.5}$ standard of 30 $\mu g/m^3$ for ambient air quality to be achieved by 2010. The reporting of these concentrations is based on the 98th percentile ambient measurement annually, averaged over 3 consecutive years.

This benchmark air concentration is applicable across airsheds in Canada, including for the current assessment in the Clarington area and was used in the EA. Appendix C includes a complete version of the guideline document.

3.4.2 Discussion of the WHO Benchmarks for $PM_{2.5}$

Considerable weight has been placed by some in the public and at least one of the peer reviewers on the use of the WHO benchmarks for $PM_{2.5}$ in the assessment of emissions from the Facility. The following section is an attempt to alleviate any confusion that the WHO values are entirely health-based and not simply benchmarks, as is the case with the CWS.

The latest air quality benchmarks for $PM_{2.5}$ set by the WHO are provided in a report entitled *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005. Summary of Risk Assessment (WHO, 2005).* The following is contained within the $PM_{2.5}$ section of the report (page 9):

> As thresholds have not been identified, and given that there is substantial inter-individual variability in exposure and in the response in a given exposure, it is unlikely that any standard or guideline value will lead to complete protection for every individual against all possible adverse health effects of particulate matter. Rather, the standard-setting process needs to aim at achieving the lowest concentrations possible in the context of local constraints, capabilities and public health priorities.

It goes on to say:

> *Countries are encouraged to consider adopting an increasingly stringent set of standards, tracking progress through the monitoring of emission reductions and declining concentrations of PM. To assist this process, the numerical guideline and interim target values given here reflect the concentrations at which increased mortality responses due to PM air pollution are expected based on current scientific findings.*

Therefore, to be absolutely clear the WHO air quality objectives for $PM_{2.5}$ of 10 $\mu g/m^3$ for annual average and 25 $\mu g/m^3$ for 24-hour mean are similar policy benchmarks to the CWS. It simply means that the guideline for 24-hour mean desired by the WHO is 5 $\mu g/m^3$ less than that selected as a guideline by Canada.

The other often misunderstood fact about the WHO guidelines is that they also include interim objectives that countries should strive to achieve. Again from the WHO 2005 document:

> *Besides the guideline value, three interim targets (IT) are defined for PM2.5 (see Table 1). These have been shown to be achievable with successive and sustained abatement measures. Countries may find these interim targets particularly helpful in gauging progress over time in the difficult process of steadily reducing population exposures to PM.*

The WHO 2005 document provides two additional tables for the guideline and interim targets for annual mean concentrations (Table 3.5) and the 24-hour concentrations (Table 3.6), which are reproduced below. The complete document is reproduced in Appendix D.

Table 3.5 WHO air quality guidelines and interim targets for particulate matter: annual mean concentrations [a]

	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Basis for the selected level
Interim target-1 (IT-1)	70	35	These levels are associated with about a 15% higher long-term mortality risk relative to the AQG level.
Interim target-2 (IT-2)	50	25	In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to theIT-1 level.
Interim target-3 (IT-3)	30	15	In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2-11%] relative to the -IT-2 level.
Air quality guideline (AQG)	**20**	**10**	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to $PM_{2.5}$.

Table 3.6 WHO air quality guidelines and interim targets for particulate matter: 24-hour concentrations [a]

	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Basis for the selected level
Interim target-1 (IT-1)	150	75	Based on published risk coefficients from multi-centre studies and meta-analyses (about 5% increase of short- term mortality over the AQG value).
Interim target-2 (IT-2)	100	50	Based on published risk coefficients from multi-centre studies and meta-analyses (about 2.5% increase of short- term mortality over the AQG value).
Interim target-3 (IT-3)*	75	37.5	Based on published risk coefficients from multi-centre studies and meta-analyses (about 1.2% increase in short-term mortality over the AQG value).
Air quality guideline (AQG)	**50**	**25**	Based on relationship between 24-hour and annual PM levels.

3.4.3 Summary of $PM_{2.5}$ Air Quality Benchmarks Used in the EA

The authors wish to reiterate that the WHO benchmarks for $PM_{2.5}$ are simply that – benchmarks and are similar to the health-based policy value produced by the CCME in the development of the CWS. They are based on the fact that that $PM_{2.5}$ is likely not a threshold contaminant and that ambient concentrations should be as low as practicable. Both sets of standards reflect the fact that $PM_{2.5}$ is a contaminant that comes from multiple industrial, natural and vehicular sources.

The only difference is that the WHO decided to publish an annual average value, rather than just a 24-hour annual average concentration. In addition to the original benchmark documents, Stantec has included the original Toxicological Profile generated for particulate matter in the EA in Appendix B.

3.5 Risk Characterization

The final stage of the HHRA process is risk characterization. This is the stage in which potential human health risk due to exposure to $PM_{2.5}$ are quantified, based on exposure and benchmark toxicity air quality guidelines. Specifically, during this stage, it is determined whether $PM_{2.5}$ exposures have the potential to cause adverse human health risks via the inhalation pathway.

Risk characterization is essentially a comparison of the predicted human intake of $PM_{2.5}$ to the TRV for $PM_{2.5}$. Evaluation of potential acute (short-term) and potential chronic (long-term) risks are completed in separate assessments. Potential inhalation acute health risks are evaluated using short-term intakes, based on 24-hour air concentrations, and compared with acute benchmarks. Chronic risk is assessed through inhalation using an annual air benchmarks.

3.5.1 Concentration Ratios (CR)

Concentration Ration (CR) values were used to evaluate acute and chronic health risk from exposure to $PM_{2.5}$ in air. CR values are only applicable to exposure to air in the inhalation assessment; therefore because 100% of exposure is from one pathway and the benchmarks/TRVs and benchmark values are inhalation specific, it is appropriate to set the CR benchmark value at 1.0. This rationale and process was accepted by all peer reviewers and the MOE during the EA process.

CR values were calculated by dividing the predicted ground level air concentration (24-hour or annual average) by the appropriate toxicity reference value or inhalation benchmark, according to the following example equation:

$$CR_{duration} = \frac{[Air]_{duration}}{RfC_{duration}}$$

Where:

$CR_{duration}$	Duration specific Concentration Ratio (unitless); calculated for 24-hr and chronic durations as appropriate
$[Air]_{duration}$	Predicted ground-level air concentration ($\mu g/m^3$); duration specific
$RfC_{duration}$	Reference / Benchmark concentration ($\mu g/m^3$); duration specific

A previously stated, a CR value of 1 is allotted because exposure in the inhalation assessment is only relevant to one exposure pathway (air); therefore the entire TRV or inhalation benchmark can be used.

3.5.2 Risk Characterization Results

The CR values for the updated inhalation assessment of $PM_{2.5}$, using July 2011 dispersion modeling results (Appendix A) for the CofA conditions, at the maximum ground level concentration (MGLC) are provided in Tables 3.7 and 3.8 for 24-hour $PM_{2.5}$ and Annual $PM_{2.5}$. Calculated CR values for all 391 sensitive receptors (i.e., schools, playgrounds, hospitals, old age homes, neighbourhoods, etc...) are provided in Appendix A.

As stated in Section 3.1, although the baseline concentration of the annual average $PM_{2.5}$ was increased from the July 2009 Air Quality Assessment of 9.8 $\mu g/m^3$ to 10.2 $\mu g/m^3$ in the December 2009 report, these values were not carried forward into the HHERA. At the time, the authors of the HHERA did not recognize the significance that this would have increased the baseline conditions to the WHO benchmark of 10 $\mu g/m^3$ or a CR = 1.0. This oversight was a function of the fact that the facility emissions had not increased, rather the baseline concentration and would not have affected the overall conclusions of the risk assessment.

However, the July 2011 results reported below represent the corrected annual baseline concentration of 10.2 $\mu g/m^3$. Regardless, from Table 3.7 and Table 3.8 it is clear that the MGLC of $PM_{2.5}$ from the Facility itself are only a minor contribution to the overall risk to human receptors. It is very important that the values presented below are the maximum ground level concentrations and that at all other locations environmental inputs would much less.

For the 24-hour period, the EA reported values were all below the applicable benchmark criteria with the exception of the Process Upset Project Case. However, when a more realistic upset condition was modelled for the CofA condition the resulting CR for the upset condition alone was <0.1. This suggests that on a 24-hour basis the Facility itself is not going to be a major source or contributor to PM health related issues.

Table 3.7 Summary of Inhalation Risk from 24-hour average $PM_{2.5}$ at the Maximum GLC

Date	Concentration Ratio (CR) CWS Benchmark					Concentration Ratio (CR) WHO Benchmark				
	Baseline Case	Project Alone Case	Project Case	Process Upset Case	Process Upset Project Case	Baseline Case	Project Alone Case	Project Case	Process Upset Case	Process Upset Project Case
July, 2009	0.68	0.018	0.70	0.18	0.86	0.82	0.021	0.84	0.21	**1.0**
December, 2009	0.68	0.018	0.70	0.18	0.86	0.82	0.021	0.84	0.21	**1.0**
July, 2011	0.69	0.030	0.72	0.08	0.76	0.82	0.026	0.85	0.092	0.92

Notes:
CWS Standard (24-hour) - 30 $\mu g/m^3$
WHO Benchmark (24-hour) - 25 $\mu g/m^3$

Table 3.8 provides the annual average CRs using the WHO benchmarks. It is clear that the Facility emissions and resulting MGLC of $PM_{2.5}$ are insignificant when compared to the baseline conditions. Therefore, the Facility itself is not anticipated to be a source of health-based concern of PM.

Table 3.8 Summary of Inhalation Risk from Annual average $PM_{2.5}$ at the Maximum GLC

Date	Concentration Ratio (CR) CWS Benchmark					Concentration Ratio (CR) WHO Benchmark				
	Baseline Case	Project Alone Case	Project Case	Process Upset Case	Process Upset Project Case	Baseline Case	Project Alone Case	Project Case	Process Upset Case	Process Upset Project Case
July, 2009	--	--	--	--	--	0.98	0.0015	0.98	0.0022	0.98
December, 2009	--	--	--	--	--	0.98	0.0015	0.98	0.0022	0.98
July, 2011	--	--	--	--	--	**1.0**	0.0030	**1.0**	0.0040	**1.0**

Notes:
"--" - No CWS annual standard available
WHO Benchmark (Annual) - 10 $\mu g/m^3$

4 CONCLUSIONS

Overall, the purpose of this report was to evaluate and report on the potential influence that modelling the CofA conditions of $PM_{2.5}$ versus those in the EA process would have had on the outcomes of the HHERA.

It was demonstrated that changes in the modelling input parameters from the CofA process from that of the EA resulted in insignificant concentrations of the ground level concentration of PM in the environment.

Stantec has also provided an expanded discussion on the origin of the CWS and WHO benchmarks for $PM_{2.5}$. It is recognized by both agencies and Stantec that $PM_{2.5}$ is likely a non-threshold contaminant and that air quality guidelines or benchmarks are only an approach to restricting unwanted significant increases in the environment.

Overall, the results of the updated dispersion modelling of $PM_{2.5}$ does not alter the original conclusions of Stantec (2009a or 2009b), in that exposure to facility-related air emissions will not result in adverse health effects to human receptors living or visiting the Local Risk Assessment Study Area.

5 CLOSURE

This Report has been prepared by Stantec Consulting Ltd (Stantec). The assessment represents the conditions at the subject property only at the time of the assessment, and is based on the information referenced and contained in the Report. The conclusions presented herein respecting current conditions, and potential future conditions are at the subject property resulting from the Project, represent the best judgment of the assessor based on current scientific standards. Stantec attests that to the best of our knowledge, the information presented in this Report is accurate. The use of this Report for other Projects without written permission of Durham Region, York Region and Stantec is solely at the users own risk.

Respectfully Submitted,

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APPENDIX A

Air Modelling and Human Health Risk Assessment Results

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
1	Campground 10	678526.8	4859996.8	4.09E-01	1.36E-02	1.64E-02	2.99E-01	9.97E-03	1.20E-02	2.99E-01	9.97E-03	1.20E-02
2	ECO 2	675490.4	4860360.1	3.53E-01	1.18E-02	1.41E-02	2.03E-01	6.75E-03	8.10E-03	2.03E-01	6.75E-03	8.10E-03
3	Recreational 5	681642.0	4860349.3	5.57E-01	1.86E-02	2.23E-02	3.55E-01	1.18E-02	1.42E-02	3.55E-01	1.18E-02	1.42E-02
4	ECO 4	676831.5	4859840.9	4.66E-01	1.55E-02	1.86E-02	2.71E-01	9.04E-03	1.09E-02	2.71E-01	9.04E-03	1.09E-02
5	Bow. Valley Cons. 3	685767.2	4863879.0	2.15E-01	7.15E-03	8.58E-03	1.33E-01	4.43E-03	5.31E-03	1.33E-01	4.43E-03	5.31E-03
6	ECO 6	679647.8	4859989.3	4.47E-01	1.49E-02	1.79E-02	3.77E-01	1.26E-02	1.51E-02	3.77E-01	1.26E-02	1.51E-02
7	ECO 7	681578.8	4862070.1	5.14E-01	1.71E-02	2.06E-02	3.46E-01	1.15E-02	1.38E-02	3.46E-01	1.15E-02	1.38E-02
8	ECO 8	679735.5	4861048.6	8.91E-01	2.97E-02	3.56E-02	6.02E-01	2.01E-02	2.41E-02	6.02E-01	2.01E-02	2.41E-02
9	ECO 9	687219.7	4864249.3	1.95E-01	6.51E-03	7.82E-03	1.24E-01	4.14E-03	4.96E-03	1.24E-01	4.14E-03	4.96E-03
10	ECO 10	686519.0	4861987.6	2.22E-01	7.41E-03	8.90E-03	1.40E-01	4.65E-03	5.58E-03	1.40E-01	4.65E-03	5.58E-03
11	ECO 11	679870.4	4859737.9	5.35E-01	1.78E-02	2.14E-02	3.45E-01	1.15E-02	1.38E-02	3.45E-01	1.15E-02	1.38E-02
12	Recreational 4	681575.5	4860557.7	4.92E-01	1.64E-02	1.97E-02	3.14E-01	1.05E-02	1.26E-02	3.14E-01	1.05E-02	1.26E-02
13	Future Industrial 9	680704.5	4859857.8	5.86E-01	1.95E-02	2.34E-02	3.39E-01	1.13E-02	1.36E-02	3.39E-01	1.13E-02	1.36E-02
14	Future Industrial 10	680608.0	4860719.6	9.50E-01	3.17E-02	3.80E-02	5.09E-01	1.70E-02	2.03E-02	5.09E-01	1.70E-02	2.03E-02
15	Harmony Creek	673992.4	4865641.4	2.59E-01	8.62E-03	1.03E-02	1.34E-01	4.46E-03	5.35E-03	1.34E-01	4.46E-03	5.35E-03
16	Farewell Creek	678079.2	4868822.7	2.63E-01	8.76E-03	1.05E-02	2.09E-01	6.97E-03	8.37E-03	2.09E-01	6.97E-03	8.37E-03
17	Farmer	681378.6	4860335.0	5.78E-01	1.93E-02	2.31E-02	3.76E-01	1.25E-02	1.50E-02	3.76E-01	1.25E-02	1.50E-02
18	Watson Farm	682883.4	4864219.7	4.66E-01	1.55E-02	1.86E-02	2.19E-01	7.30E-03	8.76E-03	2.19E-01	7.30E-03	8.76E-03
19	Racanski Farm	678929.2	4865530.2	2.95E-01	9.82E-03	1.18E-02	2.29E-01	7.62E-03	9.14E-03	2.29E-01	7.62E-03	9.14E-03
20	Zoo	687216.8	4864835.3	1.66E-01	5.52E-03	6.63E-03	1.31E-01	4.38E-03	5.25E-03	1.31E-01	4.38E-03	5.25E-03
21	Cedar Crest Beach	686652.1	4861660.9	3.20E-01	1.07E-02	1.28E-02	1.50E-01	5.02E-03	6.02E-03	1.50E-01	5.02E-03	6.02E-03
22	Darlington Prov Park Beach	677844.6	4859718.2	4.26E-01	1.42E-02	1.70E-02	2.49E-01	8.30E-03	9.96E-03	2.49E-01	8.30E-03	9.96E-03
23	OPG 1	682258.1	4860045.0	5.98E-01	1.99E-02	2.39E-02	2.80E-01	9.34E-03	1.12E-02	2.80E-01	9.34E-03	1.12E-02
24	OPG 2	682551.4	4859889.1	4.11E-01	1.37E-02	1.65E-02	2.45E-01	8.15E-03	9.78E-03	2.45E-01	8.15E-03	9.78E-03
25	OPG 3	682824.6	4859759.3	3.75E-01	1.25E-02	1.50E-02	2.24E-01	7.45E-03	8.94E-03	2.24E-01	7.45E-03	8.94E-03
26	OPG 4	683021.6	4859937.3	4.36E-01	1.45E-02	1.74E-02	2.17E-01	7.23E-03	8.67E-03	2.17E-01	7.23E-03	8.67E-03
27	OPG 5	683318.2	4859677.8	2.97E-01	9.89E-03	1.19E-02	1.98E-01	6.60E-03	7.92E-03	1.98E-01	6.60E-03	7.92E-03
28	OPG 6	683306.9	4860023.0	4.13E-01	1.38E-02	1.65E-02	2.20E-01	7.33E-03	8.79E-03	2.20E-01	7.33E-03	8.79E-03
29	OPG 7	683718.6	4859915.8	3.04E-01	1.01E-02	1.22E-02	2.07E-01	6.90E-03	8.28E-03	2.07E-01	6.90E-03	8.28E-03
30	OPG 8	682702.0	4859998.6	5.15E-01	1.72E-02	2.06E-02	2.37E-01	7.91E-03	9.49E-03	2.37E-01	7.91E-03	9.49E-03
31	OPG 9	684347.7	4861184.6	3.14E-01	1.05E-02	1.26E-02	1.71E-01	5.70E-03	6.84E-03	1.71E-01	5.70E-03	6.84E-03
32	OPG 10	682157.2	4861228.2	4.50E-01	1.50E-02	1.80E-02	2.88E-01	9.60E-03	1.15E-02	2.88E-01	9.60E-03	1.15E-02
33	St. Mary's 1	684557.0	4861070.0	3.81E-01	1.27E-02	1.52E-02	1.64E-01	5.45E-03	6.54E-03	1.64E-01	5.45E-03	6.54E-03
34	St. Mary's 2	684657.3	4861320.8	3.02E-01	1.01E-02	1.21E-02	1.62E-01	5.40E-03	6.48E-03	1.62E-01	5.40E-03	6.48E-03
35	St. Mary's 3	684905.3	4861154.4	3.57E-01	1.19E-02	1.43E-02	1.54E-01	5.12E-03	6.15E-03	1.54E-01	5.12E-03	6.15E-03
36	Court. Subdivision 1	677328.4	4862976.1	5.02E-01	1.67E-02	2.01E-02	4.06E-01	1.35E-02	1.63E-02	4.06E-01	1.35E-02	1.63E-02
37	Court. Subdivision 2	676187.9	4862611.1	3.00E-01	9.99E-03	1.20E-02	1.85E-01	6.17E-03	7.40E-03	1.85E-01	6.17E-03	7.40E-03
38	Court. Subdivision 3	675974.8	4863484.1	2.70E-01	9.00E-03	1.08E-02	2.11E-01	7.03E-03	8.44E-03	2.11E-01	7.03E-03	8.44E-03
39	Court. Subdivision 4	676606.1	4863214.1	3.66E-01	1.22E-02	1.46E-02	2.92E-01	9.74E-03	1.17E-02	2.92E-01	9.74E-03	1.17E-02
40	Court. Subdivision 5	676827.1	4863591.4	4.14E-01	1.38E-02	1.66E-02	3.25E-01	1.08E-02	1.30E-02	3.25E-01	1.08E-02	1.30E-02
41	Court. Subdivision 6	677200.4	4864074.9	4.42E-01	1.47E-02	1.77E-02	3.23E-01	1.08E-02	1.29E-02	3.23E-01	1.08E-02	1.29E-02
42	Court. Subdivision 7	677719.8	4863625.1	4.78E-01	1.59E-02	1.91E-02	3.34E-01	1.11E-02	1.34E-02	3.34E-01	1.11E-02	1.34E-02
43	Court. Subdivision 8	678271.6	4864200.6	3.75E-01	1.25E-02	1.50E-02	2.36E-01	7.85E-03	9.42E-03	2.36E-01	7.85E-03	9.42E-03
44	Court. Subdivision 9	678184.4	4863373.6	4.38E-01	1.46E-02	1.75E-02	2.79E-01	9.30E-03	1.12E-02	2.79E-01	9.30E-03	1.12E-02
45	Court. Subdivision 10	677179.7	4862499.5	4.44E-01	1.48E-02	1.78E-02	3.78E-01	1.26E-02	1.51E-02	3.78E-01	1.26E-02	1.51E-02
46	Bow. Subdivision 1	683536.7	4864215.2	3.53E-01	1.18E-02	1.41E-02	1.85E-01	6.17E-03	7.40E-03	1.85E-01	6.17E-03	7.40E-03
47	Bow. Subdivision 2	683770.0	4863915.1	2.71E-01	9.04E-03	1.08E-02	1.81E-01	6.03E-03	7.24E-03	1.81E-01	6.03E-03	7.24E-03
48	Bow. Subdivision 3	683671.0	4863534.1	3.00E-01	1.00E-02	1.20E-02	1.90E-01	6.33E-03	7.60E-03	1.90E-01	6.33E-03	7.60E-03
49	Bow. Subdivision 4	684501.9	4863847.4	3.30E-01	1.10E-02	1.32E-02	1.61E-01	5.37E-03	6.44E-03	1.61E-01	5.37E-03	6.44E-03
50	Bow. Subdivision 5	684242.9	4863518.8	2.66E-01	8.88E-03	1.07E-02	1.71E-01	5.72E-03	6.86E-03	1.71E-01	5.72E-03	6.86E-03
51	Bow. Subdivision 6	684271.4	4863201.5	2.52E-01	8.41E-03	1.01E-02	1.73E-01	5.78E-03	6.94E-03	1.73E-01	5.78E-03	6.94E-03
52	Bow. Subdivision 7	683992.6	4862628.1	2.88E-01	9.59E-03	1.15E-02	1.87E-01	6.24E-03	7.48E-03	1.87E-01	6.24E-03	7.48E-03
53	Bow. Subdivision 8	684608.2	4862956.8	2.29E-01	7.65E-03	9.18E-03	1.65E-01	5.49E-03	6.58E-03	1.65E-01	5.49E-03	6.58E-03
54	Bow. Subdivision 9	684777.3	4863330.5	2.50E-01	8.34E-03	1.00E-02	1.58E-01	5.26E-03	6.31E-03	1.58E-01	5.26E-03	6.31E-03
55	Bow. Subdivision 10	685266.0	4863243.1	2.44E-01	8.13E-03	9.76E-03	1.46E-01	4.87E-03	5.85E-03	1.46E-01	4.87E-03	5.85E-03
56	Osh/Court Subdivision 1	677396.8	4860977.3	6.26E-01	2.09E-02	2.51E-02	3.22E-01	1.07E-02	1.29E-02	3.22E-01	1.07E-02	1.29E-02
57	Osh/Court Subdivision 2	676633.5	4860816.8	3.57E-01	1.19E-02	1.43E-02	2.34E-01	7.81E-03	9.37E-03	2.34E-01	7.81E-03	9.37E-03
58	Osh/Court Subdivision 3	676916.0	4861925.0	3.22E-01	1.07E-02	1.29E-02	2.53E-01	8.43E-03	1.01E-02	2.53E-01	8.43E-03	1.01E-02
59	Osh/Court Subdivision 4	676730.5	4861317.1	5.33E-01	1.78E-02	2.13E-02	2.53E-01	8.43E-03	1.01E-02	2.53E-01	8.43E-03	1.01E-02
60	Osh/Court Subdivision 5	676087.2	4861392.3	3.74E-01	1.25E-02	1.49E-02	2.15E-01	7.16E-03	8.59E-03	2.15E-01	7.16E-03	8.59E-03
61	Osh/Court Subdivision 6	676177.1	4861722.2	3.10E-01	1.03E-02	1.24E-02	2.20E-01	7.34E-03	8.81E-03	2.20E-01	7.34E-03	8.81E-03
62	Osh/Court Subdivision 7	675670.7	4861783.2	2.88E-01	9.59E-03	1.15E-02	2.07E-01	6.91E-03	8.29E-03	2.07E-01	6.91E-03	8.29E-03
63	Osh/Court Subdivision 8	676050.8	4862055.7	2.66E-01	8.85E-03	1.06E-02	1.97E-01	6.58E-03	7.89E-03	1.97E-01	6.58E-03	7.89E-03
64	Osh/Court Subdivision 9	676636.9	4862134.3	2.74E-01	9.14E-03	1.10E-02	2.20E-01	7.32E-03	8.78E-03	2.20E-01	7.32E-03	8.78E-03
65	Osh/Court Subdivision 10	676571.3	4861634.8	3.36E-01	1.12E-02	1.34E-02	2.34E-01	7.78E-03	9.34E-03	2.34E-01	7.78E-03	9.34E-03
66	Bow. Subdivision 11	684649.2	4863182.7	2.59E-01	8.64E-03	1.04E-02	1.62E-01	5.41E-03	6.49E-03	1.62E-01	5.41E-03	6.49E-03
67	Daycare B	685172.4	4863933.1	1.79E-01	5.98E-03	7.18E-03	1.44E-01	4.81E-03	5.78E-03	1.44E-01	4.81E-03	5.78E-03
68	Daycare C	685452.0	4863104.4	2.30E-01	7.66E-03	9.19E-03	1.43E-01	4.75E-03	5.70E-03	1.43E-01	4.75E-03	5.70E-03
69	Daycare D	685527.7	4864693.3	2.45E-01	8.17E-03	9.80E-03	1.32E-01	4.39E-03	5.27E-03	1.32E-01	4.39E-03	5.27E-03
70	Daycare E	685735.4	4864790.8	2.32E-01	7.73E-03	9.27E-03	1.28E-01	4.26E-03	5.12E-03	1.28E-01	4.26E-03	5.12E-03

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	µg/m^3			µg/m^3			µg/m^3		
71	Daycare F	685520.3	4864854.3	2.41E-01	8.04E-03	9.64E-03	1.32E-01	4.40E-03	5.28E-03	1.32E-01	4.40E-03	5.28E-03
72	Daycare G	685441.9	4864878.0	2.30E-01	7.66E-03	9.19E-03	1.33E-01	4.45E-03	5.33E-03	1.33E-01	4.45E-03	5.33E-03
73	Daycare H	686364.8	4864707.8	1.50E-01	4.99E-03	5.99E-03	1.36E-01	4.53E-03	5.44E-03	1.36E-01	4.53E-03	5.44E-03
74	Daycare I	685721.6	4865127.3	2.17E-01	7.24E-03	8.68E-03	1.28E-01	4.28E-03	5.14E-03	1.28E-01	4.28E-03	5.14E-03
75	Daycare J	678256.3	4863565.4	4.09E-01	1.36E-02	1.63E-02	2.59E-01	8.64E-03	1.04E-02	2.59E-01	8.64E-03	1.04E-02
76	Daycare K	677694.1	4864043.7	4.47E-01	1.49E-02	1.79E-02	3.07E-01	1.02E-02	1.23E-02	3.07E-01	1.02E-02	1.23E-02
77	Daycare L	676479.5	4862526.2	2.84E-01	9.46E-03	1.14E-02	2.25E-01	7.51E-03	9.02E-03	2.25E-01	7.51E-03	9.02E-03
78	Daycare M	678320.9	4864763.5	3.48E-01	1.16E-02	1.39E-02	2.30E-01	7.67E-03	9.20E-03	2.30E-01	7.67E-03	9.20E-03
79	Daycare N	678513.4	4865058.0	3.20E-01	1.07E-02	1.28E-02	2.16E-01	7.20E-03	8.64E-03	2.16E-01	7.20E-03	8.64E-03
80	Daycare O	672788.7	4863936.6	1.76E-01	5.86E-03	7.04E-03	1.27E-01	4.24E-03	5.09E-03	1.27E-01	4.24E-03	5.09E-03
81	Daycare P	673952.8	4863592.5	1.97E-01	6.56E-03	7.87E-03	1.30E-01	4.35E-03	5.21E-03	1.30E-01	4.35E-03	5.21E-03
82	Daycare Q	671751.8	4864887.7	1.68E-01	5.60E-03	6.73E-03	1.28E-01	4.26E-03	5.12E-03	1.28E-01	4.26E-03	5.12E-03
83	Daycare R	685714.4	4864667.4	2.22E-01	7.41E-03	8.89E-03	1.29E-01	4.30E-03	5.16E-03	1.29E-01	4.30E-03	5.16E-03
84	Daycare S	684177.9	4863618.2	3.79E-01	1.26E-02	1.51E-02	1.72E-01	5.74E-03	6.89E-03	1.72E-01	5.74E-03	6.89E-03
85	Daycare T	678423.6	4864480.4	3.44E-01	1.15E-02	1.38E-02	2.19E-01	7.30E-03	8.76E-03	2.19E-01	7.30E-03	8.76E-03
86	Daycare U	685330.5	4863435.1	2.39E-01	7.98E-03	9.57E-03	1.44E-01	4.79E-03	5.75E-03	1.44E-01	4.79E-03	5.75E-03
87	Daycare V	685153.2	4863236.9	2.31E-01	7.69E-03	9.23E-03	1.49E-01	4.97E-03	5.96E-03	1.49E-01	4.97E-03	5.96E-03
88	Daycare W	672679.0	4862044.9	1.93E-01	6.45E-03	7.73E-03	1.49E-01	4.96E-03	5.95E-03	1.49E-01	4.96E-03	5.95E-03
89	Daycare X	672076.5	4865285.8	1.82E-01	6.07E-03	7.28E-03	1.25E-01	4.18E-03	5.02E-03	1.25E-01	4.18E-03	5.02E-03
90	Daycare Y	672638.0	4859664.4	2.52E-01	8.40E-03	1.01E-02	1.67E-01	5.56E-03	6.67E-03	1.67E-01	5.56E-03	6.67E-03
91	Daycare Z	673735.9	4858958.0	2.48E-01	8.27E-03	9.93E-03	1.87E-01	6.22E-03	7.46E-03	1.87E-01	6.22E-03	7.46E-03
92	Daycare AA	673121.8	4863385.9	1.70E-01	5.65E-03	6.78E-03	1.27E-01	4.23E-03	5.08E-03	1.27E-01	4.23E-03	5.08E-03
93	Daycare BB	673904.8	4862282.2	2.18E-01	7.25E-03	8.70E-03	1.69E-01	5.63E-03	6.76E-03	1.69E-01	5.63E-03	6.76E-03
94	Daycare CC	671471.6	4861795.3	1.63E-01	5.44E-03	6.52E-03	1.27E-01	4.24E-03	5.09E-03	1.27E-01	4.24E-03	5.09E-03
95	Daycare DD	673057.3	4862625.6	1.96E-01	6.53E-03	7.84E-03	1.56E-01	5.19E-03	6.22E-03	1.56E-01	5.19E-03	6.22E-03
96	Daycare EE	674917.1	4863957.2	2.27E-01	7.57E-03	9.09E-03	1.47E-01	4.89E-03	5.87E-03	1.47E-01	4.89E-03	5.87E-03
97	Daycare FF	671356.6	4862954.4	1.80E-01	6.01E-03	7.22E-03	1.43E-01	4.75E-03	5.71E-03	1.43E-01	4.75E-03	5.71E-03
98	Daycare GG	671675.5	4862705.8	1.85E-01	6.16E-03	7.39E-03	1.45E-01	4.83E-03	5.80E-03	1.45E-01	4.83E-03	5.80E-03
99	Daycare HH	671604.8	4860138.1	2.03E-01	6.76E-03	8.12E-03	1.39E-01	4.63E-03	5.56E-03	1.39E-01	4.63E-03	5.56E-03
100	Daycare II	670945.2	4857983.8	1.50E-01	5.02E-03	6.02E-03	1.18E-01	3.93E-03	4.72E-03	1.18E-01	3.93E-03	4.72E-03
101	Daycare JJ	677514.6	4864744.1	4.07E-01	1.36E-02	1.63E-02	2.85E-01	9.52E-03	1.14E-02	2.85E-01	9.52E-03	1.14E-02
102	Daycare KK	676519.9	4862680.1	3.00E-01	1.00E-02	1.20E-02	2.45E-01	8.16E-03	9.80E-03	2.45E-01	8.16E-03	9.80E-03
103	Daycare LL	677660.6	4863601.3	4.83E-01	1.61E-02	1.93E-02	3.43E-01	1.14E-02	1.37E-02	3.43E-01	1.14E-02	1.37E-02
104	Court. Subdivision 11	677665.8	4863406.6	5.00E-01	1.67E-02	2.00E-02	3.63E-01	1.21E-02	1.45E-02	3.63E-01	1.21E-02	1.45E-02
105	Daycare NN	674866.3	4864667.2	2.21E-01	7.35E-03	8.82E-03	1.59E-01	5.29E-03	6.34E-03	1.59E-01	5.29E-03	6.34E-03
106	Daycare OO	673201.0	4864746.4	1.97E-01	6.58E-03	7.90E-03	1.26E-01	4.19E-03	5.03E-03	1.26E-01	4.19E-03	5.03E-03
107	Daycare PP	674794.5	4864915.4	2.67E-01	8.90E-03	1.07E-02	1.58E-01	5.25E-03	6.30E-03	1.58E-01	5.25E-03	6.30E-03
108	Hospital	686324.2	4864395.8	1.90E-01	6.34E-03	7.61E-03	1.38E-01	4.61E-03	5.53E-03	1.38E-01	4.61E-03	5.53E-03
109	Hospital (Children's)	676057.8	4862180.9	2.59E-01	8.63E-03	1.04E-02	1.86E-01	6.19E-03	7.42E-03	1.86E-01	6.19E-03	7.42E-03
110	Hospital	671233.2	4863615.9	1.56E-01	5.19E-03	6.23E-03	1.30E-01	4.33E-03	5.19E-03	1.30E-01	4.33E-03	5.19E-03
111	Comm. Resp. Services	676045.4	4863902.5	3.00E-01	1.00E-02	1.20E-02	2.36E-01	7.87E-03	9.45E-03	2.36E-01	7.87E-03	9.45E-03
112	Hospital	671712.7	4862364.1	1.83E-01	6.11E-03	7.33E-03	1.42E-01	4.74E-03	5.69E-03	1.42E-01	4.74E-03	5.69E-03
113	Retirement Residence A	684199.9	4864120.3	2.21E-01	7.37E-03	8.84E-03	1.66E-01	5.52E-03	6.63E-03	1.66E-01	5.52E-03	6.63E-03
114	Retirement Residence B	685483.9	4865150.9	1.86E-01	6.19E-03	7.42E-03	1.33E-01	4.44E-03	5.33E-03	1.33E-01	4.44E-03	5.33E-03
115	Retirement Residence C	686844.0	4864732.1	1.70E-01	5.65E-03	6.78E-03	1.35E-01	4.51E-03	5.41E-03	1.35E-01	4.51E-03	5.41E-03
116	Retirement Residence D	673481.7	4863343.4	1.77E-01	5.89E-03	7.07E-03	1.27E-01	4.22E-03	5.06E-03	1.27E-01	4.22E-03	5.06E-03
117	Retirement Residence E	671825.2	4864399.0	1.64E-01	5.46E-03	6.55E-03	1.29E-01	4.31E-03	5.18E-03	1.29E-01	4.31E-03	5.18E-03
118	Retirement Residence F	671606.3	4864536.0	1.62E-01	5.40E-03	6.47E-03	1.29E-01	4.31E-03	5.17E-03	1.29E-01	4.31E-03	5.17E-03
119	Retirement Residence G	671357.1	4862958.7	1.80E-01	6.01E-03	7.21E-03	1.43E-01	4.75E-03	5.70E-03	1.43E-01	4.75E-03	5.70E-03
120	Retirement Residence H	671514.0	4862262.9	1.79E-01	5.96E-03	7.16E-03	1.39E-01	4.62E-03	5.54E-03	1.39E-01	4.62E-03	5.54E-03
121	Retirement Residence I	672602.2	4863075.9	1.77E-01	5.89E-03	7.07E-03	1.44E-01	4.80E-03	5.75E-03	1.44E-01	4.80E-03	5.75E-03
122	Retirement Residence J	671719.1	4862893.1	1.82E-01	6.08E-03	7.29E-03	1.45E-01	4.82E-03	5.79E-03	1.45E-01	4.82E-03	5.79E-03
123	Retirement Residence K	686718.0	4865648.7	1.85E-01	6.16E-03	7.39E-03	1.12E-01	3.72E-03	4.46E-03	1.12E-01	3.72E-03	4.46E-03
124	Retirement Residence L	676168.7	4865669.9	3.14E-01	1.05E-02	1.26E-02	2.39E-01	7.98E-03	9.58E-03	2.39E-01	7.98E-03	9.58E-03
125	Retirement Residence M	676118.5	4863980.7	3.12E-01	1.04E-02	1.25E-02	2.45E-01	8.17E-03	9.81E-03	2.45E-01	8.17E-03	9.81E-03
126	Bow. Subdivision 12	684649.2	4863182.7	2.59E-01	8.64E-03	1.04E-02	1.62E-01	5.41E-03	6.49E-03	1.62E-01	5.41E-03	6.49E-03
127	Primary School B	685384.8	4863575.3	2.39E-01	7.96E-03	9.55E-03	1.42E-01	4.73E-03	5.68E-03	1.42E-01	4.73E-03	5.68E-03
128	Primary School C	685021.6	4863952.9	1.75E-01	5.84E-03	7.01E-03	1.48E-01	4.92E-03	5.90E-03	1.48E-01	4.92E-03	5.90E-03
129	Primary School D	686237.0	4864085.5	2.08E-01	6.94E-03	8.33E-03	1.33E-01	4.42E-03	5.31E-03	1.33E-01	4.42E-03	5.31E-03
130	Primary School E	686719.0	4863734.7	2.01E-01	6.71E-03	8.06E-03	1.17E-01	3.91E-03	4.69E-03	1.17E-01	3.91E-03	4.69E-03
131	Primary School F	686357.0	4864754.9	1.50E-01	5.00E-03	6.00E-03	1.35E-01	4.50E-03	5.40E-03	1.35E-01	4.50E-03	5.40E-03
132	Primary School G	685502.0	4865013.4	2.13E-01	7.11E-03	8.54E-03	1.33E-01	4.42E-03	5.31E-03	1.33E-01	4.42E-03	5.31E-03
133	Primary School H	686726.7	4866061.5	1.67E-01	5.58E-03	6.69E-03	1.12E-01	3.73E-03	4.47E-03	1.12E-01	3.73E-03	4.47E-03
134	Primary School I	685186.2	4866568.2	1.82E-01	6.08E-03	7.30E-03	1.39E-01	4.64E-03	5.57E-03	1.39E-01	4.64E-03	5.57E-03
135	Primary School J	685965.3	4866979.0	2.26E-01	7.52E-03	9.02E-03	1.24E-01	4.12E-03	4.95E-03	1.24E-01	4.12E-03	4.95E-03
136	Primary School K	677709.9	4864726.5	4.02E-01	1.34E-02	1.61E-02	2.77E-01	9.24E-03	1.11E-02	2.77E-01	9.24E-03	1.11E-02
137	Primary School L	675988.3	4864270.2	3.44E-01	1.15E-02	1.38E-02	2.37E-01	7.90E-03	9.48E-03	2.37E-01	7.90E-03	9.48E-03
138	Primary School M	676608.7	4862739.0	3.28E-01	1.09E-02	1.31E-02	2.68E-01	8.92E-03	1.07E-02	2.68E-01	8.92E-03	1.07E-02
139	Primary School N	677222.2	4863759.1	4.58E-01	1.53E-02	1.83E-02	3.43E-01	1.14E-02	1.37E-02	3.43E-01	1.14E-02	1.37E-02
140	Primary School O	678154.9	4863872.7	4.10E-01	1.37E-02	1.64E-02	2.58E-01	8.61E-03	1.03E-02	2.58E-01	8.61E-03	1.03E-02

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	$\mu g/m^3$			$\mu g/m^3$			$\mu g/m^3$		
141	Court. Subdivision 12	678309.6	4863600.8	3.96E-01	1.32E-02	1.59E-02	2.60E-01	8.68E-03	1.04E-02	2.60E-01	8.68E-03	1.04E-02
142	Primary School Q	677010.6	4862470.6	3.96E-01	1.32E-02	1.58E-02	3.36E-01	1.12E-02	1.34E-02	3.36E-01	1.12E-02	1.34E-02
143	Primary School R	677431.3	4866694.7	3.22E-01	1.07E-02	1.29E-02	2.41E-01	8.04E-03	9.65E-03	2.41E-01	8.04E-03	9.65E-03
144	Primary School S	675266.2	4863562.9	2.36E-01	7.86E-03	9.44E-03	1.57E-01	5.23E-03	6.28E-03	1.57E-01	5.23E-03	6.28E-03
145	Primary School T	673479.2	4860029.4	2.60E-01	8.65E-03	1.04E-02	1.70E-01	5.67E-03	6.80E-03	1.70E-01	5.67E-03	6.80E-03
146	Primary School U	670856.0	4860710.6	1.63E-01	5.42E-03	6.51E-03	1.26E-01	4.19E-03	5.03E-03	1.26E-01	4.19E-03	5.03E-03
147	Primary School V	672660.2	4863909.2	1.73E-01	5.76E-03	6.91E-03	1.28E-01	4.27E-03	5.13E-03	1.28E-01	4.27E-03	5.13E-03
148	Primary School W	672735.2	4859232.9	2.91E-01	9.71E-03	1.16E-02	1.80E-01	6.01E-03	7.22E-03	1.80E-01	6.01E-03	7.22E-03
149	Primary School X	673575.8	4862688.6	1.97E-01	6.55E-03	7.87E-03	1.57E-01	5.24E-03	6.29E-03	1.57E-01	5.24E-03	6.29E-03
150	Primary School Y	673710.3	4861969.0	2.16E-01	7.21E-03	8.65E-03	1.63E-01	5.45E-03	6.54E-03	1.63E-01	5.45E-03	6.54E-03
151	Primary School Z	672366.0	4859928.1	2.32E-01	7.75E-03	9.30E-03	1.52E-01	5.07E-03	6.09E-03	1.52E-01	5.07E-03	6.09E-03
152	Primary School AA	672561.7	4866047.1	1.84E-01	6.13E-03	7.36E-03	1.20E-01	3.99E-03	4.79E-03	1.20E-01	3.99E-03	4.79E-03
153	Primary School BB	675095.1	4862930.4	2.05E-01	6.83E-03	8.19E-03	1.36E-01	4.55E-03	5.46E-03	1.36E-01	4.55E-03	5.46E-03
154	Primary School CC	673242.6	4865197.9	1.92E-01	6.40E-03	7.68E-03	1.24E-01	4.13E-03	4.96E-03	1.24E-01	4.13E-03	4.96E-03
155	Primary School DD	674164.9	4863031.3	1.83E-01	6.09E-03	7.31E-03	1.38E-01	4.60E-03	5.52E-03	1.38E-01	4.60E-03	5.52E-03
156	Primary School EE	671905.6	4864697.8	1.69E-01	5.63E-03	6.76E-03	1.28E-01	4.28E-03	5.13E-03	1.28E-01	4.28E-03	5.13E-03
157	Primary School FF	673294.9	4858774.5	2.20E-01	7.35E-03	8.82E-03	1.69E-01	5.64E-03	6.77E-03	1.69E-01	5.64E-03	6.77E-03
158	Primary School GG	671659.7	4863120.0	1.77E-01	5.89E-03	7.07E-03	1.42E-01	4.74E-03	5.69E-03	1.42E-01	4.74E-03	5.69E-03
159	Primary School HH	673853.4	4866711.0	2.83E-01	9.44E-03	1.13E-02	1.56E-01	5.19E-03	6.23E-03	1.56E-01	5.19E-03	6.23E-03
160	Primary School II	672616.7	4862114.9	1.94E-01	6.47E-03	7.77E-03	1.50E-01	4.99E-03	5.99E-03	1.50E-01	4.99E-03	5.99E-03
161	Primary School JJ	673567.2	4861899.5	2.11E-01	7.03E-03	8.44E-03	1.60E-01	5.32E-03	6.38E-03	1.60E-01	5.32E-03	6.38E-03
162	Primary School KK	671791.0	4861954.2	1.75E-01	5.84E-03	7.00E-03	1.35E-01	4.51E-03	5.41E-03	1.35E-01	4.51E-03	5.41E-03
163	Primary School LL	673762.3	4864210.6	2.04E-01	6.79E-03	8.15E-03	1.32E-01	4.39E-03	5.26E-03	1.32E-01	4.39E-03	5.26E-03
164	Primary School MM	672238.8	4864621.3	1.75E-01	5.82E-03	6.98E-03	1.28E-01	4.26E-03	5.11E-03	1.28E-01	4.26E-03	5.11E-03
165	Primary School NN	673213.6	4858677.0	2.06E-01	6.86E-03	8.24E-03	1.60E-01	5.35E-03	6.42E-03	1.60E-01	5.35E-03	6.42E-03
166	Primary School OO	675474.8	4863221.7	2.36E-01	7.86E-03	9.43E-03	1.57E-01	5.23E-03	6.28E-03	1.57E-01	5.23E-03	6.28E-03
167	Primary School PP	672441.8	4858748.6	2.22E-01	7.39E-03	8.86E-03	1.63E-01	5.42E-03	6.51E-03	1.63E-01	5.42E-03	6.51E-03
168	Primary School QQ	672796.8	4864438.2	1.83E-01	6.11E-03	7.33E-03	1.26E-01	4.19E-03	5.03E-03	1.26E-01	4.19E-03	5.03E-03
169	Primary School RR	671351.4	4863284.0	1.71E-01	5.69E-03	6.83E-03	1.38E-01	4.60E-03	5.53E-03	1.38E-01	4.60E-03	5.53E-03
170	Primary School SS	673213.9	4862125.5	2.04E-01	6.81E-03	8.18E-03	1.58E-01	5.25E-03	6.30E-03	1.58E-01	5.25E-03	6.30E-03
171	Primary School TT	671017.9	4860953.7	1.60E-01	5.32E-03	6.39E-03	1.25E-01	4.15E-03	4.98E-03	1.25E-01	4.15E-03	4.98E-03
172	Primary School UU	670991.0	4861089.8	1.55E-01	5.16E-03	6.20E-03	1.22E-01	4.05E-03	4.86E-03	1.22E-01	4.05E-03	4.86E-03
173	Primary School VV	674150.1	4862294.8	2.22E-01	7.39E-03	8.87E-03	1.72E-01	5.73E-03	6.88E-03	1.72E-01	5.73E-03	6.88E-03
174	Primary School WW	672005.2	4861707.9	1.70E-01	5.66E-03	6.80E-03	1.32E-01	4.38E-03	5.26E-03	1.32E-01	4.38E-03	5.26E-03
175	Primary School XX	684172.1	4863615.6	3.83E-01	1.28E-02	1.53E-02	1.73E-01	5.75E-03	6.90E-03	1.73E-01	5.75E-03	6.90E-03
176	Primary School YY	683923.3	4866636.4	2.47E-01	8.22E-03	9.87E-03	1.68E-01	5.59E-03	6.71E-03	1.68E-01	5.59E-03	6.71E-03
177	Primary School ZZ	680446.0	4865770.5	2.95E-01	9.84E-03	1.18E-02	2.63E-01	8.77E-03	1.05E-02	2.63E-01	8.77E-03	1.05E-02
178	Vacant School	685612.9	4864520.0	2.02E-01	6.74E-03	8.08E-03	1.32E-01	4.39E-03	5.27E-03	1.32E-01	4.39E-03	5.27E-03
179	Secondary School A	686291.4	4865064.3	1.77E-01	5.89E-03	7.07E-03	1.22E-01	4.08E-03	4.89E-03	1.22E-01	4.08E-03	4.89E-03
180	Secondary School B	683875.0	4864741.7	3.17E-01	1.06E-02	1.27E-02	1.76E-01	5.86E-03	7.03E-03	1.76E-01	5.86E-03	7.03E-03
181	Secondary School C	684650.3	4866460.3	1.95E-01	6.48E-03	7.78E-03	1.51E-01	5.04E-03	6.05E-03	1.51E-01	5.04E-03	6.05E-03
182	Secondary School D	678099.5	4864838.2	3.69E-01	1.23E-02	1.48E-02	2.48E-01	8.28E-03	9.93E-03	2.48E-01	8.28E-03	9.93E-03
183	Secondary School E	678467.0	4863431.2	3.71E-01	1.24E-02	1.49E-02	2.80E-01	9.35E-03	1.12E-02	2.80E-01	9.35E-03	1.12E-02
184	Secondary School F	674144.9	4862762.7	1.93E-01	6.42E-03	7.70E-03	1.54E-01	5.14E-03	6.17E-03	1.54E-01	5.14E-03	6.17E-03
185	Secondary School G	673816.0	4864357.1	2.04E-01	6.79E-03	8.15E-03	1.32E-01	4.40E-03	5.28E-03	1.32E-01	4.40E-03	5.28E-03
186	Secondary School H	673145.4	4858569.0	1.92E-01	6.40E-03	7.68E-03	1.52E-01	5.08E-03	6.10E-03	1.52E-01	5.08E-03	6.10E-03
187	Secondary School I	671291.7	4863581.3	1.58E-01	5.27E-03	6.32E-03	1.30E-01	4.35E-03	5.22E-03	1.30E-01	4.35E-03	5.22E-03
188	Secondary School J	671443.2	4861664.9	1.58E-01	5.26E-03	6.31E-03	1.24E-01	4.12E-03	4.94E-03	1.24E-01	4.12E-03	4.94E-03
189	Secondary School K	673235.3	4860885.0	1.88E-01	6.26E-03	7.52E-03	1.50E-01	5.01E-03	6.02E-03	1.50E-01	5.01E-03	6.02E-03
190	Secondary Schook L	684252.7	4866500.5	1.99E-01	6.63E-03	7.96E-03	1.61E-01	5.36E-03	6.43E-03	1.61E-01	5.36E-03	6.43E-03
191	Secondary School M	673914.1	4859551.7	3.05E-01	1.02E-02	1.22E-02	1.99E-01	6.65E-03	7.98E-03	1.99E-01	6.65E-03	7.98E-03
192	Secondary School N	675051.5	4864177.2	2.25E-01	7.51E-03	9.02E-03	1.60E-01	5.33E-03	6.39E-03	1.60E-01	5.33E-03	6.39E-03
193	Adult School	685276.1	4866019.8	1.94E-01	6.46E-03	7.75E-03	1.38E-01	4.61E-03	5.53E-03	1.38E-01	4.61E-03	5.53E-03
194	Bow. Valley Cons. 1	685356.6	4864521.2	2.27E-01	7.58E-03	9.09E-03	1.36E-01	4.54E-03	5.45E-03	1.36E-01	4.54E-03	5.45E-03
195	Bow. Valley Cons. 2	685627.7	4864167.8	1.63E-01	5.43E-03	6.51E-03	1.39E-01	4.64E-03	5.57E-03	1.39E-01	4.64E-03	5.57E-03
196	Bow. Valley Cons. 4	685852.7	4863640.2	2.00E-01	6.65E-03	7.98E-03	1.32E-01	4.41E-03	5.29E-03	1.32E-01	4.41E-03	5.29E-03
197	Bow. Valley Cons. 5	686163.1	4863621.5	2.24E-01	7.47E-03	8.96E-03	1.27E-01	4.22E-03	5.07E-03	1.27E-01	4.22E-03	5.07E-03
198	Bow. Valley Cons. 6	685931.9	4863380.6	2.15E-01	7.18E-03	8.61E-03	1.32E-01	4.39E-03	5.27E-03	1.32E-01	4.39E-03	5.27E-03
199	Maple Grove 1	681688.5	4864717.0	3.06E-01	1.02E-02	1.22E-02	2.97E-01	9.91E-03	1.19E-02	2.97E-01	9.91E-03	1.19E-02
200	Maple Grove 2	681768.9	4864631.8	3.03E-01	1.01E-02	1.21E-02	2.96E-01	9.88E-03	1.19E-02	2.96E-01	9.88E-03	1.19E-02
201	Maple Grove 3	681894.9	4864506.8	2.95E-01	9.84E-03	1.18E-02	2.92E-01	9.74E-03	1.17E-02	2.92E-01	9.74E-03	1.17E-02
202	Maple Grove 4	681974.8	4864443.2	2.89E-01	9.62E-03	1.15E-02	2.87E-01	9.58E-03	1.15E-02	2.87E-01	9.58E-03	1.15E-02
203	Maple Grove 5	681942.2	4864676.7	2.88E-01	9.60E-03	1.15E-02	2.84E-01	9.45E-03	1.13E-02	2.84E-01	9.45E-03	1.13E-02
204	Maple Grove 6	682053.2	4864586.2	2.80E-01	9.35E-03	1.12E-02	2.79E-01	9.29E-03	1.11E-02	2.79E-01	9.29E-03	1.11E-02
205	Maple Grove 7	682168.5	4864631.3	2.70E-01	9.01E-03	1.08E-02	2.70E-01	8.99E-03	1.08E-02	2.70E-01	8.99E-03	1.08E-02
206	Maple Grove 8	682261.7	4864520.9	2.67E-01	8.92E-03	1.07E-02	2.65E-01	8.82E-03	1.06E-02	2.65E-01	8.82E-03	1.06E-02
207	Maple Grove 9	682382.1	4864589.4	2.54E-01	8.46E-03	1.02E-02	2.55E-01	8.51E-03	1.02E-02	2.55E-01	8.51E-03	1.02E-02
208	Maple Grove 10	682459.8	4864499.2	2.49E-01	8.31E-03	9.97E-03	2.50E-01	8.34E-03	1.00E-02	2.50E-01	8.34E-03	1.00E-02
209	Port Darlington 1	686227.8	4861159.0	2.88E-01	9.59E-03	1.15E-02	1.35E-01	4.49E-03	5.39E-03	1.35E-01	4.49E-03	5.39E-03
210	Port Darlington 2	686184.8	4861252.0	2.66E-01	8.85E-03	1.06E-02	1.32E-01	4.40E-03	5.28E-03	1.32E-01	4.40E-03	5.28E-03

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	$\mu g/m^3$			$\mu g/m^3$			$\mu g/m^3$		
211	Port Darlington 3	686151.2	4861286.8	2.54E-01	8.46E-03	1.01E-02	1.28E-01	4.26E-03	5.11E-03	1.28E-01	4.26E-03	5.11E-03
212	Port Darlington 4	686351.1	4861341.6	2.98E-01	9.93E-03	1.19E-02	1.50E-01	5.02E-03	6.02E-03	1.50E-01	5.02E-03	6.02E-03
213	Port Darlington 5	686406.8	4861448.7	3.06E-01	1.02E-02	1.22E-02	1.55E-01	5.16E-03	6.19E-03	1.55E-01	5.16E-03	6.19E-03
214	Port Darlington 6	686504.5	4861604.0	3.10E-01	1.03E-02	1.24E-02	1.53E-01	5.09E-03	6.11E-03	1.53E-01	5.09E-03	6.11E-03
215	Port Darlington 7	686703.0	4861789.3	2.87E-01	9.58E-03	1.15E-02	1.35E-01	4.49E-03	5.38E-03	1.35E-01	4.49E-03	5.38E-03
216	Port Darlington 8	686895.8	4861960.2	2.33E-01	7.75E-03	9.30E-03	1.34E-01	4.45E-03	5.34E-03	1.34E-01	4.45E-03	5.34E-03
217	Port Darlington 9	686867.4	4862119.7	2.10E-01	6.99E-03	8.38E-03	1.34E-01	4.48E-03	5.38E-03	1.34E-01	4.48E-03	5.38E-03
218	Port Darlington 10	687190.7	4862048.8	2.05E-01	6.84E-03	8.21E-03	1.30E-01	4.32E-03	5.19E-03	1.30E-01	4.32E-03	5.19E-03
219	Port Darlington 11	687524.4	4862126.8	1.99E-01	6.65E-03	7.98E-03	1.26E-01	4.19E-03	5.02E-03	1.26E-01	4.19E-03	5.02E-03
220	Campground 1	678646.3	4860337.7	5.99E-01	2.00E-02	2.39E-02	3.65E-01	1.22E-02	1.46E-02	3.65E-01	1.22E-02	1.46E-02
221	Campground 2	678410.2	4860148.6	5.20E-01	1.73E-02	2.08E-02	3.28E-01	1.09E-02	1.31E-02	3.28E-01	1.09E-02	1.31E-02
222	Campground 3	678651.0	4860054.4	4.55E-01	1.52E-02	1.82E-02	3.15E-01	1.05E-02	1.26E-02	3.15E-01	1.05E-02	1.26E-02
223	Campground 4	678725.9	4859860.7	3.73E-01	1.24E-02	1.49E-02	3.12E-01	1.04E-02	1.25E-02	3.12E-01	1.04E-02	1.25E-02
224	Campground 5	678511.1	4859808.6	3.40E-01	1.13E-02	1.36E-02	2.82E-01	9.39E-03	1.13E-02	2.82E-01	9.39E-03	1.13E-02
225	Campground 6	678869.5	4859696.0	3.84E-01	1.28E-02	1.53E-02	2.98E-01	9.95E-03	1.19E-02	2.98E-01	9.95E-03	1.19E-02
226	Campground 7	678723.9	4860201.8	5.51E-01	1.84E-02	2.20E-02	3.49E-01	1.16E-02	1.40E-02	3.49E-01	1.16E-02	1.40E-02
227	Campground 8	678796.0	4860011.4	4.03E-01	1.34E-02	1.61E-02	3.33E-01	1.11E-02	1.33E-02	3.33E-01	1.11E-02	1.33E-02
228	Campground 9	678852.7	4859854.2	3.88E-01	1.29E-02	1.55E-02	3.18E-01	1.06E-02	1.27E-02	3.18E-01	1.06E-02	1.27E-02
229	Solina 1	681099.6	4861677.2	6.30E-01	2.10E-02	2.52E-02	4.15E-01	1.38E-02	1.66E-02	4.15E-01	1.38E-02	1.66E-02
230	Solina 2	681115.7	4861857.7	5.68E-01	1.89E-02	2.27E-02	4.09E-01	1.36E-02	1.64E-02	4.09E-01	1.36E-02	1.64E-02
231	Solina 3	680987.4	4861983.5	5.38E-01	1.79E-02	2.15E-02	4.24E-01	1.41E-02	1.70E-02	4.24E-01	1.41E-02	1.70E-02
232	Solina 4	680965.0	4862068.1	5.36E-01	1.79E-02	2.14E-02	4.22E-01	1.41E-02	1.69E-02	4.22E-01	1.41E-02	1.69E-02
233	Solina 5	681021.5	4862086.7	5.22E-01	1.74E-02	2.09E-02	4.14E-01	1.38E-02	1.66E-02	4.14E-01	1.38E-02	1.66E-02
234	Solina 6	680939.8	4862124.3	5.37E-01	1.79E-02	2.15E-02	4.23E-01	1.41E-02	1.69E-02	4.23E-01	1.41E-02	1.69E-02
235	Solina 7	680988.2	4862183.6	5.20E-01	1.73E-02	2.08E-02	4.12E-01	1.37E-02	1.65E-02	4.12E-01	1.37E-02	1.65E-02
236	Solina 8	680984.6	4862209.8	5.19E-01	1.73E-02	2.08E-02	4.12E-01	1.37E-02	1.65E-02	4.12E-01	1.37E-02	1.65E-02
237	Solina 9	680958.6	4862294.9	5.16E-01	1.72E-02	2.06E-02	4.09E-01	1.36E-02	1.64E-02	4.09E-01	1.36E-02	1.64E-02
238	Solina 10	680858.0	4862324.3	5.30E-01	1.77E-02	2.12E-02	4.19E-01	1.40E-02	1.67E-02	4.19E-01	1.40E-02	1.67E-02
239	Solina 11	680990.3	4862403.5	5.01E-01	1.67E-02	2.00E-02	3.98E-01	1.33E-02	1.59E-02	3.98E-01	1.33E-02	1.59E-02
240	Recreational 1	681545.0	4860865.0	4.94E-01	1.65E-02	1.98E-02	3.32E-01	1.11E-02	1.33E-02	3.32E-01	1.11E-02	1.33E-02
241	Recreational 2	681563.7	4860687.4	5.01E-01	1.67E-02	2.00E-02	3.23E-01	1.08E-02	1.29E-02	3.23E-01	1.08E-02	1.29E-02
242	Recreational 3	681579.7	4860610.0	5.39E-01	1.80E-02	2.15E-02	3.17E-01	1.06E-02	1.27E-02	3.17E-01	1.06E-02	1.27E-02
243	Recreational 6	681876.6	4860254.4	6.84E-01	2.28E-02	2.74E-02	3.62E-01	1.21E-02	1.45E-02	3.62E-01	1.21E-02	1.45E-02
244	Recreational 7	682166.9	4860324.4	5.40E-01	1.80E-02	2.16E-02	3.21E-01	1.07E-02	1.28E-02	3.21E-01	1.07E-02	1.28E-02
245	Darlington 1	679565.4	4861052.9	8.49E-01	2.83E-02	3.39E-02	5.62E-01	1.87E-02	2.25E-02	5.62E-01	1.87E-02	2.25E-02
246	Darlington 2	679452.9	4861051.4	7.29E-01	2.43E-02	2.91E-02	5.29E-01	1.76E-02	2.12E-02	5.29E-01	1.76E-02	2.12E-02
247	Darlington 3	679130.5	4860948.8	6.92E-01	2.31E-02	2.77E-02	4.47E-01	1.49E-02	1.79E-02	4.47E-01	1.49E-02	1.79E-02
248	Darlington 4	679112.6	4860941.9	7.02E-01	2.34E-02	2.81E-02	4.42E-01	1.47E-02	1.77E-02	4.42E-01	1.47E-02	1.77E-02
249	Darlington 5	679057.6	4860994.1	6.86E-01	2.29E-02	2.74E-02	4.36E-01	1.45E-02	1.74E-02	4.36E-01	1.45E-02	1.74E-02
250	Darlington 6	679075.2	4860931.6	7.07E-01	2.36E-02	2.83E-02	4.35E-01	1.45E-02	1.74E-02	4.35E-01	1.45E-02	1.74E-02
251	Darlington 7	678814.3	4860843.1	6.36E-01	2.12E-02	2.54E-02	3.84E-01	1.28E-02	1.54E-02	3.84E-01	1.28E-02	1.54E-02
252	Darlington 8	678840.4	4860777.1	6.43E-01	2.14E-02	2.57E-02	3.85E-01	1.28E-02	1.54E-02	3.85E-01	1.28E-02	1.54E-02
253	Light Ind. 1	680000.1	4861034.1	9.32E-01	3.11E-02	3.73E-02	6.57E-01	2.19E-02	2.63E-02	6.57E-01	2.19E-02	2.63E-02
254	Light Ind. 2	680060.7	4861056.4	9.48E-01	3.16E-02	3.79E-02	6.68E-01	2.23E-02	2.67E-02	6.68E-01	2.23E-02	2.67E-02
255	Light Ind. 3	680291.2	4861151.6	9.20E-01	3.07E-02	3.68E-02	6.56E-01	2.19E-02	2.62E-02	6.56E-01	2.19E-02	2.62E-02
256	Light Ind. 4	680536.3	4861204.6	7.81E-01	2.60E-02	3.12E-02	5.74E-01	1.91E-02	2.30E-02	5.74E-01	1.91E-02	2.30E-02
257	Light Ind. 5	680350.4	4861290.6	8.64E-01	2.88E-02	3.46E-02	6.28E-01	2.09E-02	2.51E-02	6.28E-01	2.09E-02	2.51E-02
258	Light Ind. 6	680306.9	4861275.6	8.83E-01	2.94E-02	3.53E-02	6.39E-01	2.13E-02	2.56E-02	6.39E-01	2.13E-02	2.56E-02
259	Light Ind. 7	680267.2	4861262.4	9.00E-01	3.00E-02	3.60E-02	6.49E-01	2.16E-02	2.60E-02	6.49E-01	2.16E-02	2.60E-02
260	Light Ind. 8	680233.6	4861250.7	9.12E-01	3.04E-02	3.65E-02	6.56E-01	2.19E-02	2.62E-02	6.56E-01	2.19E-02	2.62E-02
261	Light Ind. 9	680175.3	4861227.5	9.25E-01	3.08E-02	3.70E-02	6.63E-01	2.21E-02	2.65E-02	6.63E-01	2.21E-02	2.65E-02
262	Light Ind. 10	680092.5	4861185.1	9.37E-01	3.12E-02	3.75E-02	6.68E-01	2.23E-02	2.67E-02	6.68E-01	2.23E-02	2.67E-02
263	Light Ind. 11	680071.6	4861246.6	9.25E-01	3.08E-02	3.70E-02	6.64E-01	2.21E-02	2.66E-02	6.64E-01	2.21E-02	2.66E-02
264	Light Ind. 12	680021.4	4861186.9	9.31E-01	3.10E-02	3.72E-02	6.64E-01	2.21E-02	2.66E-02	6.64E-01	2.21E-02	2.66E-02
265	Future Industrial 7	680816.2	4860219.3	5.26E-01	1.75E-02	2.11E-02	4.48E-01	1.49E-02	1.79E-02	4.48E-01	1.49E-02	1.79E-02
266	Future Industrial 8	680398.0	4860731.8	1.02E+00	3.41E-02	4.09E-02	6.65E-01	2.22E-02	2.66E-02	6.65E-01	2.22E-02	2.66E-02
267	Future Industrial 1	680359.6	4859959.2	5.66E-01	1.89E-02	2.26E-02	3.80E-01	1.27E-02	1.52E-02	3.80E-01	1.27E-02	1.52E-02
268	Future Industrial 2	680083.7	4859985.7	5.04E-01	1.68E-02	2.02E-02	3.92E-01	1.31E-02	1.57E-02	3.92E-01	1.31E-02	1.57E-02
269	Future Industrial 3	680819.9	4860705.3	6.99E-01	2.33E-02	2.80E-02	5.11E-01	1.70E-02	2.05E-02	5.11E-01	1.70E-02	2.05E-02
270	Future Industrial 4	681070.0	4859937.2	4.73E-01	1.58E-02	1.89E-02	3.22E-01	1.07E-02	1.29E-02	3.22E-01	1.07E-02	1.29E-02
271	Future Industrial 5	679898.8	4860067.4	4.94E-01	1.65E-02	1.98E-02	4.07E-01	1.36E-02	1.63E-02	4.07E-01	1.36E-02	1.63E-02
272	Future Industrial 6	680134.8	4860694.1	8.87E-01	2.96E-02	3.55E-02	6.05E-01	2.02E-02	2.42E-02	6.05E-01	2.02E-02	2.42E-02
273	Future Industrial 11	680253.7	4860255.2	7.45E-01	2.48E-02	2.98E-02	4.67E-01	1.56E-02	1.87E-02	4.67E-01	1.56E-02	1.87E-02
274	Future Indsutrial 12	679901.2	4860511.8	6.44E-01	2.15E-02	2.58E-02	4.94E-01	1.65E-02	1.97E-02	4.94E-01	1.65E-02	1.97E-02
275	Commercial Farmer	679867.8	4860445.4	6.53E-01	2.18E-02	2.61E-02	4.85E-01	1.62E-02	1.94E-02	4.85E-01	1.62E-02	1.94E-02
276	Farmer	679277.0	4859981.5	4.43E-01	1.48E-02	1.77E-02	3.63E-01	1.21E-02	1.45E-02	3.63E-01	1.21E-02	1.45E-02
277	Residence	679387.2	4860648.9	7.22E-01	2.41E-02	2.89E-02	4.66E-01	1.55E-02	1.86E-02	4.66E-01	1.55E-02	1.86E-02
278	Barn	679261.9	4860574.2	6.31E-01	2.10E-02	2.52E-02	4.41E-01	1.47E-02	1.76E-02	4.41E-01	1.47E-02	1.76E-02
279	Residence	680150.7	4861295.7	9.12E-01	3.04E-02	3.65E-02	6.58E-01	2.19E-02	2.63E-02	6.58E-01	2.19E-02	2.63E-02
280	Residence	679939.8	4861213.4	9.13E-01	3.04E-02	3.65E-02	6.53E-01	2.18E-02	2.61E-02	6.53E-01	2.18E-02	2.61E-02

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	µg/m^3			µg/m^3			µg/m^3		
281	Farmer	680855.7	4861456.9	7.29E-01	2.43E-02	2.92E-02	4.67E-01	1.56E-02	1.87E-02	4.67E-01	1.56E-02	1.87E-02
282	Farmer	681386.2	4861673.3	5.05E-01	1.68E-02	2.02E-02	3.73E-01	1.24E-02	1.49E-02	3.73E-01	1.24E-02	1.49E-02
283	Residence	680683.5	4861597.9	6.66E-01	2.22E-02	2.66E-02	5.07E-01	1.69E-02	2.03E-02	5.07E-01	1.69E-02	2.03E-02
284	Business	680064.3	4861343.7	9.05E-01	3.02E-02	3.62E-02	6.55E-01	2.18E-02	2.62E-02	6.55E-01	2.18E-02	2.62E-02
285	Farmer	679680.1	4861213.5	8.27E-01	2.76E-02	3.31E-02	6.03E-01	2.01E-02	2.41E-02	6.03E-01	2.01E-02	2.41E-02
286	Farmer	681344.8	4861792.9	5.13E-01	1.71E-02	2.05E-02	3.79E-01	1.26E-02	1.52E-02	3.79E-01	1.26E-02	1.52E-02
287	Youth Centre	685644.2	4864814.8	2.42E-01	8.08E-03	9.70E-03	1.30E-01	4.32E-03	5.19E-03	1.30E-01	4.32E-03	5.19E-03
288	Bowmanville Arena	685462.9	4864615.2	2.41E-01	8.03E-03	9.64E-03	1.34E-01	4.45E-03	5.34E-03	1.34E-01	4.45E-03	5.34E-03
289	Bowmanville Rec Complex	684160.3	4864604.5	2.82E-01	9.39E-03	1.13E-02	1.65E-01	5.51E-03	6.61E-03	1.65E-01	5.51E-03	6.61E-03
290	Recreation Complex	684586.6	4862406.3	2.42E-01	8.07E-03	9.69E-03	1.67E-01	5.57E-03	6.68E-03	1.67E-01	5.57E-03	6.68E-03
291	Superdog Central	681487.7	4865723.3	2.81E-01	9.38E-03	1.13E-02	2.58E-01	8.59E-03	1.03E-02	2.58E-01	8.59E-03	1.03E-02
292	Equestrian Centre	681567.1	4863670.7	4.03E-01	1.34E-02	1.61E-02	3.20E-01	1.07E-02	1.28E-02	3.20E-01	1.07E-02	1.28E-02
293	Flea Market	678574.6	4862819.4	4.53E-01	1.51E-02	1.81E-02	3.30E-01	1.10E-02	1.32E-02	3.30E-01	1.10E-02	1.32E-02
294	Equestrian Centre	680030.8	4867320.2	2.34E-01	7.80E-03	9.36E-03	1.97E-01	6.57E-03	7.89E-03	1.97E-01	6.57E-03	7.89E-03
295	Courtice Community Complex	678099.3	4864629.8	3.78E-01	1.26E-02	1.51E-02	2.50E-01	8.35E-03	1.00E-02	2.50E-01	8.35E-03	1.00E-02
296	Former Restaurant	679830.2	4860702.2	7.44E-01	2.48E-02	2.98E-02	5.42E-01	1.81E-02	2.17E-02	5.42E-01	1.81E-02	2.17E-02
297	Commercial	679364.8	4861016.0	6.91E-01	2.30E-02	2.76E-02	5.04E-01	1.68E-02	2.02E-02	5.04E-01	1.68E-02	2.02E-02
298	GM Oshawa Headquarters	676418.3	4860463.7	3.84E-01	1.28E-02	1.54E-02	2.48E-01	8.28E-03	9.94E-03	2.48E-01	8.28E-03	9.94E-03
299	Farm A?	682972.3	4862201.9	3.31E-01	1.10E-02	1.32E-02	2.36E-01	7.88E-03	9.46E-03	2.36E-01	7.88E-03	9.46E-03
300	Farm B?	683546.9	4861959.7	3.21E-01	1.07E-02	1.29E-02	2.07E-01	6.90E-03	8.28E-03	2.07E-01	6.90E-03	8.28E-03
301	Farm C?	682547.5	4862321.1	4.29E-01	1.43E-02	1.72E-02	2.62E-01	8.72E-03	1.05E-02	2.62E-01	8.72E-03	1.05E-02
302	Farm D?	683238.3	4862393.3	3.05E-01	1.02E-02	1.22E-02	2.21E-01	7.36E-03	8.83E-03	2.21E-01	7.36E-03	8.83E-03
303	Farm E?	682512.6	4862858.0	4.81E-01	1.60E-02	1.92E-02	2.55E-01	8.51E-03	1.02E-02	2.55E-01	8.51E-03	1.02E-02
304	Farm F?	683129.1	4863649.4	3.51E-01	1.17E-02	1.40E-02	2.08E-01	6.93E-03	8.31E-03	2.08E-01	6.93E-03	8.31E-03
305	Bennett 1	688209.3	4862512.1	1.75E-01	5.82E-03	6.98E-03	1.19E-01	3.96E-03	4.75E-03	1.19E-01	3.96E-03	4.75E-03
306	Bennett 2	687990.0	4863221.3	1.53E-01	5.10E-03	6.12E-03	1.09E-01	3.62E-03	4.35E-03	1.09E-01	3.62E-03	4.35E-03
307	Bennett 3	688818.4	4862836.3	1.61E-01	5.37E-03	6.45E-03	1.13E-01	3.76E-03	4.51E-03	1.13E-01	3.76E-03	4.51E-03
308	Bennett 4	689045.1	4863365.5	1.57E-01	5.22E-03	6.27E-03	1.06E-01	3.54E-03	4.24E-03	1.06E-01	3.54E-03	4.24E-03
309	Bennett 5	688270.5	4863763.1	1.91E-01	6.36E-03	7.63E-03	9.71E-02	3.24E-03	3.88E-03	9.71E-02	3.24E-03	3.88E-03
310	Bennett 6	689908.5	4863100.5	1.47E-01	4.91E-03	5.90E-03	1.06E-01	3.52E-03	4.23E-03	1.06E-01	3.52E-03	4.23E-03
311	Bennett 7	688929.9	4864392.0	2.75E-01	9.18E-03	1.10E-02	1.36E-01	4.54E-03	5.45E-03	1.36E-01	4.54E-03	5.45E-03
312	Bennett 8	689684.2	4863837.7	1.41E-01	4.70E-03	5.65E-03	9.84E-02	3.28E-03	3.94E-03	9.84E-02	3.28E-03	3.94E-03
313	Soper 1	687557.9	4862512.4	1.84E-01	6.15E-03	7.38E-03	1.24E-01	4.13E-03	4.96E-03	1.24E-01	4.13E-03	4.96E-03
314	Soper 2	687241.9	4863171.7	1.52E-01	5.08E-03	6.09E-03	1.11E-01	3.69E-03	4.42E-03	1.11E-01	3.69E-03	4.42E-03
315	Soper 3	687023.2	4863903.8	1.94E-01	6.47E-03	7.76E-03	1.14E-01	3.79E-03	4.54E-03	1.14E-01	3.79E-03	4.54E-03
316	Soper 4	688158.2	4865389.3	1.65E-01	5.50E-03	6.60E-03	1.20E-01	4.00E-03	4.79E-03	1.20E-01	4.00E-03	4.79E-03
317	Soper 5	685027.3	4868253.9	2.26E-01	7.52E-03	9.03E-03	1.33E-01	4.44E-03	5.32E-03	1.33E-01	4.44E-03	5.32E-03
318	Soper 6	687287.4	4867037.3	1.21E-01	4.05E-03	4.86E-03	1.04E-01	3.48E-03	4.18E-03	1.04E-01	3.48E-03	4.18E-03
319	Soper 7	685683.2	4867148.1	1.97E-01	6.56E-03	7.87E-03	1.28E-01	4.27E-03	5.12E-03	1.28E-01	4.27E-03	5.12E-03
320	Soper 8	686748.7	4865874.7	1.80E-01	5.99E-03	7.19E-03	1.11E-01	3.70E-03	4.45E-03	1.11E-01	3.70E-03	4.45E-03
321	Bowmanville 1	687026.3	4862368.4	1.98E-01	6.59E-03	7.91E-03	1.30E-01	4.34E-03	5.21E-03	1.30E-01	4.34E-03	5.21E-03
322	Bowmanville 2	686625.7	4863020.3	1.92E-01	6.40E-03	7.68E-03	1.20E-01	4.00E-03	4.80E-03	1.20E-01	4.00E-03	4.80E-03
323	Bowmanville 3	683380.3	4865365.9	2.61E-01	8.69E-03	1.04E-02	1.96E-01	6.52E-03	7.82E-03	1.96E-01	6.52E-03	7.82E-03
324	Bowmanville 4	683111.4	4867150.3	2.23E-01	7.42E-03	8.90E-03	1.79E-01	5.97E-03	7.16E-03	1.79E-01	5.97E-03	7.16E-03
325	Bowmanville 5	682452.2	4869417.5	1.71E-01	5.72E-03	6.86E-03	1.49E-01	4.97E-03	5.97E-03	1.49E-01	4.97E-03	5.97E-03
326	Bowmanville 6	684778.5	4864888.2	2.03E-01	6.77E-03	8.12E-03	1.49E-01	4.96E-03	5.95E-03	1.49E-01	4.96E-03	5.95E-03
327	Bowmanville 7	684549.5	4866404.4	1.97E-01	6.56E-03	7.87E-03	1.54E-01	5.13E-03	6.16E-03	1.54E-01	5.13E-03	6.16E-03
328	Upper Tooley 1	679944.8	4864883.1	3.90E-01	1.30E-02	1.56E-02	2.98E-01	9.94E-03	1.19E-02	2.98E-01	9.94E-03	1.19E-02
329	Upper Tooley 2	679055.1	4863885.8	3.54E-01	1.18E-02	1.42E-02	2.80E-01	9.32E-03	1.12E-02	2.80E-01	9.32E-03	1.12E-02
330	Upper Tooley 3	679714.0	4862767.4	5.37E-01	1.79E-02	2.15E-02	4.26E-01	1.42E-02	1.70E-02	4.26E-01	1.42E-02	1.70E-02
331	Upper Tooley 4	678898.8	4861800.6	6.54E-01	2.18E-02	2.62E-02	4.29E-01	1.43E-02	1.72E-02	4.29E-01	1.43E-02	1.72E-02
332	Upper Tooley 5	680353.5	4862156.5	7.35E-01	2.45E-02	2.94E-02	5.00E-01	1.67E-02	2.00E-02	5.00E-01	1.67E-02	2.00E-02
333	Upper Tooley 6	679818.1	4861625.7	8.04E-01	2.68E-02	3.22E-02	6.00E-01	2.00E-02	2.40E-02	6.00E-01	2.00E-02	2.40E-02
334	Robinson 1	678434.8	4860943.1	5.38E-01	1.79E-02	2.15E-02	3.38E-01	1.13E-02	1.35E-02	3.38E-01	1.13E-02	1.35E-02
335	Robinson 2	677752.6	4861240.6	4.40E-01	1.47E-02	1.76E-02	3.41E-01	1.14E-02	1.36E-02	3.41E-01	1.14E-02	1.36E-02
336	Robinson 3	677642.2	4861787.2	4.34E-01	1.45E-02	1.74E-02	3.59E-01	1.20E-02	1.44E-02	3.59E-01	1.20E-02	1.44E-02
337	Robinson 4	678532.7	4862143.6	5.47E-01	1.82E-02	2.19E-02	3.65E-01	1.22E-02	1.46E-02	3.65E-01	1.22E-02	1.46E-02
338	Robinson 5	678005.1	4862784.9	5.02E-01	1.67E-02	2.01E-02	3.85E-01	1.28E-02	1.54E-02	3.85E-01	1.28E-02	1.54E-02
339	Robinson 6	677882.7	4860587.7	4.32E-01	1.44E-02	1.73E-02	3.03E-01	1.01E-02	1.21E-02	3.03E-01	1.01E-02	1.21E-02
340	F/B 1	677443.1	4867862.1	2.86E-01	9.52E-03	1.14E-02	2.22E-01	7.38E-03	8.86E-03	2.22E-01	7.38E-03	8.86E-03
341	F/B 2	679667.4	4866611.4	2.92E-01	9.72E-03	1.17E-02	2.15E-01	7.17E-03	8.60E-03	2.15E-01	7.17E-03	8.60E-03
342	F/B 3	678655.0	4867470.1	2.72E-01	9.07E-03	1.09E-02	2.12E-01	7.06E-03	8.48E-03	2.12E-01	7.06E-03	8.48E-03
343	F/B 4	676191.2	4866844.7	2.87E-01	9.56E-03	1.15E-02	2.20E-01	7.33E-03	8.80E-03	2.20E-01	7.33E-03	8.80E-03
344	F/B 5	678273.3	4866093.0	3.16E-01	1.05E-02	1.26E-02	2.30E-01	7.67E-03	9.21E-03	2.30E-01	7.67E-03	9.21E-03
345	F/B 6	681241.2	4867098.8	2.24E-01	7.47E-03	8.96E-03	2.06E-01	6.86E-03	8.24E-03	2.06E-01	6.86E-03	8.24E-03
346	F/B 7	682165.3	4868082.3	2.00E-01	6.67E-03	8.01E-03	1.74E-01	5.80E-03	6.96E-03	1.74E-01	5.80E-03	6.96E-03
347	F/B 8	679366.6	4868628.3	2.41E-01	8.02E-03	9.62E-03	1.94E-01	6.46E-03	7.75E-03	1.94E-01	6.46E-03	7.75E-03
348	F/B 9	680310.1	4869967.1	2.18E-01	7.25E-03	8.70E-03	1.78E-01	5.93E-03	7.12E-03	1.78E-01	5.93E-03	7.12E-03
349	F/B 10	676487.3	4869291.6	2.47E-01	8.25E-03	9.90E-03	1.96E-01	6.54E-03	7.85E-03	1.96E-01	6.54E-03	7.85E-03
350	F/B 11	676851.4	4865409.3	3.63E-01	1.21E-02	1.45E-02	2.69E-01	8.95E-03	1.07E-02	2.69E-01	8.95E-03	1.07E-02

Table A - 1. 24-hour Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5])	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	$\mu g/m^3$			$\mu g/m^3$			$\mu g/m^3$		
351	F/B 12	681153.3	4868682.2	1.97E-01	6.56E-03	7.87E-03	1.68E-01	5.59E-03	6.71E-03	1.68E-01	5.59E-03	6.71E-03
352	F/B 13	675416.3	4859833.9	3.84E-01	1.28E-02	1.54E-02	2.65E-01	8.83E-03	1.06E-02	2.65E-01	8.83E-03	1.06E-02
353	Second 1	675153.4	4860552.8	2.58E-01	8.59E-03	1.03E-02	1.83E-01	6.09E-03	7.31E-03	1.83E-01	6.09E-03	7.31E-03
354	Second 2	675297.5	4860891.3	2.72E-01	9.06E-03	1.09E-02	2.01E-01	6.71E-03	8.05E-03	2.01E-01	6.71E-03	8.05E-03
355	Second 3	675647.2	4860644.9	3.02E-01	1.01E-02	1.21E-02	1.98E-01	6.59E-03	7.91E-03	1.98E-01	6.59E-03	7.91E-03
356	Second 4	675670.5	4860076.5	4.20E-01	1.40E-02	1.68E-02	2.46E-01	8.21E-03	9.85E-03	2.46E-01	8.21E-03	9.85E-03
357	Second 5	676043.3	4860319.1	4.15E-01	1.38E-02	1.66E-02	2.30E-01	7.68E-03	9.21E-03	2.30E-01	7.68E-03	9.21E-03
358	Second 6	675923.4	4859821.4	3.83E-01	1.28E-02	1.53E-02	2.72E-01	9.07E-03	1.09E-02	2.72E-01	9.07E-03	1.09E-02
359	McLaughlin Bay 1	676714.7	4860903.8	3.42E-01	1.14E-02	1.37E-02	2.32E-01	7.73E-03	9.28E-03	2.32E-01	7.73E-03	9.28E-03
360	McLaughlin Bay 2	677310.8	4860528.2	4.35E-01	1.45E-02	1.74E-02	2.83E-01	9.44E-03	1.13E-02	2.83E-01	9.44E-03	1.13E-02
361	McLaughlin Bay 3	676563.5	4860260.1	4.71E-01	1.57E-02	1.88E-02	2.59E-01	8.65E-03	1.04E-02	2.59E-01	8.65E-03	1.04E-02
362	McLaughlin Bay 4	676699.5	4859696.6	7.57E-01	2.52E-02	3.03E-02	3.43E-01	1.14E-02	1.37E-02	3.43E-01	1.14E-02	1.37E-02
363	McLaughlin Bay 5	677560.0	4860060.1	4.17E-01	1.39E-02	1.67E-02	3.08E-01	1.03E-02	1.23E-02	3.08E-01	1.03E-02	1.23E-02
364	McLaughlin Bay 6	678204.5	4859832.5	3.25E-01	1.08E-02	1.30E-02	2.66E-01	8.86E-03	1.06E-02	2.66E-01	8.86E-03	1.06E-02
365	Harmony Creek 1	674178.3	4861024.2	1.85E-01	6.15E-03	7.38E-03	1.78E-01	5.94E-03	7.13E-03	1.78E-01	5.94E-03	7.13E-03
366	Harmony Creek 2	674592.0	4862605.3	2.03E-01	6.75E-03	8.10E-03	1.60E-01	5.34E-03	6.40E-03	1.60E-01	5.34E-03	6.40E-03
367	Harmony Creek 3	672863.4	4862808.0	1.89E-01	6.29E-03	7.55E-03	1.52E-01	5.05E-03	6.06E-03	1.52E-01	5.05E-03	6.06E-03
368	Harmony Creek 4	675671.6	4864469.0	3.21E-01	1.07E-02	1.29E-02	2.11E-01	7.04E-03	8.45E-03	2.11E-01	7.04E-03	8.45E-03
369	Harmony Creek 5	672443.1	4864713.0	1.79E-01	5.98E-03	7.18E-03	1.27E-01	4.22E-03	5.07E-03	1.27E-01	4.22E-03	5.07E-03
370	Harmony Creek 6	674830.5	4866909.6	2.13E-01	7.12E-03	8.54E-03	1.67E-01	5.56E-03	6.67E-03	1.67E-01	5.56E-03	6.67E-03
371	Harmony Creek 7	675799.9	4868594.1	2.38E-01	7.93E-03	9.51E-03	1.87E-01	6.24E-03	7.49E-03	1.87E-01	6.24E-03	7.49E-03
372	Westside 1	686082.6	4862776.6	1.98E-01	6.61E-03	7.93E-03	1.30E-01	4.33E-03	5.20E-03	1.30E-01	4.33E-03	5.20E-03
373	Westside 2	685778.7	4862137.9	2.32E-01	7.72E-03	9.27E-03	1.46E-01	4.86E-03	5.83E-03	1.46E-01	4.86E-03	5.83E-03
374	Westside 3	685084.2	4862827.4	2.02E-01	6.73E-03	8.07E-03	1.52E-01	5.07E-03	6.09E-03	1.52E-01	5.07E-03	6.09E-03
375	Darlington 1	680977.5	4865674.4	2.92E-01	9.74E-03	1.17E-02	2.68E-01	8.94E-03	1.07E-02	2.68E-01	8.94E-03	1.07E-02
376	Darlington 2	680913.9	4863967.1	4.02E-01	1.34E-02	1.61E-02	3.58E-01	1.19E-02	1.43E-02	3.58E-01	1.19E-02	1.43E-02
377	Darlington 3	682602.8	4863659.6	4.88E-01	1.63E-02	1.95E-02	2.30E-01	7.65E-03	9.18E-03	2.30E-01	7.65E-03	9.18E-03
378	Darlington 4	682206.4	4862910.4	5.05E-01	1.68E-02	2.02E-02	2.73E-01	9.09E-03	1.09E-02	2.73E-01	9.09E-03	1.09E-02
379	Darlington 5	683223.2	4861114.0	4.38E-01	1.46E-02	1.75E-02	2.17E-01	7.24E-03	8.69E-03	2.17E-01	7.24E-03	8.69E-03
380	Darlington 6	683947.7	4862362.0	3.23E-01	1.08E-02	1.29E-02	1.90E-01	6.32E-03	7.59E-03	1.90E-01	6.32E-03	7.59E-03
381	Darlington 7	685361.9	4861143.4	2.94E-01	9.81E-03	1.18E-02	1.42E-01	4.74E-03	5.69E-03	1.42E-01	4.74E-03	5.69E-03
382	Bennett ECO/HH	688606.4	4862634.8	1.67E-01	5.57E-03	6.68E-03	1.15E-01	3.84E-03	4.61E-03	1.15E-01	3.84E-03	4.61E-03
383	Oshawa ECO/HH	673884.9	4859128.9	3.13E-01	1.04E-02	1.25E-02	1.99E-01	6.64E-03	7.97E-03	1.99E-01	6.64E-03	7.97E-03
384	Oshawa Creek 1	671671.2	4862793.7	1.84E-01	6.12E-03	7.35E-03	1.45E-01	4.83E-03	5.79E-03	1.45E-01	4.83E-03	5.79E-03
385	Oshawa Creek 2	671668.5	4861589.5	1.59E-01	5.30E-03	6.36E-03	1.24E-01	4.13E-03	4.96E-03	1.24E-01	4.13E-03	4.96E-03
386	Oshawa Creek 3	672820.2	4861287.2	1.71E-01	5.69E-03	6.82E-03	1.38E-01	4.61E-03	5.53E-03	1.38E-01	4.61E-03	5.53E-03
387	Oshawa Creek 4	672360.3	4860262.6	2.10E-01	7.01E-03	8.41E-03	1.48E-01	4.93E-03	5.91E-03	1.48E-01	4.93E-03	5.91E-03
388	Oshawa Creek 5	673921.2	4860115.0	2.70E-01	8.98E-03	1.08E-02	1.72E-01	5.72E-03	6.86E-03	1.72E-01	5.72E-03	6.86E-03
389	Oshawa Creek 6	673154.0	4859421.9	2.77E-01	9.24E-03	1.11E-02	1.86E-01	6.19E-03	7.42E-03	1.86E-01	6.19E-03	7.42E-03
390	Farmer	677409.8	4861051.4	6.60E-01	2.20E-02	2.64E-02	3.22E-01	1.07E-02	1.29E-02	3.22E-01	1.07E-02	1.29E-02
391	Commercial Market	688276.3	4864698.5	1.95E-01	6.52E-03	7.82E-03	1.19E-01	3.96E-03	4.75E-03	1.19E-01	3.96E-03	4.75E-03

Notes:

CWS Standard (24-hour) - 30 $\mu g/m^3$

WHO Benchmark (24-hour) - 25 $\mu g/m^3$

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	$\mu g/m^3$			$\mu g/m^3$			$\mu g/m^3$		
1	Campground 10	678526.8	4859996.8	1.02E+00	3.41E-02	4.09E-02	2.99E+00	9.97E-02	1.20E-01	2.99E+00	9.97E-02	1.20E-01
2	ECO 2	675490.4	4860360.1	8.84E-01	2.95E-02	3.53E-02	2.03E+00	6.75E-02	8.10E-02	2.03E+00	6.75E-02	8.10E-02
3	Recreational 5	681642.0	4860349.3	1.39E+00	4.64E-02	5.57E-02	3.55E+00	1.18E-01	1.42E-01	3.55E+00	1.18E-01	1.42E-01
4	ECO 4	676831.5	4859840.9	1.16E+00	3.88E-02	4.66E-02	2.71E+00	9.04E-02	1.09E-01	2.71E+00	9.04E-02	1.09E-01
5	Bow. Valley Cons. 3	685767.2	4863879.0	5.36E-01	1.79E-02	2.15E-02	1.33E+00	4.43E-02	5.31E-02	1.33E+00	4.43E-02	5.31E-02
6	ECO 6	679647.8	4859989.3	1.12E+00	3.72E-02	4.47E-02	3.77E+00	1.26E-01	1.51E-01	3.77E+00	1.26E-01	1.51E-01
7	ECO 7	681578.8	4862070.1	1.29E+00	4.29E-02	5.14E-02	3.46E+00	1.15E-01	1.38E-01	3.46E+00	1.15E-01	1.38E-01
8	ECO 8	679735.5	4861048.6	2.23E+00	7.43E-02	8.91E-02	6.02E+00	2.01E-01	2.41E-01	6.02E+00	2.01E-01	2.41E-01
9	ECO 9	687219.7	4864249.3	4.89E-01	1.63E-02	1.95E-02	1.24E+00	4.14E-02	4.96E-02	1.24E+00	4.14E-02	4.96E-02
10	ECO 10	686519.0	4861987.6	5.56E-01	1.85E-02	2.22E-02	1.40E+00	4.65E-02	5.58E-02	1.40E+00	4.65E-02	5.58E-02
11	ECO 11	679870.4	4859737.9	1.34E+00	4.46E-02	5.35E-02	3.45E+00	1.15E-01	1.38E-01	3.45E+00	1.15E-01	1.38E-01
12	Recreational 4	681575.5	4860557.7	1.23E+00	4.10E-02	4.92E-02	3.14E+00	1.05E-01	1.26E-01	3.14E+00	1.05E-01	1.26E-01
13	Future Industrial 9	680704.5	4859857.8	1.46E+00	4.88E-02	5.86E-02	3.39E+00	1.13E-01	1.36E-01	3.39E+00	1.13E-01	1.36E-01
14	Future Industrial 10	680608.0	4860719.6	2.37E+00	7.91E-02	9.50E-02	5.09E+00	1.70E-01	2.03E-01	5.09E+00	1.70E-01	2.03E-01
15	Harmony Creek	673992.4	4865641.4	6.47E-01	2.16E-02	2.59E-02	1.34E+00	4.46E-02	5.35E-02	1.34E+00	4.46E-02	5.35E-02
16	Farewell Creek	678079.2	4868822.7	6.57E-01	2.19E-02	2.63E-02	2.09E+00	6.97E-02	8.37E-02	2.09E+00	6.97E-02	8.37E-02
17	Farmer	681378.6	4860335.0	1.45E+00	4.82E-02	5.78E-02	3.76E+00	1.25E-01	1.50E-01	3.76E+00	1.25E-01	1.50E-01
18	Watson Farm	682883.4	4864219.7	1.16E+00	3.88E-02	4.66E-02	2.19E+00	7.30E-02	8.76E-02	2.19E+00	7.30E-02	8.76E-02
19	Racanski Farm	678929.2	4865530.2	7.36E-01	2.45E-02	2.95E-02	2.29E+00	7.62E-02	9.14E-02	2.29E+00	7.62E-02	9.14E-02
20	Zoo	687216.8	4864835.3	4.14E-01	1.38E-02	1.66E-02	1.31E+00	4.38E-02	5.25E-02	1.31E+00	4.38E-02	5.25E-02
21	Cedar Crest Beach	686652.1	4861660.9	8.00E-01	2.67E-02	3.20E-02	1.50E+00	5.02E-02	6.02E-02	1.50E+00	5.02E-02	6.02E-02
22	Darlington Prov Park Beach	677844.6	4859718.2	1.07E+00	3.55E-02	4.26E-02	2.49E+00	8.30E-02	9.96E-02	2.49E+00	8.30E-02	9.96E-02
23	OPG 1	682258.1	4860045.0	1.49E+00	4.98E-02	5.98E-02	2.80E+00	9.34E-02	1.12E-01	2.80E+00	9.34E-02	1.12E-01
24	OPG 2	682551.4	4859889.1	1.03E+00	3.43E-02	4.11E-02	2.45E+00	8.15E-02	9.78E-02	2.45E+00	8.15E-02	9.78E-02
25	OPG 3	682824.6	4859759.3	9.37E-01	3.12E-02	3.75E-02	2.24E+00	7.45E-02	8.94E-02	2.24E+00	7.45E-02	8.94E-02
26	OPG 4	683021.6	4859937.3	1.09E+00	3.63E-02	4.36E-02	2.17E+00	7.23E-02	8.67E-02	2.17E+00	7.23E-02	8.67E-02
27	OPG 5	683318.2	4859677.8	7.42E-01	2.47E-02	2.97E-02	1.98E+00	6.60E-02	7.92E-02	1.98E+00	6.60E-02	7.92E-02
28	OPG 6	683306.9	4860023.0	1.03E+00	3.44E-02	4.13E-02	2.20E+00	7.33E-02	8.79E-02	2.20E+00	7.33E-02	8.79E-02
29	OPG 7	683718.6	4859915.8	7.61E-01	2.54E-02	3.04E-02	2.07E+00	6.90E-02	8.28E-02	2.07E+00	6.90E-02	8.28E-02
30	OPG 8	682702.0	4859998.6	1.29E+00	4.29E-02	5.15E-02	2.37E+00	7.91E-02	9.49E-02	2.37E+00	7.91E-02	9.49E-02
31	OPG 9	684347.7	4861184.6	7.85E-01	2.62E-02	3.14E-02	1.71E+00	5.70E-02	6.84E-02	1.71E+00	5.70E-02	6.84E-02
32	OPG 10	682157.2	4861228.2	1.12E+00	3.75E-02	4.50E-02	2.88E+00	9.60E-02	1.15E-01	2.88E+00	9.60E-02	1.15E-01
33	St. Mary|s 1	684557.0	4861070.0	9.52E-01	3.17E-02	3.81E-02	1.64E+00	5.45E-02	6.54E-02	1.64E+00	5.45E-02	6.54E-02
34	St. Mary|s 2	684657.3	4861320.8	7.54E-01	2.51E-02	3.02E-02	1.62E+00	5.40E-02	6.48E-02	1.62E+00	5.40E-02	6.48E-02
35	St. Mary|s 3	684905.3	4861154.4	8.93E-01	2.98E-02	3.57E-02	1.54E+00	5.12E-02	6.15E-02	1.54E+00	5.12E-02	6.15E-02
36	Court. Subdivision 1	677328.4	4862976.1	1.26E+00	4.18E-02	5.02E-02	4.06E+00	1.35E-01	1.63E-01	4.06E+00	1.35E-01	1.63E-01
37	Court. Subdivision 2	676187.9	4862611.1	7.50E-01	2.50E-02	3.00E-02	1.85E+00	6.17E-02	7.40E-02	1.85E+00	6.17E-02	7.40E-02
38	Court. Subdivision 3	675974.8	4863484.1	6.75E-01	2.25E-02	2.70E-02	2.11E+00	7.03E-02	8.44E-02	2.11E+00	7.03E-02	8.44E-02
39	Court. Subdivision 4	676606.1	4863214.1	9.14E-01	3.05E-02	3.66E-02	2.92E+00	9.74E-02	1.17E-01	2.92E+00	9.74E-02	1.17E-01
40	Court. Subdivision 5	676827.1	4863591.4	1.04E+00	3.45E-02	4.14E-02	3.25E+00	1.08E-01	1.30E-01	3.25E+00	1.08E-01	1.30E-01
41	Court. Subdivision 6	677200.4	4864074.9	1.10E+00	3.68E-02	4.42E-02	3.23E+00	1.08E-01	1.29E-01	3.23E+00	1.08E-01	1.29E-01
42	Court. Subdivision 7	677719.8	4863625.1	1.19E+00	3.98E-02	4.78E-02	3.34E+00	1.11E-01	1.34E-01	3.34E+00	1.11E-01	1.34E-01
43	Court. Subdivision 8	678271.6	4864200.6	9.36E-01	3.12E-02	3.75E-02	2.36E+00	7.85E-02	9.42E-02	2.36E+00	7.85E-02	9.42E-02
44	Court. Subdivision 9	678184.4	4863373.6	1.10E+00	3.65E-02	4.38E-02	2.79E+00	9.30E-02	1.12E-01	2.79E+00	9.30E-02	1.12E-01
45	Court. Subdivision 10	677179.7	4862499.5	1.11E+00	3.70E-02	4.44E-02	3.78E+00	1.26E-01	1.51E-01	3.78E+00	1.26E-01	1.51E-01
46	Bow. Subdivision 1	683536.7	4864215.2	8.82E-01	2.94E-02	3.53E-02	1.85E+00	6.17E-02	7.40E-02	1.85E+00	6.17E-02	7.40E-02
47	Bow. Subdivision 2	683770.0	4863915.1	6.78E-01	2.26E-02	2.71E-02	1.81E+00	6.03E-02	7.24E-02	1.81E+00	6.03E-02	7.24E-02
48	Bow. Subdivision 3	683671.0	4863534.1	7.51E-01	2.50E-02	3.00E-02	1.90E+00	6.33E-02	7.60E-02	1.90E+00	6.33E-02	7.60E-02
49	Bow. Subdivision 4	684501.9	4863847.4	8.24E-01	2.75E-02	3.30E-02	1.61E+00	5.37E-02	6.44E-02	1.61E+00	5.37E-02	6.44E-02
50	Bow. Subdivision 5	684242.9	4863518.8	6.66E-01	2.22E-02	2.66E-02	1.71E+00	5.72E-02	6.86E-02	1.71E+00	5.72E-02	6.86E-02
51	Bow. Subdivision 6	684271.4	4863201.5	6.31E-01	2.10E-02	2.52E-02	1.73E+00	5.78E-02	6.94E-02	1.73E+00	5.78E-02	6.94E-02
52	Bow. Subdivision 7	683992.6	4862628.1	7.19E-01	2.40E-02	2.88E-02	1.87E+00	6.24E-02	7.48E-02	1.87E+00	6.24E-02	7.48E-02
53	Bow. Subdivision 8	684608.2	4862956.8	5.74E-01	1.91E-02	2.29E-02	1.65E+00	5.49E-02	6.58E-02	1.65E+00	5.49E-02	6.58E-02
54	Bow. Subdivision 9	684777.3	4863330.5	6.26E-01	2.09E-02	2.50E-02	1.58E+00	5.26E-02	6.31E-02	1.58E+00	5.26E-02	6.31E-02
55	Bow. Subdivision 10	685266.0	4863243.1	6.10E-01	2.03E-02	2.44E-02	1.46E+00	4.87E-02	5.85E-02	1.46E+00	4.87E-02	5.85E-02
56	Osh/Court Subdivision 1	677396.8	4860977.3	1.57E+00	5.22E-02	6.26E-02	3.22E+00	1.07E-01	1.29E-01	3.22E+00	1.07E-01	1.29E-01
57	Osh/Court Subdivision 2	676633.5	4860816.8	8.92E-01	2.97E-02	3.57E-02	2.34E+00	7.81E-02	9.37E-02	2.34E+00	7.81E-02	9.37E-02
58	Osh/Court Subdivision 3	676916.0	4861925.0	8.05E-01	2.68E-02	3.22E-02	2.53E+00	8.43E-02	1.01E-01	2.53E+00	8.43E-02	1.01E-01
59	Osh/Court Subdivision 4	676730.5	4861317.1	1.33E+00	4.44E-02	5.33E-02	2.53E+00	8.43E-02	1.01E-01	2.53E+00	8.43E-02	1.01E-01
60	Osh/Court Subdivision 5	676087.2	4861392.3	9.34E-01	3.11E-02	3.74E-02	2.15E+00	7.16E-02	8.59E-02	2.15E+00	7.16E-02	8.59E-02
61	Osh/Court Subdivision 6	676177.1	4861722.2	7.76E-01	2.59E-02	3.10E-02	2.20E+00	7.34E-02	8.81E-02	2.20E+00	7.34E-02	8.81E-02
62	Osh/Court Subdivision 7	675670.7	4861783.2	7.19E-01	2.40E-02	2.88E-02	2.07E+00	6.91E-02	8.29E-02	2.07E+00	6.91E-02	8.29E-02

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011 Particulate Matter PM2.5 Process Upset µg/m³	July 2011 Concentration Ratio CWS Standard	July 2011 Concentration Ratio WHO Benchmark	December 2009 Particulate Matter PM2.5 Process Upset µg/m³	December 2009 Concentration Ratio CWS Standard	December 2009 Concentration Ratio WHO Benchmark	July 2009 Particulate Matter PM2.5 Process Upset µg/m³	July 2009 Concentration Ratio CWS Standard	July 2009 Concentration Ratio WHO Benchmark
63	Osh/Court Subdivision 8	676050.8	4862055.7	6.64E-01	2.21E-02	2.66E-02	1.97E+00	6.58E-02	7.89E-02	1.97E+00	6.58E-02	7.89E-02
64	Osh/Court Subdivision 9	676636.9	4862134.3	6.86E-01	2.29E-02	2.74E-02	2.20E+00	7.32E-02	8.78E-02	2.20E+00	7.32E-02	8.78E-02
65	Osh/Court Subdivision 10	676571.3	4861634.8	8.40E-01	2.80E-02	3.36E-02	2.34E+00	7.78E-02	9.34E-02	2.34E+00	7.78E-02	9.34E-02
66	Bow. Subdivision 11	684649.2	4863182.7	6.48E-01	2.16E-02	2.59E-02	1.62E+00	5.41E-02	6.49E-02	1.62E+00	5.41E-02	6.49E-02
67	Daycare B	685172.4	4863933.1	4.49E-01	1.50E-02	1.79E-02	1.44E+00	4.81E-02	5.78E-02	1.44E+00	4.81E-02	5.78E-02
68	Daycare C	685452.0	4863104.4	5.74E-01	1.91E-02	2.30E-02	1.43E+00	4.75E-02	5.70E-02	1.43E+00	4.75E-02	5.70E-02
69	Daycare D	685527.7	4864693.3	6.13E-01	2.04E-02	2.45E-02	1.32E+00	4.39E-02	5.27E-02	1.32E+00	4.39E-02	5.27E-02
70	Daycare E	685735.4	4864790.8	5.79E-01	1.93E-02	2.32E-02	1.28E+00	4.26E-02	5.12E-02	1.28E+00	4.26E-02	5.12E-02
71	Daycare F	685520.3	4864854.3	6.03E-01	2.01E-02	2.41E-02	1.32E+00	4.40E-02	5.28E-02	1.32E+00	4.40E-02	5.28E-02
72	Daycare G	685441.9	4864878.0	5.74E-01	1.91E-02	2.30E-02	1.33E+00	4.45E-02	5.33E-02	1.33E+00	4.45E-02	5.33E-02
73	Daycare H	686364.8	4864707.8	3.74E-01	1.25E-02	1.50E-02	1.36E+00	4.53E-02	5.44E-02	1.36E+00	4.53E-02	5.44E-02
74	Daycare I	685721.6	4865127.3	5.43E-01	1.81E-02	2.17E-02	1.28E+00	4.28E-02	5.14E-02	1.28E+00	4.28E-02	5.14E-02
75	Daycare J	678256.3	4863565.4	1.02E+00	3.41E-02	4.09E-02	2.59E+00	8.64E-02	1.04E-01	2.59E+00	8.64E-02	1.04E-01
76	Daycare K	677694.1	4864043.7	1.12E+00	3.72E-02	4.47E-02	3.07E+00	1.02E-01	1.23E-01	3.07E+00	1.02E-01	1.23E-01
77	Daycare L	676479.5	4862526.2	7.10E-01	2.37E-02	2.84E-02	2.25E+00	7.51E-02	9.02E-02	2.25E+00	7.51E-02	9.02E-02
78	Daycare M	678320.9	4864763.5	8.71E-01	2.90E-02	3.48E-02	2.30E+00	7.67E-02	9.20E-02	2.30E+00	7.67E-02	9.20E-02
79	Daycare N	678513.4	4865058.0	8.01E-01	2.67E-02	3.20E-02	2.16E+00	7.20E-02	8.64E-02	2.16E+00	7.20E-02	8.64E-02
80	Daycare O	672788.7	4863936.6	4.40E-01	1.47E-02	1.76E-02	1.27E+00	4.24E-02	5.09E-02	1.27E+00	4.24E-02	5.09E-02
81	Daycare P	673952.8	4863592.5	4.92E-01	1.64E-02	1.97E-02	1.30E+00	4.35E-02	5.21E-02	1.30E+00	4.35E-02	5.21E-02
82	Daycare Q	671751.8	4864887.7	4.20E-01	1.40E-02	1.68E-02	1.28E+00	4.26E-02	5.12E-02	1.28E+00	4.26E-02	5.12E-02
83	Daycare R	685714.4	4864667.4	5.56E-01	1.85E-02	2.22E-02	1.29E+00	4.30E-02	5.16E-02	1.29E+00	4.30E-02	5.16E-02
84	Daycare S	684177.9	4863618.2	9.47E-01	3.16E-02	3.79E-02	1.72E+00	5.74E-02	6.89E-02	1.72E+00	5.74E-02	6.89E-02
85	Daycare T	678423.6	4864480.4	8.60E-01	2.87E-02	3.44E-02	2.19E+00	7.30E-02	8.76E-02	2.19E+00	7.30E-02	8.76E-02
86	Daycare U	685330.5	4863435.1	5.98E-01	1.99E-02	2.39E-02	1.44E+00	4.79E-02	5.75E-02	1.44E+00	4.79E-02	5.75E-02
87	Daycare V	685153.2	4863236.9	5.77E-01	1.92E-02	2.31E-02	1.49E+00	4.97E-02	5.96E-02	1.49E+00	4.97E-02	5.96E-02
88	Daycare W	672679.0	4862044.9	4.83E-01	1.61E-02	1.93E-02	1.49E+00	4.96E-02	5.95E-02	1.49E+00	4.96E-02	5.95E-02
89	Daycare X	672076.5	4865285.8	4.55E-01	1.52E-02	1.82E-02	1.25E+00	4.18E-02	5.02E-02	1.25E+00	4.18E-02	5.02E-02
90	Daycare Y	672638.0	4859664.4	6.30E-01	2.10E-02	2.52E-02	1.67E+00	5.56E-02	6.67E-02	1.67E+00	5.56E-02	6.67E-02
91	Daycare Z	673735.9	4858958.0	6.21E-01	2.07E-02	2.48E-02	1.87E+00	6.22E-02	7.46E-02	1.87E+00	6.22E-02	7.46E-02
92	Daycare AA	673121.8	4863385.9	4.24E-01	1.41E-02	1.70E-02	1.27E+00	4.23E-02	5.08E-02	1.27E+00	4.23E-02	5.08E-02
93	Daycare BB	673904.8	4862282.2	5.44E-01	1.81E-02	2.18E-02	1.69E+00	5.63E-02	6.76E-02	1.69E+00	5.63E-02	6.76E-02
94	Daycare CC	671471.6	4861795.3	4.08E-01	1.36E-02	1.63E-02	1.27E+00	4.24E-02	5.09E-02	1.27E+00	4.24E-02	5.09E-02
95	Daycare DD	673057.3	4862625.6	4.90E-01	1.63E-02	1.96E-02	1.56E+00	5.19E-02	6.22E-02	1.56E+00	5.19E-02	6.22E-02
96	Daycare EE	674917.1	4863957.2	5.68E-01	1.89E-02	2.27E-02	1.47E+00	4.89E-02	5.87E-02	1.47E+00	4.89E-02	5.87E-02
97	Daycare FF	671356.6	4862954.4	4.51E-01	1.50E-02	1.80E-02	1.43E+00	4.75E-02	5.71E-02	1.43E+00	4.75E-02	5.71E-02
98	Daycare GG	671675.5	4862705.8	4.62E-01	1.54E-02	1.85E-02	1.45E+00	4.83E-02	5.80E-02	1.45E+00	4.83E-02	5.80E-02
99	Daycare HH	671604.8	4860138.1	5.07E-01	1.69E-02	2.03E-02	1.39E+00	4.63E-02	5.56E-02	1.39E+00	4.63E-02	5.56E-02
100	Daycare II	670945.2	4857983.8	3.76E-01	1.25E-02	1.50E-02	1.18E+00	3.93E-02	4.72E-02	1.18E+00	3.93E-02	4.72E-02
101	Daycare JJ	677514.6	4864744.1	1.02E+00	3.39E-02	4.07E-02	2.85E+00	9.52E-02	1.14E-01	2.85E+00	9.52E-02	1.14E-01
102	Daycare KK	676519.9	4862680.1	7.51E-01	2.50E-02	3.00E-02	2.45E+00	8.16E-02	9.80E-02	2.45E+00	8.16E-02	9.80E-02
103	Daycare LL	677660.6	4863601.3	1.21E+00	4.02E-02	4.83E-02	3.43E+00	1.14E-01	1.37E-01	3.43E+00	1.14E-01	1.37E-01
104	Court. Subdivision 11	677665.8	4863406.6	1.25E+00	4.17E-02	5.00E-02	3.63E+00	1.21E-01	1.45E-01	3.63E+00	1.21E-01	1.45E-01
105	Daycare NN	674866.3	4864667.2	5.52E-01	1.84E-02	2.21E-02	1.59E+00	5.29E-02	6.34E-02	1.59E+00	5.29E-02	6.34E-02
106	Daycare OO	673201.0	4864746.4	4.94E-01	1.65E-02	1.97E-02	1.26E+00	4.19E-02	5.03E-02	1.26E+00	4.19E-02	5.03E-02
107	Daycare PP	674794.5	4864915.4	6.67E-01	2.22E-02	2.67E-02	1.58E+00	5.25E-02	6.30E-02	1.58E+00	5.25E-02	6.30E-02
108	Hospital	686324.2	4864395.8	4.76E-01	1.59E-02	1.90E-02	1.38E+00	4.61E-02	5.53E-02	1.38E+00	4.61E-02	5.53E-02
109	Hospital (Children's)	676057.8	4862180.9	6.47E-01	2.16E-02	2.59E-02	1.86E+00	6.19E-02	7.42E-02	1.86E+00	6.19E-02	7.42E-02
110	Hospital	671233.2	4863615.9	3.90E-01	1.30E-02	1.56E-02	1.30E+00	4.33E-02	5.19E-02	1.30E+00	4.33E-02	5.19E-02
111	Comm. Resp. Services	676045.4	4863902.5	7.50E-01	2.50E-02	3.00E-02	2.36E+00	7.87E-02	9.45E-02	2.36E+00	7.87E-02	9.45E-02
112	Hospital	671712.7	4862364.1	4.58E-01	1.53E-02	1.83E-02	1.42E+00	4.74E-02	5.69E-02	1.42E+00	4.74E-02	5.69E-02
113	Retirement Residence A	684199.9	4864120.3	5.53E-01	1.84E-02	2.21E-02	1.66E+00	5.52E-02	6.63E-02	1.66E+00	5.52E-02	6.63E-02
114	Retirement Residence B	685483.9	4865150.9	4.64E-01	1.55E-02	1.86E-02	1.33E+00	4.44E-02	5.33E-02	1.33E+00	4.44E-02	5.33E-02
115	Retirement Residence C	686844.0	4864732.1	4.24E-01	1.41E-02	1.70E-02	1.35E+00	4.51E-02	5.41E-02	1.35E+00	4.51E-02	5.41E-02
116	Retirement Residence D	673481.7	4863343.4	4.42E-01	1.47E-02	1.77E-02	1.27E+00	4.22E-02	5.06E-02	1.27E+00	4.22E-02	5.06E-02
117	Retirement Residence E	671825.2	4864399.0	4.09E-01	1.36E-02	1.64E-02	1.29E+00	4.31E-02	5.18E-02	1.29E+00	4.31E-02	5.18E-02
118	Retirement Residence F	671606.3	4864536.0	4.05E-01	1.35E-02	1.62E-02	1.29E+00	4.31E-02	5.17E-02	1.29E+00	4.31E-02	5.17E-02
119	Retirement Residence G	671357.1	4862958.7	4.51E-01	1.50E-02	1.80E-02	1.43E+00	4.75E-02	5.70E-02	1.43E+00	4.75E-02	5.70E-02
120	Retirement Residence H	671514.0	4862262.9	4.47E-01	1.49E-02	1.79E-02	1.39E+00	4.62E-02	5.54E-02	1.39E+00	4.62E-02	5.54E-02
121	Retirement Residence I	672602.2	4863075.9	4.42E-01	1.47E-02	1.77E-02	1.44E+00	4.80E-02	5.75E-02	1.44E+00	4.80E-02	5.75E-02
122	Retirement Residence J	671719.1	4862893.1	4.56E-01	1.52E-02	1.82E-02	1.45E+00	4.82E-02	5.79E-02	1.45E+00	4.82E-02	5.79E-02
123	Retirement Residence K	686718.0	4865648.7	4.62E-01	1.54E-02	1.85E-02	1.12E+00	3.72E-02	4.46E-02	1.12E+00	3.72E-02	4.46E-02
124	Retirement Residence L	676168.7	4865669.9	7.85E-01	2.62E-02	3.14E-02	2.39E+00	7.98E-02	9.58E-02	2.39E+00	7.98E-02	9.58E-02

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011 Particulate Matter PM2.5 Process Upset µg/m³	July 2011 Concentration Ratio CWS Standard	July 2011 Concentration Ratio WHO Benchmark	December 2009 Particulate Matter PM2.5 Process Upset µg/m³	December 2009 Concentration Ratio CWS Standard	December 2009 Concentration Ratio WHO Benchmark	July 2009 Particulate Matter PM2.5 Process Upset µg/m³	July 2009 Concentration Ratio CWS Standard	July 2009 Concentration Ratio WHO Benchmark
125	Retirement Residence M	676118.5	4863980.7	7.79E-01	2.60E-02	3.12E-02	2.45E+00	8.17E-02	9.81E-02	2.45E+00	8.17E-02	9.81E-02
126	Bow. Subdivision 12	684649.2	4863182.7	6.48E-01	2.16E-02	2.59E-02	1.62E+00	5.41E-02	6.49E-02	1.62E+00	5.41E-02	6.49E-02
127	Primary School B	685384.8	4863575.3	5.97E-01	1.99E-02	2.39E-02	1.42E+00	4.73E-02	5.68E-02	1.42E+00	4.73E-02	5.68E-02
128	Primary School C	685021.6	4863952.9	4.38E-01	1.46E-02	1.75E-02	1.48E+00	4.92E-02	5.90E-02	1.48E+00	4.92E-02	5.90E-02
129	Primary School D	686237.0	4864085.5	5.21E-01	1.74E-02	2.08E-02	1.33E+00	4.42E-02	5.31E-02	1.33E+00	4.42E-02	5.31E-02
130	Primary School E	686719.0	4863734.7	5.04E-01	1.68E-02	2.01E-02	1.17E+00	3.91E-02	4.69E-02	1.17E+00	3.91E-02	4.69E-02
131	Primary School F	686357.0	4864754.9	3.75E-01	1.25E-02	1.50E-02	1.35E+00	4.50E-02	5.40E-02	1.35E+00	4.50E-02	5.40E-02
132	Primary School G	685502.0	4865013.4	5.34E-01	1.78E-02	2.13E-02	1.33E+00	4.42E-02	5.31E-02	1.33E+00	4.42E-02	5.31E-02
133	Primary School H	686726.7	4866061.5	4.18E-01	1.39E-02	1.67E-02	1.12E+00	3.73E-02	4.47E-02	1.12E+00	3.73E-02	4.47E-02
134	Primary School I	685186.2	4866568.2	4.56E-01	1.52E-02	1.82E-02	1.39E+00	4.64E-02	5.57E-02	1.39E+00	4.64E-02	5.57E-02
135	Primary School J	685965.3	4866979.0	5.64E-01	1.88E-02	2.26E-02	1.24E+00	4.12E-02	4.95E-02	1.24E+00	4.12E-02	4.95E-02
136	Primary School K	677709.9	4864726.5	1.01E+00	3.35E-02	4.02E-02	2.77E+00	9.24E-02	1.11E-01	2.77E+00	9.24E-02	1.11E-01
137	Primary School L	675988.3	4864270.2	8.60E-01	2.87E-02	3.44E-02	2.37E+00	7.90E-02	9.48E-02	2.37E+00	7.90E-02	9.48E-02
138	Primary School M	676608.7	4862739.0	8.21E-01	2.74E-02	3.28E-02	2.68E+00	8.92E-02	1.07E-01	2.68E+00	8.92E-02	1.07E-01
139	Primary School N	677222.2	4863759.1	1.15E+00	3.82E-02	4.58E-02	3.43E+00	1.14E-01	1.37E-01	3.43E+00	1.14E-01	1.37E-01
140	Primary School O	678154.9	4863872.7	1.02E+00	3.41E-02	4.10E-02	2.58E+00	8.61E-02	1.03E-01	2.58E+00	8.61E-02	1.03E-01
141	Court. Subdivision 12	678309.6	4863600.8	9.91E-01	3.30E-02	3.96E-02	2.60E+00	8.68E-02	1.04E-01	2.60E+00	8.68E-02	1.04E-01
142	Primary School Q	677010.6	4862470.6	9.89E-01	3.30E-02	3.96E-02	3.36E+00	1.12E-01	1.34E-01	3.36E+00	1.12E-01	1.34E-01
143	Primary School R	677431.3	4866694.7	8.06E-01	2.69E-02	3.22E-02	2.41E+00	8.04E-02	9.65E-02	2.41E+00	8.04E-02	9.65E-02
144	Primary School S	675266.2	4863562.9	5.90E-01	1.97E-02	2.36E-02	1.57E+00	5.23E-02	6.28E-02	1.57E+00	5.23E-02	6.28E-02
145	Primary School T	673479.2	4860029.4	6.49E-01	2.16E-02	2.60E-02	1.70E+00	5.67E-02	6.80E-02	1.70E+00	5.67E-02	6.80E-02
146	Primary School U	670856.0	4860710.6	4.07E-01	1.36E-02	1.63E-02	1.26E+00	4.19E-02	5.03E-02	1.26E+00	4.19E-02	5.03E-02
147	Primary School V	672660.2	4863909.2	4.32E-01	1.44E-02	1.73E-02	1.28E+00	4.27E-02	5.13E-02	1.28E+00	4.27E-02	5.13E-02
148	Primary School W	672735.2	4859232.9	7.28E-01	2.43E-02	2.91E-02	1.80E+00	6.01E-02	7.22E-02	1.80E+00	6.01E-02	7.22E-02
149	Primary School X	673575.8	4862688.6	4.92E-01	1.64E-02	1.97E-02	1.57E+00	5.24E-02	6.29E-02	1.57E+00	5.24E-02	6.29E-02
150	Primary School Y	673710.3	4861969.0	5.41E-01	1.80E-02	2.16E-02	1.63E+00	5.45E-02	6.54E-02	1.63E+00	5.45E-02	6.54E-02
151	Primary School Z	672366.0	4859928.1	5.81E-01	1.94E-02	2.32E-02	1.52E+00	5.07E-02	6.09E-02	1.52E+00	5.07E-02	6.09E-02
152	Primary School AA	672561.7	4866047.1	4.60E-01	1.53E-02	1.84E-02	1.20E+00	3.99E-02	4.79E-02	1.20E+00	3.99E-02	4.79E-02
153	Primary School BB	675095.1	4862930.4	5.12E-01	1.71E-02	2.05E-02	1.36E+00	4.55E-02	5.46E-02	1.36E+00	4.55E-02	5.46E-02
154	Primary School CC	673242.6	4865197.9	4.80E-01	1.60E-02	1.92E-02	1.24E+00	4.13E-02	4.96E-02	1.24E+00	4.13E-02	4.96E-02
155	Primary School DD	674164.9	4863031.3	4.57E-01	1.52E-02	1.83E-02	1.38E+00	4.60E-02	5.52E-02	1.38E+00	4.60E-02	5.52E-02
156	Primary School EE	671905.6	4864697.8	4.22E-01	1.41E-02	1.69E-02	1.28E+00	4.28E-02	5.13E-02	1.28E+00	4.28E-02	5.13E-02
157	Primary School FF	673294.9	4858774.5	5.51E-01	1.84E-02	2.20E-02	1.69E+00	5.64E-02	6.77E-02	1.69E+00	5.64E-02	6.77E-02
158	Primary School GG	671659.7	4863120.0	4.42E-01	1.47E-02	1.77E-02	1.42E+00	4.74E-02	5.69E-02	1.42E+00	4.74E-02	5.69E-02
159	Primary School HH	673853.4	4866711.0	7.08E-01	2.36E-02	2.83E-02	1.56E+00	5.19E-02	6.23E-02	1.56E+00	5.19E-02	6.23E-02
160	Primary School II	672616.7	4862114.9	4.85E-01	1.62E-02	1.94E-02	1.50E+00	4.99E-02	5.99E-02	1.50E+00	4.99E-02	5.99E-02
161	Primary School JJ	673567.2	4861899.5	5.27E-01	1.76E-02	2.11E-02	1.60E+00	5.32E-02	6.38E-02	1.60E+00	5.32E-02	6.38E-02
162	Primary School KK	671791.0	4861954.2	4.38E-01	1.46E-02	1.75E-02	1.35E+00	4.51E-02	5.41E-02	1.35E+00	4.51E-02	5.41E-02
163	Primary School LL	673762.3	4864210.6	5.09E-01	1.70E-02	2.04E-02	1.32E+00	4.39E-02	5.26E-02	1.32E+00	4.39E-02	5.26E-02
164	Primary School MM	672238.8	4864621.3	4.36E-01	1.45E-02	1.75E-02	1.28E+00	4.26E-02	5.11E-02	1.28E+00	4.26E-02	5.11E-02
165	Primary School NN	673213.6	4858677.0	5.15E-01	1.72E-02	2.06E-02	1.60E+00	5.35E-02	6.42E-02	1.60E+00	5.35E-02	6.42E-02
166	Primary School OO	675474.8	4863221.7	5.89E-01	1.96E-02	2.36E-02	1.57E+00	5.23E-02	6.28E-02	1.57E+00	5.23E-02	6.28E-02
167	Primary School PP	672441.8	4858748.6	5.54E-01	1.85E-02	2.22E-02	1.63E+00	5.42E-02	6.51E-02	1.63E+00	5.42E-02	6.51E-02
168	Primary School QQ	672796.8	4864438.2	4.58E-01	1.53E-02	1.83E-02	1.26E+00	4.19E-02	5.03E-02	1.26E+00	4.19E-02	5.03E-02
169	Primary School RR	671351.4	4863284.0	4.27E-01	1.42E-02	1.71E-02	1.38E+00	4.60E-02	5.53E-02	1.38E+00	4.60E-02	5.53E-02
170	Primary School SS	673213.9	4862125.5	5.11E-01	1.70E-02	2.04E-02	1.58E+00	5.25E-02	6.30E-02	1.58E+00	5.25E-02	6.30E-02
171	Primary School TT	671017.9	4860953.7	3.99E-01	1.33E-02	1.60E-02	1.25E+00	4.15E-02	4.98E-02	1.25E+00	4.15E-02	4.98E-02
172	Primary School UU	670991.0	4861089.8	3.87E-01	1.29E-02	1.55E-02	1.22E+00	4.05E-02	4.86E-02	1.22E+00	4.05E-02	4.86E-02
173	Primary School VV	674150.1	4862294.8	5.54E-01	1.85E-02	2.22E-02	1.72E+00	5.73E-02	6.88E-02	1.72E+00	5.73E-02	6.88E-02
174	Primary School WW	672005.2	4861707.9	4.25E-01	1.42E-02	1.70E-02	1.32E+00	4.38E-02	5.26E-02	1.32E+00	4.38E-02	5.26E-02
175	Primary School XX	684172.1	4863615.6	9.57E-01	3.19E-02	3.83E-02	1.73E+00	5.75E-02	6.90E-02	1.73E+00	5.75E-02	6.90E-02
176	Primary School YY	683923.3	4866636.4	6.17E-01	2.06E-02	2.47E-02	1.68E+00	5.59E-02	6.71E-02	1.68E+00	5.59E-02	6.71E-02
177	Primary School ZZ	680446.0	4865770.5	7.38E-01	2.46E-02	2.95E-02	2.63E+00	8.77E-02	1.05E-01	2.63E+00	8.77E-02	1.05E-01
178	Vacant School	685612.9	4864520.0	5.05E-01	1.68E-02	2.02E-02	1.32E+00	4.39E-02	5.27E-02	1.32E+00	4.39E-02	5.27E-02
179	Secondary School A	686291.4	4865064.3	4.42E-01	1.47E-02	1.77E-02	1.22E+00	4.08E-02	4.89E-02	1.22E+00	4.08E-02	4.89E-02
180	Secondary School B	683875.0	4864741.7	7.93E-01	2.64E-02	3.17E-02	1.76E+00	5.86E-02	7.03E-02	1.76E+00	5.86E-02	7.03E-02
181	Secondary School C	684650.3	4866460.3	4.86E-01	1.62E-02	1.95E-02	1.51E+00	5.04E-02	6.05E-02	1.51E+00	5.04E-02	6.05E-02
182	Secondary School D	678099.5	4864838.2	9.22E-01	3.07E-02	3.69E-02	2.48E+00	8.28E-02	9.93E-02	2.48E+00	8.28E-02	9.93E-02
183	Secondary School E	678467.0	4863431.2	9.29E-01	3.10E-02	3.71E-02	2.80E+00	9.35E-02	1.12E-01	2.80E+00	9.35E-02	1.12E-01
184	Secondary School F	674144.9	4862762.7	4.81E-01	1.60E-02	1.93E-02	1.54E+00	5.14E-02	6.17E-02	1.54E+00	5.14E-02	6.17E-02
185	Secondary School G	673816.0	4864357.1	5.09E-01	1.70E-02	2.04E-02	1.32E+00	4.40E-02	5.28E-02	1.32E+00	4.40E-02	5.28E-02
186	Secondary School H	673145.4	4858569.0	4.80E-01	1.60E-02	1.92E-02	1.52E+00	5.08E-02	6.10E-02	1.52E+00	5.08E-02	6.10E-02

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
		(m)	(m)	Particulate Matter PM2.5 Process Upset µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
187	Secondary School I	671291.7	4863581.3	3.95E-01	1.32E-02	1.58E-02	1.30E+00	4.35E-02	5.22E-02	1.30E+00	4.35E-02	5.22E-02
188	Secondary School J	671443.2	4861664.9	3.95E-01	1.32E-02	1.58E-02	1.24E+00	4.12E-02	4.94E-02	1.24E+00	4.12E-02	4.94E-02
189	Secondary School K	673235.3	4860885.0	4.70E-01	1.57E-02	1.88E-02	1.50E+00	5.01E-02	6.02E-02	1.50E+00	5.01E-02	6.02E-02
190	Secondary Schook L	684252.7	4866500.5	4.97E-01	1.66E-02	1.99E-02	1.61E+00	5.36E-02	6.43E-02	1.61E+00	5.36E-02	6.43E-02
191	Secondary School M	673914.1	4859551.7	7.62E-01	2.54E-02	3.05E-02	1.99E+00	6.65E-02	7.98E-02	1.99E+00	6.65E-02	7.98E-02
192	Secondary School N	675051.5	4864177.2	5.63E-01	1.88E-02	2.25E-02	1.60E+00	5.33E-02	6.39E-02	1.60E+00	5.33E-02	6.39E-02
193	Adult School	685276.1	4866019.8	4.84E-01	1.61E-02	1.94E-02	1.38E+00	4.61E-02	5.53E-02	1.38E+00	4.61E-02	5.53E-02
194	Bow. Valley Cons. 1	685356.6	4864521.2	5.68E-01	1.89E-02	2.27E-02	1.36E+00	4.54E-02	5.45E-02	1.36E+00	4.54E-02	5.45E-02
195	Bow. Valley Cons. 2	685627.7	4864167.8	4.07E-01	1.36E-02	1.63E-02	1.39E+00	4.64E-02	5.57E-02	1.39E+00	4.64E-02	5.57E-02
196	Bow. Valley Cons. 4	685852.7	4863640.2	4.99E-01	1.66E-02	2.00E-02	1.32E+00	4.41E-02	5.29E-02	1.32E+00	4.41E-02	5.29E-02
197	Bow. Valley Cons. 5	686163.1	4863621.5	5.60E-01	1.87E-02	2.24E-02	1.27E+00	4.22E-02	5.07E-02	1.27E+00	4.22E-02	5.07E-02
198	Bow. Valley Cons. 6	685931.9	4863380.6	5.38E-01	1.79E-02	2.15E-02	1.32E+00	4.39E-02	5.27E-02	1.32E+00	4.39E-02	5.27E-02
199	Maple Grove 1	681688.5	4864717.0	7.65E-01	2.55E-02	3.06E-02	2.97E+00	9.91E-02	1.19E-01	2.97E+00	9.91E-02	1.19E-01
200	Maple Grove 2	681768.9	4864631.8	7.57E-01	2.52E-02	3.03E-02	2.96E+00	9.88E-02	1.19E-01	2.96E+00	9.88E-02	1.19E-01
201	Maple Grove 3	681894.9	4864506.8	7.38E-01	2.46E-02	2.95E-02	2.92E+00	9.74E-02	1.17E-01	2.92E+00	9.74E-02	1.17E-01
202	Maple Grove 4	681974.8	4864443.2	7.22E-01	2.41E-02	2.89E-02	2.87E+00	9.58E-02	1.15E-01	2.87E+00	9.58E-02	1.15E-01
203	Maple Grove 5	681942.2	4864676.7	7.20E-01	2.40E-02	2.88E-02	2.84E+00	9.45E-02	1.13E-01	2.84E+00	9.45E-02	1.13E-01
204	Maple Grove 6	682053.2	4864586.2	7.01E-01	2.34E-02	2.80E-02	2.79E+00	9.29E-02	1.11E-01	2.79E+00	9.29E-02	1.11E-01
205	Maple Grove 7	682168.5	4864631.3	6.76E-01	2.25E-02	2.70E-02	2.70E+00	8.99E-02	1.08E-01	2.70E+00	8.99E-02	1.08E-01
206	Maple Grove 8	682261.7	4864520.9	6.69E-01	2.23E-02	2.67E-02	2.65E+00	8.82E-02	1.06E-01	2.65E+00	8.82E-02	1.06E-01
207	Maple Grove 9	682382.1	4864589.4	6.35E-01	2.12E-02	2.54E-02	2.55E+00	8.51E-02	1.02E-01	2.55E+00	8.51E-02	1.02E-01
208	Maple Grove 10	682459.8	4864499.2	6.23E-01	2.08E-02	2.49E-02	2.50E+00	8.34E-02	1.00E-01	2.50E+00	8.34E-02	1.00E-01
209	Port Darlington 1	686227.8	4861159.0	7.19E-01	2.40E-02	2.88E-02	1.35E+00	4.49E-02	5.39E-02	1.35E+00	4.49E-02	5.39E-02
210	Port Darlington 2	686184.8	4861252.0	6.64E-01	2.21E-02	2.66E-02	1.32E+00	4.40E-02	5.28E-02	1.32E+00	4.40E-02	5.28E-02
211	Port Darlington 3	686151.2	4861286.8	6.34E-01	2.11E-02	2.54E-02	1.28E+00	4.26E-02	5.11E-02	1.28E+00	4.26E-02	5.11E-02
212	Port Darlington 4	686351.1	4861341.6	7.45E-01	2.48E-02	2.98E-02	1.50E+00	5.02E-02	6.02E-02	1.50E+00	5.02E-02	6.02E-02
213	Port Darlington 5	686406.8	4861448.7	7.65E-01	2.55E-02	3.06E-02	1.55E+00	5.16E-02	6.19E-02	1.55E+00	5.16E-02	6.19E-02
214	Port Darlington 6	686504.5	4861604.0	7.75E-01	2.58E-02	3.10E-02	1.53E+00	5.09E-02	6.11E-02	1.53E+00	5.09E-02	6.11E-02
215	Port Darlington 7	686703.0	4861789.3	7.18E-01	2.39E-02	2.87E-02	1.35E+00	4.49E-02	5.38E-02	1.35E+00	4.49E-02	5.38E-02
216	Port Darlington 8	686895.8	4861960.2	5.81E-01	1.94E-02	2.33E-02	1.34E+00	4.45E-02	5.34E-02	1.34E+00	4.45E-02	5.34E-02
217	Port Darlington 9	686867.4	4862119.7	5.24E-01	1.75E-02	2.10E-02	1.34E+00	4.48E-02	5.38E-02	1.34E+00	4.48E-02	5.38E-02
218	Port Darlington 10	687190.7	4862048.8	5.13E-01	1.71E-02	2.05E-02	1.30E+00	4.32E-02	5.19E-02	1.30E+00	4.32E-02	5.19E-02
219	Port Darlington 11	687524.4	4862126.8	4.99E-01	1.66E-02	1.99E-02	1.26E+00	4.19E-02	5.02E-02	1.26E+00	4.19E-02	5.02E-02
220	Campground 1	678646.3	4860337.7	1.50E+00	4.99E-02	5.99E-02	3.65E+00	1.22E-01	1.46E-01	3.65E+00	1.22E-01	1.46E-01
221	Campground 2	678410.2	4860148.6	1.30E+00	4.33E-02	5.20E-02	3.28E+00	1.09E-01	1.31E-01	3.28E+00	1.09E-01	1.31E-01
222	Campground 3	678651.0	4860054.4	1.14E+00	3.79E-02	4.55E-02	3.15E+00	1.05E-01	1.26E-01	3.15E+00	1.05E-01	1.26E-01
223	Campground 4	678725.9	4859860.7	9.33E-01	3.11E-02	3.73E-02	3.12E+00	1.04E-01	1.25E-01	3.12E+00	1.04E-01	1.25E-01
224	Campground 5	678511.1	4859808.6	8.49E-01	2.83E-02	3.40E-02	2.82E+00	9.39E-02	1.13E-01	2.82E+00	9.39E-02	1.13E-01
225	Campground 6	678869.5	4859696.0	9.59E-01	3.20E-02	3.84E-02	2.98E+00	9.95E-02	1.19E-01	2.98E+00	9.95E-02	1.19E-01
226	Campground 7	678723.9	4860201.8	1.38E+00	4.59E-02	5.51E-02	3.49E+00	1.16E-01	1.40E-01	3.49E+00	1.16E-01	1.40E-01
227	Campground 8	678796.0	4860011.4	1.01E+00	3.36E-02	4.03E-02	3.33E+00	1.11E-01	1.33E-01	3.33E+00	1.11E-01	1.33E-01
228	Campground 9	678852.7	4859854.2	9.70E-01	3.23E-02	3.88E-02	3.18E+00	1.06E-01	1.27E-01	3.18E+00	1.06E-01	1.27E-01
229	Solina 1	681099.6	4861677.2	1.57E+00	5.25E-02	6.30E-02	4.15E+00	1.38E-01	1.66E-01	4.15E+00	1.38E-01	1.66E-01
230	Solina 2	681115.7	4861857.7	1.42E+00	4.74E-02	5.68E-02	4.09E+00	1.36E-01	1.64E-01	4.09E+00	1.36E-01	1.64E-01
231	Solina 3	680987.4	4861983.5	1.35E+00	4.49E-02	5.38E-02	4.24E+00	1.41E-01	1.70E-01	4.24E+00	1.41E-01	1.70E-01
232	Solina 4	680965.0	4862068.1	1.34E+00	4.46E-02	5.36E-02	4.22E+00	1.41E-01	1.69E-01	4.22E+00	1.41E-01	1.69E-01
233	Solina 5	681021.5	4862086.7	1.30E+00	4.35E-02	5.22E-02	4.14E+00	1.38E-01	1.66E-01	4.14E+00	1.38E-01	1.66E-01
234	Solina 6	680939.8	4862124.3	1.34E+00	4.48E-02	5.37E-02	4.23E+00	1.41E-01	1.69E-01	4.23E+00	1.41E-01	1.69E-01
235	Solina 7	680988.2	4862183.6	1.30E+00	4.34E-02	5.20E-02	4.12E+00	1.37E-01	1.65E-01	4.12E+00	1.37E-01	1.65E-01
236	Solina 8	680984.6	4862209.8	1.30E+00	4.33E-02	5.19E-02	4.12E+00	1.37E-01	1.65E-01	4.12E+00	1.37E-01	1.65E-01
237	Solina 9	680958.6	4862294.9	1.29E+00	4.30E-02	5.16E-02	4.09E+00	1.36E-01	1.64E-01	4.09E+00	1.36E-01	1.64E-01
238	Solina 10	680858.0	4862324.3	1.32E+00	4.42E-02	5.30E-02	4.19E+00	1.40E-01	1.67E-01	4.19E+00	1.40E-01	1.67E-01
239	Solina 11	680990.3	4862403.5	1.25E+00	4.17E-02	5.01E-02	3.98E+00	1.33E-01	1.59E-01	3.98E+00	1.33E-01	1.59E-01
240	Recreational 1	681545.0	4860865.0	1.23E+00	4.12E-02	4.94E-02	3.32E+00	1.11E-01	1.33E-01	3.32E+00	1.11E-01	1.33E-01
241	Recreational 2	681563.7	4860687.4	1.25E+00	4.17E-02	5.01E-02	3.23E+00	1.08E-01	1.29E-01	3.23E+00	1.08E-01	1.29E-01
242	Recreational 3	681579.7	4860610.0	1.35E+00	4.49E-02	5.39E-02	3.17E+00	1.06E-01	1.27E-01	3.17E+00	1.06E-01	1.27E-01
243	Recreational 6	681876.6	4860254.4	1.71E+00	5.70E-02	6.84E-02	3.62E+00	1.21E-01	1.45E-01	3.62E+00	1.21E-01	1.45E-01
244	Recreational 7	682166.9	4860324.4	1.35E+00	4.50E-02	5.40E-02	3.21E+00	1.07E-01	1.28E-01	3.21E+00	1.07E-01	1.28E-01
245	Darlington 1	679565.4	4861052.9	2.12E+00	7.07E-02	8.49E-02	5.62E+00	1.87E-01	2.25E-01	5.62E+00	1.87E-01	2.25E-01
246	Darlington 2	679452.9	4861051.4	1.82E+00	6.07E-02	7.29E-02	5.29E+00	1.76E-01	2.12E-01	5.29E+00	1.76E-01	2.12E-01
247	Darlington 3	679130.5	4860948.8	1.73E+00	5.77E-02	6.92E-02	4.47E+00	1.49E-01	1.79E-01	4.47E+00	1.49E-01	1.79E-01
248	Darlington 4	679112.6	4860941.9	1.75E+00	5.85E-02	7.02E-02	4.42E+00	1.47E-01	1.77E-01	4.42E+00	1.47E-01	1.77E-01

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011 Particulate Matter PM2.5 Process Upset µg/m³	July 2011 Concentration Ratio CWS Standard	July 2011 Concentration Ratio WHO Benchmark	December 2009 Particulate Matter PM2.5 Process Upset µg/m³	December 2009 Concentration Ratio CWS Standard	December 2009 Concentration Ratio WHO Benchmark	July 2009 Particulate Matter PM2.5 Process Upset µg/m³	July 2009 Concentration Ratio CWS Standard	July 2009 Concentration Ratio WHO Benchmark
249	Darlington 5	679057.6	4860994.1	1.71E+00	5.71E-02	6.86E-02	4.36E+00	1.45E-01	1.74E-01	4.36E+00	1.45E-01	1.74E-01
250	Darlington 6	679075.2	4860931.6	1.77E+00	5.89E-02	7.07E-02	4.35E+00	1.45E-01	1.74E-01	4.35E+00	1.45E-01	1.74E-01
251	Darlington 7	678814.3	4860843.1	1.59E+00	5.30E-02	6.36E-02	3.84E+00	1.28E-01	1.54E-01	3.84E+00	1.28E-01	1.54E-01
252	Darlington 8	678840.4	4860777.1	1.61E+00	5.36E-02	6.43E-02	3.85E+00	1.28E-01	1.54E-01	3.85E+00	1.28E-01	1.54E-01
253	Light Ind. 1	680000.1	4861034.1	2.33E+00	7.77E-02	9.32E-02	6.57E+00	2.19E-01	2.63E-01	6.57E+00	2.19E-01	2.63E-01
254	Light Ind. 2	680060.7	4861056.4	2.37E+00	7.90E-02	9.48E-02	6.68E+00	2.23E-01	2.67E-01	6.68E+00	2.23E-01	2.67E-01
255	Light Ind. 3	680291.2	4861151.6	2.30E+00	7.67E-02	9.20E-02	6.56E+00	2.19E-01	2.62E-01	6.56E+00	2.19E-01	2.62E-01
256	Light Ind. 4	680536.3	4861204.6	1.95E+00	6.51E-02	7.81E-02	5.74E+00	1.91E-01	2.30E-01	5.74E+00	1.91E-01	2.30E-01
257	Light Ind. 5	680350.4	4861290.6	2.16E+00	7.20E-02	8.64E-02	6.28E+00	2.09E-01	2.51E-01	6.28E+00	2.09E-01	2.51E-01
258	Light Ind. 6	680306.9	4861275.6	2.21E+00	7.36E-02	8.83E-02	6.39E+00	2.13E-01	2.56E-01	6.39E+00	2.13E-01	2.56E-01
259	Light Ind. 7	680267.2	4861262.4	2.25E+00	7.50E-02	9.00E-02	6.49E+00	2.16E-01	2.60E-01	6.49E+00	2.16E-01	2.60E-01
260	Light Ind. 8	680233.6	4861250.7	2.28E+00	7.60E-02	9.12E-02	6.56E+00	2.19E-01	2.62E-01	6.56E+00	2.19E-01	2.62E-01
261	Light Ind. 9	680175.3	4861227.5	2.31E+00	7.71E-02	9.25E-02	6.63E+00	2.21E-01	2.65E-01	6.63E+00	2.21E-01	2.65E-01
262	Light Ind. 10	680092.5	4861185.1	2.34E+00	7.81E-02	9.37E-02	6.68E+00	2.23E-01	2.67E-01	6.68E+00	2.23E-01	2.67E-01
263	Light Ind. 11	680071.6	4861246.6	2.31E+00	7.71E-02	9.25E-02	6.64E+00	2.21E-01	2.66E-01	6.64E+00	2.21E-01	2.66E-01
264	Light Ind. 12	680021.4	4861186.9	2.33E+00	7.76E-02	9.31E-02	6.64E+00	2.21E-01	2.66E-01	6.64E+00	2.21E-01	2.66E-01
265	Future Industrial 7	680816.2	4860219.3	1.32E+00	4.39E-02	5.26E-02	4.48E+00	1.49E-01	1.79E-01	4.48E+00	1.49E-01	1.79E-01
266	Future Industrial 8	680398.0	4860731.8	2.56E+00	8.52E-02	1.02E-01	6.65E+00	2.22E-01	2.66E-01	6.65E+00	2.22E-01	2.66E-01
267	Future Industrial 1	680359.6	4859959.2	1.42E+00	4.72E-02	5.66E-02	3.80E+00	1.27E-01	1.52E-01	3.80E+00	1.27E-01	1.52E-01
268	Future Industrial 2	680083.7	4859985.7	1.26E+00	4.20E-02	5.04E-02	3.92E+00	1.31E-01	1.57E-01	3.92E+00	1.31E-01	1.57E-01
269	Future Industrial 3	680819.9	4860705.3	1.75E+00	5.82E-02	6.99E-02	5.11E+00	1.70E-01	2.05E-01	5.11E+00	1.70E-01	2.05E-01
270	Future Industrial 4	681070.0	4859937.2	1.18E+00	3.94E-02	4.73E-02	3.22E+00	1.07E-01	1.29E-01	3.22E+00	1.07E-01	1.29E-01
271	Future Industrial 5	679898.8	4860067.4	1.24E+00	4.12E-02	4.94E-02	4.07E+00	1.36E-01	1.63E-01	4.07E+00	1.36E-01	1.63E-01
272	Future Industrial 6	680134.8	4860694.1	2.22E+00	7.39E-02	8.87E-02	6.05E+00	2.02E-01	2.42E-01	6.05E+00	2.02E-01	2.42E-01
273	Future Industrial 11	680253.7	4860255.2	1.86E+00	6.21E-02	7.45E-02	4.67E+00	1.56E-01	1.87E-01	4.67E+00	1.56E-01	1.87E-01
274	Future Indsutrial 12	679901.2	4860511.8	1.61E+00	5.37E-02	6.44E-02	4.94E+00	1.65E-01	1.97E-01	4.94E+00	1.65E-01	1.97E-01
275	Commercial Farmer	679867.8	4860445.4	1.63E+00	5.44E-02	6.53E-02	4.85E+00	1.62E-01	1.94E-01	4.85E+00	1.62E-01	1.94E-01
276	Farmer	679277.0	4859981.5	1.11E+00	3.69E-02	4.43E-02	3.63E+00	1.21E-01	1.45E-01	3.63E+00	1.21E-01	1.45E-01
277	Residence	679387.2	4860648.9	1.80E+00	6.02E-02	7.22E-02	4.66E+00	1.55E-01	1.86E-01	4.66E+00	1.55E-01	1.86E-01
278	Barn	679261.9	4860574.2	1.58E+00	5.25E-02	6.31E-02	4.41E+00	1.47E-01	1.76E-01	4.41E+00	1.47E-01	1.76E-01
279	Residence	680150.7	4861295.7	2.28E+00	7.60E-02	9.12E-02	6.58E+00	2.19E-01	2.63E-01	6.58E+00	2.19E-01	2.63E-01
280	Residence	679939.8	4861213.4	2.28E+00	7.60E-02	9.13E-02	6.53E+00	2.18E-01	2.61E-01	6.53E+00	2.18E-01	2.61E-01
281	Farmer	680855.7	4861456.9	1.82E+00	6.07E-02	7.29E-02	4.67E+00	1.56E-01	1.87E-01	4.67E+00	1.56E-01	1.87E-01
282	Farmer	681386.2	4861673.3	1.26E+00	4.21E-02	5.05E-02	3.73E+00	1.24E-01	1.49E-01	3.73E+00	1.24E-01	1.49E-01
283	Residence	680683.5	4861597.9	1.66E+00	5.55E-02	6.66E-02	5.07E+00	1.69E-01	2.03E-01	5.07E+00	1.69E-01	2.03E-01
284	Business	680064.3	4861343.7	2.26E+00	7.54E-02	9.05E-02	6.55E+00	2.18E-01	2.62E-01	6.55E+00	2.18E-01	2.62E-01
285	Farmer	679680.1	4861213.5	2.07E+00	6.89E-02	8.27E-02	6.03E+00	2.01E-01	2.41E-01	6.03E+00	2.01E-01	2.41E-01
286	Farmer	681344.8	4861792.9	1.28E+00	4.27E-02	5.13E-02	3.79E+00	1.26E-01	1.52E-01	3.79E+00	1.26E-01	1.52E-01
287	Youth Centre	685644.2	4864814.8	6.06E-01	2.02E-02	2.42E-02	1.30E+00	4.32E-02	5.19E-02	1.30E+00	4.32E-02	5.19E-02
288	Bowmanville Arena	685462.9	4864615.2	6.03E-01	2.01E-02	2.41E-02	1.34E+00	4.45E-02	5.34E-02	1.34E+00	4.45E-02	5.34E-02
289	Bowmanville Rec Complex	684160.3	4864604.5	7.04E-01	2.35E-02	2.82E-02	1.65E+00	5.51E-02	6.61E-02	1.65E+00	5.51E-02	6.61E-02
290	Recreation Complex	684586.6	4862406.3	6.05E-01	2.02E-02	2.42E-02	1.67E+00	5.57E-02	6.68E-02	1.67E+00	5.57E-02	6.68E-02
291	Superdog Central	681487.7	4865723.3	7.04E-01	2.35E-02	2.81E-02	2.58E+00	8.59E-02	1.03E-01	2.58E+00	8.59E-02	1.03E-01
292	Equestrian Centre	681567.1	4863670.7	1.01E+00	3.36E-02	4.03E-02	3.20E+00	1.07E-01	1.28E-01	3.20E+00	1.07E-01	1.28E-01
293	Flea Market	678574.6	4862819.4	1.13E+00	3.77E-02	4.53E-02	3.30E+00	1.10E-01	1.32E-01	3.30E+00	1.10E-01	1.32E-01
294	Equestrian Centre	680030.8	4867320.2	5.85E-01	1.95E-02	2.34E-02	1.97E+00	6.57E-02	7.89E-02	1.97E+00	6.57E-02	7.89E-02
295	Courtice Community Complex	678099.3	4864629.8	9.44E-01	3.15E-02	3.78E-02	2.50E+00	8.35E-02	1.00E-01	2.50E+00	8.35E-02	1.00E-01
296	Former Restaurant	679830.2	4860702.2	1.86E+00	6.20E-02	7.44E-02	5.42E+00	1.81E-01	2.17E-01	5.42E+00	1.81E-01	2.17E-01
297	Commercial	679364.8	4861016.0	1.73E+00	5.76E-02	6.91E-02	5.04E+00	1.68E-01	2.02E-01	5.04E+00	1.68E-01	2.02E-01
298	GM Oshawa Headquarters	676418.3	4860463.7	9.59E-01	3.20E-02	3.84E-02	2.48E+00	8.28E-02	9.94E-02	2.48E+00	8.28E-02	9.94E-02
299	Farm A?	682972.3	4862201.9	8.28E-01	2.76E-02	3.31E-02	2.36E+00	7.88E-02	9.46E-02	2.36E+00	7.88E-02	9.46E-02
300	Farm B?	683546.9	4861959.7	8.03E-01	2.68E-02	3.21E-02	2.07E+00	6.90E-02	8.28E-02	2.07E+00	6.90E-02	8.28E-02
301	Farm C?	682547.5	4862321.1	1.07E+00	3.57E-02	4.29E-02	2.62E+00	8.72E-02	1.05E-01	2.62E+00	8.72E-02	1.05E-01
302	Farm D?	683238.3	4862393.3	7.62E-01	2.54E-02	3.05E-02	2.21E+00	7.36E-02	8.83E-02	2.21E+00	7.36E-02	8.83E-02
303	Farm E?	682512.6	4862858.0	1.20E+00	4.01E-02	4.81E-02	2.55E+00	8.51E-02	1.02E-01	2.55E+00	8.51E-02	1.02E-01
304	Farm F?	683129.1	4863649.4	8.78E-01	2.93E-02	3.51E-02	2.08E+00	6.93E-02	8.31E-02	2.08E+00	6.93E-02	8.31E-02
305	Bennett 1	688209.3	4862512.1	4.36E-01	1.45E-02	1.75E-02	1.19E+00	3.96E-02	4.75E-02	1.19E+00	3.96E-02	4.75E-02
306	Bennett 2	687990.0	4863221.3	3.82E-01	1.27E-02	1.53E-02	1.09E+00	3.62E-02	4.35E-02	1.09E+00	3.62E-02	4.35E-02
307	Bennett 3	688818.4	4862836.3	4.03E-01	1.34E-02	1.61E-02	1.13E+00	3.76E-02	4.51E-02	1.13E+00	3.76E-02	4.51E-02
308	Bennett 4	689045.1	4863365.5	3.92E-01	1.31E-02	1.57E-02	1.06E+00	3.54E-02	4.24E-02	1.06E+00	3.54E-02	4.24E-02
309	Bennett 5	688270.5	4863763.1	4.77E-01	1.59E-02	1.91E-02	9.71E-01	3.24E-02	3.88E-02	9.71E-01	3.24E-02	3.88E-02
310	Bennett 6	689908.5	4863100.5	3.69E-01	1.23E-02	1.47E-02	1.06E+00	3.52E-02	4.23E-02	1.06E+00	3.52E-02	4.23E-02

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011 Particulate Matter PM2.5 Process Upset µg/m³	July 2011 Concentration Ratio CWS Standard	July 2011 Concentration Ratio WHO Benchmark	December 2009 Particulate Matter PM2.5 Process Upset µg/m³	December 2009 Concentration Ratio CWS Standard	December 2009 Concentration Ratio WHO Benchmark	July 2009 Particulate Matter PM2.5 Process Upset µg/m³	July 2009 Concentration Ratio CWS Standard	July 2009 Concentration Ratio WHO Benchmark
311	Bennett 7	688929.9	4864392.0	6.88E-01	2.29E-02	2.75E-02	1.36E+00	4.54E-02	5.45E-02	1.36E+00	4.54E-02	5.45E-02
312	Bennett 8	689684.2	4863837.7	3.53E-01	1.18E-02	1.41E-02	9.84E-01	3.28E-02	3.94E-02	9.84E-01	3.28E-02	3.94E-02
313	Soper 1	687557.9	4862512.4	4.61E-01	1.54E-02	1.84E-02	1.24E+00	4.13E-02	4.96E-02	1.24E+00	4.13E-02	4.96E-02
314	Soper 2	687241.9	4863171.7	3.81E-01	1.27E-02	1.52E-02	1.11E+00	3.69E-02	4.42E-02	1.11E+00	3.69E-02	4.42E-02
315	Soper 3	687023.2	4863903.8	4.85E-01	1.62E-02	1.94E-02	1.14E+00	3.79E-02	4.54E-02	1.14E+00	3.79E-02	4.54E-02
316	Soper 4	688158.2	4865389.3	4.13E-01	1.38E-02	1.65E-02	1.20E+00	4.00E-02	4.79E-02	1.20E+00	4.00E-02	4.79E-02
317	Soper 5	685027.3	4868253.9	5.64E-01	1.88E-02	2.26E-02	1.33E+00	4.44E-02	5.32E-02	1.33E+00	4.44E-02	5.32E-02
318	Soper 6	687287.4	4867037.3	3.04E-01	1.01E-02	1.21E-02	1.04E+00	3.48E-02	4.18E-02	1.04E+00	3.48E-02	4.18E-02
319	Soper 7	685683.2	4867148.1	4.92E-01	1.64E-02	1.97E-02	1.28E+00	4.27E-02	5.12E-02	1.28E+00	4.27E-02	5.12E-02
320	Soper 8	686748.7	4865874.7	4.49E-01	1.50E-02	1.80E-02	1.11E+00	3.70E-02	4.45E-02	1.11E+00	3.70E-02	4.45E-02
321	Bowmanville 1	687026.3	4862368.4	4.94E-01	1.65E-02	1.98E-02	1.30E+00	4.34E-02	5.21E-02	1.30E+00	4.34E-02	5.21E-02
322	Bowmanville 2	686625.7	4863020.3	4.80E-01	1.60E-02	1.92E-02	1.20E+00	4.00E-02	4.80E-02	1.20E+00	4.00E-02	4.80E-02
323	Bowmanville 3	683380.3	4865365.9	6.52E-01	2.17E-02	2.61E-02	1.96E+00	6.52E-02	7.82E-02	1.96E+00	6.52E-02	7.82E-02
324	Bowmanville 4	683111.4	4867150.3	5.56E-01	1.85E-02	2.23E-02	1.79E+00	5.97E-02	7.16E-02	1.79E+00	5.97E-02	7.16E-02
325	Bowmanville 5	682452.2	4869417.5	4.29E-01	1.43E-02	1.71E-02	1.49E+00	4.97E-02	5.97E-02	1.49E+00	4.97E-02	5.97E-02
326	Bowmanville 6	684778.5	4864888.2	5.08E-01	1.69E-02	2.03E-02	1.49E+00	4.96E-02	5.95E-02	1.49E+00	4.96E-02	5.95E-02
327	Bowmanville 7	684549.5	4866404.4	4.92E-01	1.64E-02	1.97E-02	1.54E+00	5.13E-02	6.16E-02	1.54E+00	5.13E-02	6.16E-02
328	Upper Tooley 1	679944.8	4864883.1	9.75E-01	3.25E-02	3.90E-02	2.98E+00	9.94E-02	1.19E-01	2.98E+00	9.94E-02	1.19E-01
329	Upper Tooley 2	679055.1	4863885.8	8.85E-01	2.95E-02	3.54E-02	2.80E+00	9.32E-02	1.12E-01	2.80E+00	9.32E-02	1.12E-01
330	Upper Tooley 3	679714.0	4862767.4	1.34E+00	4.48E-02	5.37E-02	4.26E+00	1.42E-01	1.70E-01	4.26E+00	1.42E-01	1.70E-01
331	Upper Tooley 4	678898.8	4861800.6	1.63E+00	5.45E-02	6.54E-02	4.29E+00	1.43E-01	1.72E-01	4.29E+00	1.43E-01	1.72E-01
332	Upper Tooley 5	680353.5	4862156.5	1.84E+00	6.12E-02	7.35E-02	5.00E+00	1.67E-01	2.00E-01	5.00E+00	1.67E-01	2.00E-01
333	Upper Tooley 6	679818.1	4861625.7	2.01E+00	6.70E-02	8.04E-02	6.00E+00	2.00E-01	2.40E-01	6.00E+00	2.00E-01	2.40E-01
334	Robinson 1	678434.8	4860943.1	1.35E+00	4.48E-02	5.38E-02	3.38E+00	1.13E-01	1.35E-01	3.38E+00	1.13E-01	1.35E-01
335	Robinson 2	677752.6	4861240.6	1.10E+00	3.67E-02	4.40E-02	3.41E+00	1.14E-01	1.36E-01	3.41E+00	1.14E-01	1.36E-01
336	Robinson 3	677642.2	4861787.2	1.08E+00	3.62E-02	4.34E-02	3.59E+00	1.20E-01	1.44E-01	3.59E+00	1.20E-01	1.44E-01
337	Robinson 4	678532.7	4862143.6	1.37E+00	4.55E-02	5.47E-02	3.65E+00	1.22E-01	1.46E-01	3.65E+00	1.22E-01	1.46E-01
338	Robinson 5	678005.1	4862784.9	1.26E+00	4.19E-02	5.02E-02	3.85E+00	1.28E-01	1.54E-01	3.85E+00	1.28E-01	1.54E-01
339	Robinson 6	677882.7	4860587.7	1.08E+00	3.60E-02	4.32E-02	3.03E+00	1.01E-01	1.21E-01	3.03E+00	1.01E-01	1.21E-01
340	F/B 1	677443.1	4867862.1	7.14E-01	2.38E-02	2.86E-02	2.22E+00	7.38E-02	8.86E-02	2.22E+00	7.38E-02	8.86E-02
341	F/B 2	679667.4	4866611.4	7.29E-01	2.43E-02	2.92E-02	2.15E+00	7.17E-02	8.60E-02	2.15E+00	7.17E-02	8.60E-02
342	F/B 3	678655.0	4867470.1	6.81E-01	2.27E-02	2.72E-02	2.12E+00	7.06E-02	8.48E-02	2.12E+00	7.06E-02	8.48E-02
343	F/B 4	676191.2	4866844.7	7.17E-01	2.39E-02	2.87E-02	2.20E+00	7.33E-02	8.80E-02	2.20E+00	7.33E-02	8.80E-02
344	F/B 5	678273.3	4866093.0	7.89E-01	2.63E-02	3.16E-02	2.30E+00	7.67E-02	9.21E-02	2.30E+00	7.67E-02	9.21E-02
345	F/B 6	681241.2	4867098.8	5.60E-01	1.87E-02	2.24E-02	2.06E+00	6.86E-02	8.24E-02	2.06E+00	6.86E-02	8.24E-02
346	F/B 7	682165.3	4868082.3	5.00E-01	1.67E-02	2.00E-02	1.74E+00	5.80E-02	6.96E-02	1.74E+00	5.80E-02	6.96E-02
347	F/B 8	679366.6	4868628.3	6.01E-01	2.00E-02	2.41E-02	1.94E+00	6.46E-02	7.75E-02	1.94E+00	6.46E-02	7.75E-02
348	F/B 9	680310.1	4869967.1	5.44E-01	1.81E-02	2.18E-02	1.78E+00	5.93E-02	7.12E-02	1.78E+00	5.93E-02	7.12E-02
349	F/B 10	676487.3	4869291.6	6.19E-01	2.06E-02	2.47E-02	1.96E+00	6.54E-02	7.85E-02	1.96E+00	6.54E-02	7.85E-02
350	F/B 11	676851.4	4865409.3	9.09E-01	3.03E-02	3.63E-02	2.69E+00	8.95E-02	1.07E-01	2.69E+00	8.95E-02	1.07E-01
351	F/B 12	681153.3	4868682.2	4.92E-01	1.64E-02	1.97E-02	1.68E+00	5.59E-02	6.71E-02	1.68E+00	5.59E-02	6.71E-02
352	F/B 13	675416.3	4859833.9	9.61E-01	3.20E-02	3.84E-02	2.65E+00	8.83E-02	1.06E-01	2.65E+00	8.83E-02	1.06E-01
353	Second 1	675153.4	4860552.8	6.45E-01	2.15E-02	2.58E-02	1.83E+00	6.09E-02	7.31E-02	1.83E+00	6.09E-02	7.31E-02
354	Second 2	675297.5	4860891.3	6.80E-01	2.27E-02	2.72E-02	2.01E+00	6.71E-02	8.05E-02	2.01E+00	6.71E-02	8.05E-02
355	Second 3	675647.2	4860644.9	7.55E-01	2.52E-02	3.02E-02	1.98E+00	6.59E-02	7.91E-02	1.98E+00	6.59E-02	7.91E-02
356	Second 4	675670.5	4860076.5	1.05E+00	3.50E-02	4.20E-02	2.46E+00	8.21E-02	9.85E-02	2.46E+00	8.21E-02	9.85E-02
357	Second 5	676043.3	4860319.1	1.04E+00	3.46E-02	4.15E-02	2.30E+00	7.68E-02	9.21E-02	2.30E+00	7.68E-02	9.21E-02
358	Second 6	675923.4	4859821.4	9.58E-01	3.19E-02	3.83E-02	2.72E+00	9.07E-02	1.09E-01	2.72E+00	9.07E-02	1.09E-01
359	McLaughlin Bay 1	676714.7	4860903.8	8.56E-01	2.85E-02	3.42E-02	2.32E+00	7.73E-02	9.28E-02	2.32E+00	7.73E-02	9.28E-02
360	McLaughlin Bay 2	677310.8	4860528.2	1.09E+00	3.63E-02	4.35E-02	2.83E+00	9.44E-02	1.13E-01	2.83E+00	9.44E-02	1.13E-01
361	McLaughlin Bay 3	676563.5	4860260.1	1.18E+00	3.93E-02	4.71E-02	2.59E+00	8.65E-02	1.04E-01	2.59E+00	8.65E-02	1.04E-01
362	McLaughlin Bay 4	676699.5	4859696.6	1.89E+00	6.31E-02	7.57E-02	3.43E+00	1.14E-01	1.37E-01	3.43E+00	1.14E-01	1.37E-01
363	McLaughlin Bay 5	677560.0	4860060.1	1.04E+00	3.48E-02	4.17E-02	3.08E+00	1.03E-01	1.23E-01	3.08E+00	1.03E-01	1.23E-01
364	McLaughlin Bay 6	678204.5	4859832.5	8.13E-01	2.71E-02	3.25E-02	2.66E+00	8.86E-02	1.06E-01	2.66E+00	8.86E-02	1.06E-01
365	Harmony Creek 1	674178.3	4861024.2	4.61E-01	1.54E-02	1.85E-02	1.78E+00	5.94E-02	7.13E-02	1.78E+00	5.94E-02	7.13E-02
366	Harmony Creek 2	674592.0	4862605.3	5.06E-01	1.69E-02	2.03E-02	1.60E+00	5.34E-02	6.40E-02	1.60E+00	5.34E-02	6.40E-02
367	Harmony Creek 3	672863.4	4862808.0	4.72E-01	1.57E-02	1.89E-02	1.52E+00	5.05E-02	6.06E-02	1.52E+00	5.05E-02	6.06E-02
368	Harmony Creek 4	675671.6	4864469.0	8.03E-01	2.68E-02	3.21E-02	2.11E+00	7.04E-02	8.45E-02	2.11E+00	7.04E-02	8.45E-02
369	Harmony Creek 5	672443.1	4864713.0	4.49E-01	1.50E-02	1.79E-02	1.27E+00	4.22E-02	5.07E-02	1.27E+00	4.22E-02	5.07E-02
370	Harmony Creek 6	674830.5	4866909.6	5.34E-01	1.78E-02	2.13E-02	1.67E+00	5.56E-02	6.67E-02	1.67E+00	5.56E-02	6.67E-02
371	Harmony Creek 7	675799.9	4868594.1	5.95E-01	1.98E-02	2.38E-02	1.87E+00	6.24E-02	7.49E-02	1.87E+00	6.24E-02	7.49E-02
372	Westside 1	686082.6	4862776.6	4.96E-01	1.65E-02	1.98E-02	1.30E+00	4.33E-02	5.20E-02	1.30E+00	4.33E-02	5.20E-02

Table A - 2. 24-hour Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
		(m)	(m)	Particulate Matter PM2.5 Process Upset $\mu g/m^3$	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset $\mu g/m^3$	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset $\mu g/m^3$	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
373	Westside 2	685778.7	4862137.9	5.79E-01	1.93E-02	2.32E-02	1.46E+00	4.86E-02	5.83E-02	1.46E+00	4.86E-02	5.83E-02
374	Westside 3	685084.2	4862827.4	5.05E-01	1.68E-02	2.02E-02	1.52E+00	5.07E-02	6.09E-02	1.52E+00	5.07E-02	6.09E-02
375	Darlington 1	680977.5	4865674.4	7.30E-01	2.43E-02	2.92E-02	2.68E+00	8.94E-02	1.07E-01	2.68E+00	8.94E-02	1.07E-01
376	Darlington 2	680913.9	4863967.1	1.01E+00	3.35E-02	4.02E-02	3.58E+00	1.19E-01	1.43E-01	3.58E+00	1.19E-01	1.43E-01
377	Darlington 3	682602.8	4863659.6	1.22E+00	4.07E-02	4.88E-02	2.30E+00	7.65E-02	9.18E-02	2.30E+00	7.65E-02	9.18E-02
378	Darlington 4	682206.4	4862910.4	1.26E+00	4.20E-02	5.05E-02	2.73E+00	9.09E-02	1.09E-01	2.73E+00	9.09E-02	1.09E-01
379	Darlington 5	683223.2	4861114.0	1.10E+00	3.65E-02	4.38E-02	2.17E+00	7.24E-02	8.69E-02	2.17E+00	7.24E-02	8.69E-02
380	Darlington 6	683947.7	4862362.0	8.09E-01	2.70E-02	3.23E-02	1.90E+00	6.32E-02	7.59E-02	1.90E+00	6.32E-02	7.59E-02
381	Darlington 7	685361.9	4861143.4	7.36E-01	2.45E-02	2.94E-02	1.42E+00	4.74E-02	5.69E-02	1.42E+00	4.74E-02	5.69E-02
382	Bennett ECO/HH	688606.4	4862634.8	4.18E-01	1.39E-02	1.67E-02	1.15E+00	3.84E-02	4.61E-02	1.15E+00	3.84E-02	4.61E-02
383	Oshawa ECO/HH	673884.9	4859128.9	7.82E-01	2.61E-02	3.13E-02	1.99E+00	6.64E-02	7.97E-02	1.99E+00	6.64E-02	7.97E-02
384	Oshawa Creek 1	671671.2	4862793.7	4.59E-01	1.53E-02	1.84E-02	1.45E+00	4.83E-02	5.79E-02	1.45E+00	4.83E-02	5.79E-02
385	Oshawa Creek 2	671668.5	4861589.5	3.98E-01	1.33E-02	1.59E-02	1.24E+00	4.13E-02	4.96E-02	1.24E+00	4.13E-02	4.96E-02
386	Oshawa Creek 3	672820.2	4861287.2	4.26E-01	1.42E-02	1.71E-02	1.38E+00	4.61E-02	5.53E-02	1.38E+00	4.61E-02	5.53E-02
387	Oshawa Creek 4	672360.3	4860262.6	5.26E-01	1.75E-02	2.10E-02	1.48E+00	4.93E-02	5.91E-02	1.48E+00	4.93E-02	5.91E-02
388	Oshawa Creek 5	673921.2	4860115.0	6.74E-01	2.25E-02	2.70E-02	1.72E+00	5.72E-02	6.86E-02	1.72E+00	5.72E-02	6.86E-02
389	Oshawa Creek 6	673154.0	4859421.9	6.93E-01	2.31E-02	2.77E-02	1.86E+00	6.19E-02	7.42E-02	1.86E+00	6.19E-02	7.42E-02
390	Farmer	677409.8	4861051.4	1.65E+00	5.50E-02	6.60E-02	3.22E+00	1.07E-01	1.29E-01	3.22E+00	1.07E-01	1.29E-01
391	Commercial Market	688276.3	4864698.5	4.89E-01	1.63E-02	1.95E-02	1.19E+00	3.96E-02	4.75E-02	1.19E+00	3.96E-02	4.75E-02

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
1	Campground 10	678526.8	4859996.8	1.45E-02	--	1.45E-03	8.71E-03	--	8.71E-04	8.71E-03	--	8.71E-04
2	ECO 2	675490.4	4860360.1	1.05E-02	--	1.05E-03	5.81E-03	--	5.81E-04	5.81E-03	--	5.81E-04
3	Recreational 5	681642.0	4860349.3	2.03E-02	--	2.03E-03	1.21E-02	--	1.21E-03	1.21E-02	--	1.21E-03
4	ECO 4	676831.5	4859840.9	1.34E-02	--	1.34E-03	7.69E-03	--	7.69E-04	7.69E-03	--	7.69E-04
5	Bow. Valley Cons. 3	685767.2	4863879.0	1.11E-02	--	1.11E-03	6.32E-03	--	6.32E-04	6.32E-03	--	6.32E-04
6	ECO 6	679647.8	4859989.3	1.05E-02	--	1.05E-03	6.75E-03	--	6.75E-04	6.75E-03	--	6.75E-04
7	ECO 7	681578.8	4862070.1	2.88E-02	--	2.88E-03	1.57E-02	--	1.57E-03	1.57E-02	--	1.57E-03
8	ECO 8	679735.5	4861048.6	2.00E-02	--	2.00E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
9	ECO 9	687219.7	4864249.3	9.52E-03	--	9.52E-04	5.51E-03	--	5.51E-04	5.51E-03	--	5.51E-04
10	ECO 10	686519.0	4861987.6	1.25E-02	--	1.25E-03	6.92E-03	--	6.92E-04	6.92E-03	--	6.92E-04
11	ECO 11	679870.4	4859737.9	6.36E-03	--	6.36E-04	4.39E-03	--	4.39E-04	4.39E-03	--	4.39E-04
12	Recreational 4	681575.5	4860557.7	1.88E-02	--	1.88E-03	1.17E-02	--	1.17E-03	1.17E-02	--	1.17E-03
13	Future Industrial 9	680704.5	4859857.8	1.08E-02	--	1.08E-03	7.27E-03	--	7.27E-04	7.27E-03	--	7.27E-04
14	Future Industrial 10	680608.0	4860719.6	1.13E-02	--	1.13E-03	6.88E-03	--	6.88E-04	6.88E-03	--	6.88E-04
15	Harmony Creek	673992.4	4865641.4	6.01E-03	--	6.01E-04	3.77E-03	--	3.77E-04	3.77E-03	--	3.77E-04
16	Farewell Creek	678079.2	4868822.7	7.09E-03	--	7.09E-04	4.64E-03	--	4.64E-04	4.64E-03	--	4.64E-04
17	Farmer	681378.6	4860335.0	1.74E-02	--	1.74E-03	1.10E-02	--	1.10E-03	1.10E-02	--	1.10E-03
18	Watson Farm	682883.4	4864219.7	1.79E-02	--	1.79E-03	9.86E-03	--	9.86E-04	9.86E-03	--	9.86E-04
19	Racanski Farm	678929.2	4865530.2	9.34E-03	--	9.34E-04	5.99E-03	--	5.99E-04	5.99E-03	--	5.99E-04
20	Zoo	687216.8	4864835.3	1.02E-02	--	1.02E-03	5.89E-03	--	5.89E-04	5.89E-03	--	5.89E-04
21	Cedar Crest Beach	686652.1	4861660.9	1.48E-02	--	1.48E-03	8.00E-03	--	8.00E-04	8.00E-03	--	8.00E-04
22	Darlington Prov Park Beach	677844.6	4859718.2	1.20E-02	--	1.20E-03	7.37E-03	--	7.37E-04	7.37E-03	--	7.37E-04
23	OPG 1	682258.1	4860045.0	1.78E-02	--	1.78E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
24	OPG 2	682551.4	4859889.1	1.89E-02	--	1.89E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
25	OPG 3	682824.6	4859759.3	2.01E-02	--	2.01E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
26	OPG 4	683021.6	4859937.3	2.11E-02	--	2.11E-03	1.10E-02	--	1.10E-03	1.10E-02	--	1.10E-03
27	OPG 5	683318.2	4859677.8	1.84E-02	--	1.84E-03	9.64E-03	--	9.64E-04	9.64E-03	--	9.64E-04
28	OPG 6	683306.9	4860023.0	2.14E-02	--	2.14E-03	1.09E-02	--	1.09E-03	1.09E-02	--	1.09E-03
29	OPG 7	683718.6	4859915.8	1.93E-02	--	1.93E-03	1.00E-02	--	1.00E-03	1.00E-02	--	1.00E-03
30	OPG 8	682702.0	4859998.6	1.99E-02	--	1.99E-03	1.06E-02	--	1.06E-03	1.06E-02	--	1.06E-03
31	OPG 9	684347.7	4861184.6	1.73E-02	--	1.73E-03	9.24E-03	--	9.24E-04	9.24E-03	--	9.24E-04
32	OPG 10	682157.2	4861228.2	2.17E-02	--	2.17E-03	1.25E-02	--	1.25E-03	1.25E-02	--	1.25E-03
33	St. Mary|s 1	684557.0	4861070.0	1.82E-02	--	1.82E-03	9.62E-03	--	9.62E-04	9.62E-03	--	9.62E-04
34	St. Mary|s 2	684657.3	4861320.8	1.60E-02	--	1.60E-03	8.57E-03	--	8.57E-04	8.57E-03	--	8.57E-04
35	St. Mary|s 3	684905.3	4861154.4	1.61E-02	--	1.61E-03	8.54E-03	--	8.54E-04	8.54E-03	--	8.54E-04
36	Court. Subdivision 1	677328.4	4862976.1	1.12E-02	--	1.12E-03	6.77E-03	--	6.77E-04	6.77E-03	--	6.77E-04
37	Court. Subdivision 2	676187.9	4862611.1	1.16E-02	--	1.16E-03	6.46E-03	--	6.46E-04	6.46E-03	--	6.46E-04
38	Court. Subdivision 3	675974.8	4863484.1	8.73E-03	--	8.73E-04	5.24E-03	--	5.24E-04	5.24E-03	--	5.24E-04
39	Court. Subdivision 4	676606.1	4863214.1	9.61E-03	--	9.61E-04	5.77E-03	--	5.77E-04	5.77E-03	--	5.77E-04
40	Court. Subdivision 5	676827.1	4863591.4	9.31E-03	--	9.31E-04	5.69E-03	--	5.69E-04	5.69E-03	--	5.69E-04
41	Court. Subdivision 6	677200.4	4864074.9	8.72E-03	--	8.72E-04	5.40E-03	--	5.40E-04	5.40E-03	--	5.40E-04
42	Court. Subdivision 7	677719.8	4863625.1	9.63E-03	--	9.63E-04	5.77E-03	--	5.77E-04	5.77E-03	--	5.77E-04
43	Court. Subdivision 8	678271.6	4864200.6	8.24E-03	--	8.24E-04	5.28E-03	--	5.28E-04	5.28E-03	--	5.28E-04
44	Court. Subdivision 9	678184.4	4863373.6	1.04E-02	--	1.04E-03	5.98E-03	--	5.98E-04	5.98E-03	--	5.98E-04
45	Court. Subdivision 10	677179.7	4862499.5	1.28E-02	--	1.28E-03	7.40E-03	--	7.40E-04	7.40E-03	--	7.40E-04
46	Bow. Subdivision 1	683536.7	4864215.2	1.68E-02	--	1.68E-03	9.04E-03	--	9.04E-04	9.04E-03	--	9.04E-04
47	Bow. Subdivision 2	683770.0	4863915.1	1.60E-02	--	1.60E-03	8.63E-03	--	8.63E-04	8.63E-03	--	8.63E-04
48	Bow. Subdivision 3	683671.0	4863534.1	1.73E-02	--	1.73E-03	9.25E-03	--	9.25E-04	9.25E-03	--	9.25E-04
49	Bow. Subdivision 4	684501.9	4863847.4	1.48E-02	--	1.48E-03	8.03E-03	--	8.03E-04	8.03E-03	--	8.03E-04
50	Bow. Subdivision 5	684242.9	4863518.8	1.51E-02	--	1.51E-03	8.17E-03	--	8.17E-04	8.17E-03	--	8.17E-04
51	Bow. Subdivision 6	684271.4	4863201.5	1.41E-02	--	1.41E-03	7.75E-03	--	7.75E-04	7.75E-03	--	7.75E-04
52	Bow. Subdivision 7	683992.6	4862628.1	1.58E-02	--	1.58E-03	8.30E-03	--	8.30E-04	8.30E-03	--	8.30E-04
53	Bow. Subdivision 8	684608.2	4862956.8	1.39E-02	--	1.39E-03	7.10E-03	--	7.10E-04	7.10E-03	--	7.10E-04
54	Bow. Subdivision 9	684777.3	4863330.5	1.28E-02	--	1.28E-03	7.04E-03	--	7.04E-04	7.04E-03	--	7.04E-04
55	Bow. Subdivision 10	685266.0	4863243.1	1.24E-02	--	1.24E-03	6.43E-03	--	6.43E-04	6.43E-03	--	6.43E-04
56	Osh/Court Subdivision 1	677396.8	4860977.3	2.07E-02	--	2.07E-03	1.11E-02	--	1.11E-03	1.11E-02	--	1.11E-03
57	Osh/Court Subdivision 2	676633.5	4860816.8	1.52E-02	--	1.52E-03	8.31E-03	--	8.31E-04	8.31E-03	--	8.31E-04
58	Osh/Court Subdivision 3	676916.0	4861925.0	1.41E-02	--	1.41E-03	8.22E-03	--	8.22E-04	8.22E-03	--	8.22E-04
59	Osh/Court Subdivision 4	676730.5	4861317.1	1.73E-02	--	1.73E-03	9.30E-03	--	9.30E-04	9.30E-03	--	9.30E-04
60	Osh/Court Subdivision 5	676087.2	4861392.3	1.47E-02	--	1.47E-03	8.07E-03	--	8.07E-04	8.07E-03	--	8.07E-04
61	Osh/Court Subdivision 6	676177.1	4861722.2	1.34E-02	--	1.34E-03	7.38E-03	--	7.38E-04	7.38E-03	--	7.38E-04
62	Osh/Court Subdivision 7	675670.7	4861783.2	1.23E-02	--	1.23E-03	6.90E-03	--	6.90E-04	6.90E-03	--	6.90E-04
63	Osh/Court Subdivision 8	676050.8	4862055.7	1.31E-02	--	1.31E-03	7.49E-03	--	7.49E-04	7.49E-03	--	7.49E-04
64	Osh/Court Subdivision 9	676636.9	4862134.3	1.38E-02	--	1.38E-03	7.75E-03	--	7.75E-04	7.75E-03	--	7.75E-04
65	Osh/Court Subdivision 10	676571.3	4861634.8	1.43E-02	--	1.43E-03	7.87E-03	--	7.87E-04	7.87E-03	--	7.87E-04
66	Bow. Subdivision 11	684649.2	4863182.7	1.34E-02	--	1.34E-03	7.00E-03	--	7.00E-04	7.00E-03	--	7.00E-04
67	Daycare B	685172.4	4863933.1	1.25E-02	--	1.25E-03	7.06E-03	--	7.06E-04	7.06E-03	--	7.06E-04
68	Daycare C	685452.0	4863104.4	1.22E-02	--	1.22E-03	6.23E-03	--	6.23E-04	6.23E-03	--	6.23E-04

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
69	Daycare D	685527.7	4864693.3	1.27E-02	--	1.27E-03	7.25E-03	--	7.25E-04	7.25E-03	--	7.25E-04
70	Daycare E	685735.4	4864790.8	1.24E-02	--	1.24E-03	7.11E-03	--	7.11E-04	7.11E-03	--	7.11E-04
71	Daycare F	685520.3	4864854.3	1.27E-02	--	1.27E-03	7.23E-03	--	7.23E-04	7.23E-03	--	7.23E-04
72	Daycare G	685441.9	4864878.0	1.28E-02	--	1.28E-03	7.25E-03	--	7.25E-04	7.25E-03	--	7.25E-04
73	Daycare H	686364.8	4864707.8	1.12E-02	--	1.12E-03	6.46E-03	--	6.46E-04	6.46E-03	--	6.46E-04
74	Daycare I	685721.6	4865127.3	1.23E-02	--	1.23E-03	7.04E-03	--	7.04E-04	7.04E-03	--	7.04E-04
75	Daycare J	678256.3	4863565.4	9.95E-03	--	9.95E-04	5.68E-03	--	5.68E-04	5.68E-03	--	5.68E-04
76	Daycare K	677694.1	4864043.7	8.89E-03	--	8.89E-04	5.35E-03	--	5.35E-04	5.35E-03	--	5.35E-04
77	Daycare L	676479.5	4862526.2	1.22E-02	--	1.22E-03	6.78E-03	--	6.78E-04	6.78E-03	--	6.78E-04
78	Daycare M	678320.9	4864763.5	7.77E-03	--	7.77E-04	5.09E-03	--	5.09E-04	5.09E-03	--	5.09E-04
79	Daycare N	678513.4	4865058.0	8.32E-03	--	8.32E-04	5.49E-03	--	5.49E-04	5.49E-03	--	5.49E-04
80	Daycare O	672788.7	4863936.6	6.65E-03	--	6.65E-04	4.61E-03	--	4.61E-04	4.61E-03	--	4.61E-04
81	Daycare P	673952.8	4863592.5	7.40E-03	--	7.40E-04	4.89E-03	--	4.89E-04	4.89E-03	--	4.89E-04
82	Daycare Q	671751.8	4864887.7	5.72E-03	--	5.72E-04	4.04E-03	--	4.04E-04	4.04E-03	--	4.04E-04
83	Daycare R	685714.4	4864667.4	1.25E-02	--	1.25E-03	7.17E-03	--	7.17E-04	7.17E-03	--	7.17E-04
84	Daycare S	684177.9	4863618.2	1.55E-02	--	1.55E-03	8.34E-03	--	8.34E-04	8.34E-03	--	8.34E-04
85	Daycare T	678423.6	4864480.4	8.29E-03	--	8.29E-04	5.23E-03	--	5.23E-04	5.23E-03	--	5.23E-04
86	Daycare U	685330.5	4863435.1	1.19E-02	--	1.19E-03	6.52E-03	--	6.52E-04	6.52E-03	--	6.52E-04
87	Daycare V	685153.2	4863236.9	1.26E-02	--	1.26E-03	6.56E-03	--	6.56E-04	6.56E-03	--	6.56E-04
88	Daycare W	672679.0	4862044.9	8.06E-03	--	8.06E-04	5.26E-03	--	5.26E-04	5.26E-03	--	5.26E-04
89	Daycare X	672076.5	4865285.8	5.75E-03	--	5.75E-04	3.86E-03	--	3.86E-04	3.86E-03	--	3.86E-04
90	Daycare Y	672638.0	4859664.4	7.63E-03	--	7.63E-04	4.78E-03	--	4.78E-04	4.78E-03	--	4.78E-04
91	Daycare Z	673735.9	4858958.0	8.38E-03	--	8.38E-04	5.09E-03	--	5.09E-04	5.09E-03	--	5.09E-04
92	Daycare AA	673121.8	4863385.9	7.28E-03	--	7.28E-04	4.96E-03	--	4.96E-04	4.96E-03	--	4.96E-04
93	Daycare BB	673904.8	4862282.2	9.49E-03	--	9.49E-04	5.52E-03	--	5.52E-04	5.52E-03	--	5.52E-04
94	Daycare CC	671471.6	4861795.3	7.29E-03	--	7.29E-04	4.92E-03	--	4.92E-04	4.92E-03	--	4.92E-04
95	Daycare DD	673057.3	4862625.6	8.40E-03	--	8.40E-04	5.22E-03	--	5.22E-04	5.22E-03	--	5.22E-04
96	Daycare EE	674917.1	4863957.2	7.59E-03	--	7.59E-04	4.74E-03	--	4.74E-04	4.74E-03	--	4.74E-04
97	Daycare FF	671356.6	4862954.4	7.59E-03	--	7.59E-04	4.95E-03	--	4.95E-04	4.95E-03	--	4.95E-04
98	Daycare GG	671675.5	4862705.8	7.72E-03	--	7.72E-04	5.02E-03	--	5.02E-04	5.02E-03	--	5.02E-04
99	Daycare HH	671604.8	4860138.1	6.90E-03	--	6.90E-04	4.71E-03	--	4.71E-04	4.71E-03	--	4.71E-04
100	Daycare II	670945.2	4857983.8	5.70E-03	--	5.70E-04	3.77E-03	--	3.77E-04	3.77E-03	--	3.77E-04
101	Daycare JJ	677514.6	4864744.1	7.88E-03	--	7.88E-04	4.87E-03	--	4.87E-04	4.87E-03	--	4.87E-04
102	Daycare KK	676519.9	4862680.1	1.15E-02	--	1.15E-03	6.46E-03	--	6.46E-04	6.46E-03	--	6.46E-04
103	Daycare LL	677660.6	4863601.3	9.66E-03	--	9.66E-04	5.82E-03	--	5.82E-04	5.82E-03	--	5.82E-04
104	Court. Subdivision 11	677665.8	4863406.6	1.01E-02	--	1.01E-03	6.11E-03	--	6.11E-04	6.11E-03	--	6.11E-04
105	Daycare NN	674866.3	4864667.2	6.90E-03	--	6.90E-04	4.34E-03	--	4.34E-04	4.34E-03	--	4.34E-04
106	Daycare OO	673201.0	4864746.4	6.15E-03	--	6.15E-04	4.11E-03	--	4.11E-04	4.11E-03	--	4.11E-04
107	Daycare PP	674794.5	4864915.4	6.70E-03	--	6.70E-04	4.18E-03	--	4.18E-04	4.18E-03	--	4.18E-04
108	Hospital	686324.2	4864395.8	1.12E-02	--	1.12E-03	6.42E-03	--	6.42E-04	6.42E-03	--	6.42E-04
109	Hospital (Children's)	676057.8	4862180.9	1.32E-02	--	1.32E-03	7.44E-03	--	7.44E-04	7.44E-03	--	7.44E-04
110	Hospital	671233.2	4863615.9	7.09E-03	--	7.09E-04	4.78E-03	--	4.78E-04	4.78E-03	--	4.78E-04
111	Comm. Resp. Services	676045.4	4863902.5	8.34E-03	--	8.34E-04	5.12E-03	--	5.12E-04	5.12E-03	--	5.12E-04
112	Hospital	671712.7	4862364.1	7.49E-03	--	7.49E-04	5.06E-03	--	5.06E-04	5.06E-03	--	5.06E-04
113	Retirement Residence A	684199.9	4864120.3	1.52E-02	--	1.52E-03	8.08E-03	--	8.08E-04	8.08E-03	--	8.08E-04
114	Retirement Residence B	685483.9	4865150.9	1.25E-02	--	1.25E-03	7.13E-03	--	7.13E-04	7.13E-03	--	7.13E-04
115	Retirement Residence C	686844.0	4864732.1	1.08E-02	--	1.08E-03	6.16E-03	--	6.16E-04	6.16E-03	--	6.16E-04
116	Retirement Residence D	673481.7	4863343.4	7.38E-03	--	7.38E-04	5.02E-03	--	5.02E-04	5.02E-03	--	5.02E-04
117	Retirement Residence E	671825.2	4864399.0	6.10E-03	--	6.10E-04	4.29E-03	--	4.29E-04	4.29E-03	--	4.29E-04
118	Retirement Residence F	671606.3	4864536.0	5.99E-03	--	5.99E-04	4.22E-03	--	4.22E-04	4.22E-03	--	4.22E-04
119	Retirement Residence G	671357.1	4862958.7	7.59E-03	--	7.59E-04	4.95E-03	--	4.95E-04	4.95E-03	--	4.95E-04
120	Retirement Residence H	671514.0	4862262.9	7.46E-03	--	7.46E-04	5.04E-03	--	5.04E-04	5.04E-03	--	5.04E-04
121	Retirement Residence I	672602.2	4863075.9	7.70E-03	--	7.70E-04	5.08E-03	--	5.08E-04	5.08E-03	--	5.08E-04
122	Retirement Residence J	671719.1	4862893.1	7.73E-03	--	7.73E-04	4.99E-03	--	4.99E-04	4.99E-03	--	4.99E-04
123	Retirement Residence K	686718.0	4865648.7	1.09E-02	--	1.09E-03	6.40E-03	--	6.40E-04	6.40E-03	--	6.40E-04
124	Retirement Residence L	676168.7	4865669.9	6.98E-03	--	6.98E-04	4.50E-03	--	4.50E-04	4.50E-03	--	4.50E-04
125	Retirement Residence M	676118.5	4863980.7	8.28E-03	--	8.28E-04	5.11E-03	--	5.11E-04	5.11E-03	--	5.11E-04
126	Bow. Subdivision 12	684649.2	4863182.7	1.34E-02	--	1.34E-03	7.00E-03	--	7.00E-04	7.00E-03	--	7.00E-04
127	Primary School B	685384.8	4863575.3	1.16E-02	--	1.16E-03	6.56E-03	--	6.56E-04	6.56E-03	--	6.56E-04
128	Primary School C	685021.6	4863952.9	1.30E-02	--	1.30E-03	7.30E-03	--	7.30E-04	7.30E-03	--	7.30E-04
129	Primary School D	686237.0	4864085.5	1.08E-02	--	1.08E-03	6.19E-03	--	6.19E-04	6.19E-03	--	6.19E-04
130	Primary School E	686719.0	4863734.7	9.97E-03	--	9.97E-04	5.43E-03	--	5.43E-04	5.43E-03	--	5.43E-04
131	Primary School F	686357.0	4864754.9	1.12E-02	--	1.12E-03	6.46E-03	--	6.46E-04	6.46E-03	--	6.46E-04
132	Primary School G	685502.0	4865013.4	1.26E-02	--	1.26E-03	7.19E-03	--	7.19E-04	7.19E-03	--	7.19E-04
133	Primary School H	686726.7	4866061.5	1.08E-02	--	1.08E-03	6.33E-03	--	6.33E-04	6.33E-03	--	6.33E-04
134	Primary School I	685186.2	4866568.2	1.16E-02	--	1.16E-03	6.94E-03	--	6.94E-04	6.94E-03	--	6.94E-04
135	Primary School J	685965.3	4866979.0	1.10E-02	--	1.10E-03	6.31E-03	--	6.31E-04	6.31E-03	--	6.31E-04
136	Primary School K	677709.9	4864726.5	7.87E-03	--	7.87E-04	4.84E-03	--	4.84E-04	4.84E-03	--	4.84E-04

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
137	Primary School L	675988.3	4864270.2	7.90E-03	--	7.90E-04	4.94E-03	--	4.94E-04	4.94E-03	--	4.94E-04
138	Primary School M	676608.7	4862739.0	1.12E-02	--	1.12E-03	6.39E-03	--	6.39E-04	6.39E-03	--	6.39E-04
139	Primary School N	677222.2	4863759.1	9.18E-03	--	9.18E-04	5.65E-03	--	5.65E-04	5.65E-03	--	5.65E-04
140	Primary School O	678154.9	4863872.7	9.19E-03	--	9.19E-04	5.30E-03	--	5.30E-04	5.30E-03	--	5.30E-04
141	Court. Subdivision 12	678309.6	4863600.8	9.86E-03	--	9.86E-04	5.60E-03	--	5.60E-04	5.60E-03	--	5.60E-04
142	Primary School Q	677010.6	4862470.6	1.27E-02	--	1.27E-03	7.27E-03	--	7.27E-04	7.27E-03	--	7.27E-04
143	Primary School R	677431.3	4866694.7	6.73E-03	--	6.73E-04	4.51E-03	--	4.51E-04	4.51E-03	--	4.51E-04
144	Primary School S	675266.2	4863562.9	8.40E-03	--	8.40E-04	5.13E-03	--	5.13E-04	5.13E-03	--	5.13E-04
145	Primary School T	673479.2	4860029.4	7.26E-03	--	7.26E-04	4.80E-03	--	4.80E-04	4.80E-03	--	4.80E-04
146	Primary School U	670856.0	4860710.6	7.01E-03	--	7.01E-04	4.76E-03	--	4.76E-04	4.76E-03	--	4.76E-04
147	Primary School V	672660.2	4863909.2	6.70E-03	--	6.70E-04	4.65E-03	--	4.65E-04	4.65E-03	--	4.65E-04
148	Primary School W	672735.2	4859232.9	8.33E-03	--	8.33E-04	4.99E-03	--	4.99E-04	4.99E-03	--	4.99E-04
149	Primary School X	673575.8	4862688.6	8.39E-03	--	8.39E-04	5.33E-03	--	5.33E-04	5.33E-03	--	5.33E-04
150	Primary School Y	673710.3	4861969.0	9.14E-03	--	9.14E-04	5.40E-03	--	5.40E-04	5.40E-03	--	5.40E-04
151	Primary School Z	672366.0	4859928.1	7.03E-03	--	7.03E-04	4.68E-03	--	4.68E-04	4.68E-03	--	4.68E-04
152	Primary School AA	672561.7	4866047.1	6.06E-03	--	6.06E-04	3.64E-03	--	3.64E-04	3.64E-03	--	3.64E-04
153	Primary School BB	675095.1	4862930.4	9.24E-03	--	9.24E-04	5.56E-03	--	5.56E-04	5.56E-03	--	5.56E-04
154	Primary School CC	673242.6	4865197.9	6.26E-03	--	6.26E-04	3.94E-03	--	3.94E-04	3.94E-03	--	3.94E-04
155	Primary School DD	674164.9	4863031.3	8.08E-03	--	8.08E-04	5.28E-03	--	5.28E-04	5.28E-03	--	5.28E-04
156	Primary School EE	671905.6	4864697.8	5.85E-03	--	5.85E-04	4.13E-03	--	4.13E-04	4.13E-03	--	4.13E-04
157	Primary School FF	673294.9	4858774.5	7.42E-03	--	7.42E-04	4.59E-03	--	4.59E-04	4.59E-03	--	4.59E-04
158	Primary School GG	671659.7	4863120.0	7.65E-03	--	7.65E-04	4.97E-03	--	4.97E-04	4.97E-03	--	4.97E-04
159	Primary School HH	673853.4	4866711.0	5.91E-03	--	5.91E-04	3.67E-03	--	3.67E-04	3.67E-03	--	3.67E-04
160	Primary School II	672616.7	4862114.9	8.15E-03	--	8.15E-04	5.27E-03	--	5.27E-04	5.27E-03	--	5.27E-04
161	Primary School JJ	673567.2	4861899.5	8.83E-03	--	8.83E-04	5.36E-03	--	5.36E-04	5.36E-03	--	5.36E-04
162	Primary School KK	671791.0	4861954.2	7.61E-03	--	7.61E-04	5.10E-03	--	5.10E-04	5.10E-03	--	5.10E-04
163	Primary School LL	673762.3	4864210.6	6.73E-03	--	6.73E-04	4.45E-03	--	4.45E-04	4.45E-03	--	4.45E-04
164	Primary School MM	672238.8	4864621.3	5.97E-03	--	5.97E-04	4.18E-03	--	4.18E-04	4.18E-03	--	4.18E-04
165	Primary School NN	673213.6	4858677.0	7.12E-03	--	7.12E-04	4.43E-03	--	4.43E-04	4.43E-03	--	4.43E-04
166	Primary School OO	675474.8	4863221.7	9.33E-03	--	9.33E-04	5.50E-03	--	5.50E-04	5.50E-03	--	5.50E-04
167	Primary School PP	672441.8	4858748.6	7.10E-03	--	7.10E-04	4.48E-03	--	4.48E-04	4.48E-03	--	4.48E-04
168	Primary School QQ	672796.8	4864438.2	6.22E-03	--	6.22E-04	4.28E-03	--	4.28E-04	4.28E-03	--	4.28E-04
169	Primary School RR	671351.4	4863284.0	7.43E-03	--	7.43E-04	4.88E-03	--	4.88E-04	4.88E-03	--	4.88E-04
170	Primary School SS	673213.9	4862125.5	8.65E-03	--	8.65E-04	5.30E-03	--	5.30E-04	5.30E-03	--	5.30E-04
171	Primary School TT	671017.9	4860953.7	6.99E-03	--	6.99E-04	4.75E-03	--	4.75E-04	4.75E-03	--	4.75E-04
172	Primary School UU	670991.0	4861089.8	6.93E-03	--	6.93E-04	4.72E-03	--	4.72E-04	4.72E-03	--	4.72E-04
173	Primary School VV	674150.1	4862294.8	9.66E-03	--	9.66E-04	5.60E-03	--	5.60E-04	5.60E-03	--	5.60E-04
174	Primary School WW	672005.2	4861707.9	7.64E-03	--	7.64E-04	5.11E-03	--	5.11E-04	5.11E-03	--	5.11E-04
175	Primary School XX	684172.1	4863615.6	1.56E-02	--	1.56E-03	8.36E-03	--	8.36E-04	8.36E-03	--	8.36E-04
176	Primary School YY	683923.3	4866636.4	1.21E-02	--	1.21E-03	7.33E-03	--	7.33E-04	7.33E-03	--	7.33E-04
177	Primary School ZZ	680446.0	4865770.5	1.01E-02	--	1.01E-03	6.27E-03	--	6.27E-04	6.27E-03	--	6.27E-04
178	Vacant School	685612.9	4864520.0	1.24E-02	--	1.24E-03	7.07E-03	--	7.07E-04	7.07E-03	--	7.07E-04
179	Secondary School A	686291.4	4865064.3	1.12E-02	--	1.12E-03	6.53E-03	--	6.53E-04	6.53E-03	--	6.53E-04
180	Secondary School B	683875.0	4864741.7	1.55E-02	--	1.55E-03	8.46E-03	--	8.46E-04	8.46E-03	--	8.46E-04
181	Secondary School C	684650.3	4866460.3	1.17E-02	--	1.17E-03	7.18E-03	--	7.18E-04	7.18E-03	--	7.18E-04
182	Secondary School D	678099.5	4864838.2	7.57E-03	--	7.57E-04	4.88E-03	--	4.88E-04	4.88E-03	--	4.88E-04
183	Secondary School E	678467.0	4863431.2	9.94E-03	--	9.94E-04	5.89E-03	--	5.89E-04	5.89E-03	--	5.89E-04
184	Secondary School F	674144.9	4862762.7	8.25E-03	--	8.25E-04	5.44E-03	--	5.44E-04	5.44E-03	--	5.44E-04
185	Secondary School G	673816.0	4864357.1	6.58E-03	--	6.58E-04	4.35E-03	--	4.35E-04	4.35E-03	--	4.35E-04
186	Secondary School H	673145.4	4858569.0	6.90E-03	--	6.90E-04	4.33E-03	--	4.33E-04	4.33E-03	--	4.33E-04
187	Secondary School I	671291.7	4863581.3	7.20E-03	--	7.20E-04	4.83E-03	--	4.83E-04	4.83E-03	--	4.83E-04
188	Secondary School J	671443.2	4861664.9	7.24E-03	--	7.24E-04	4.89E-03	--	4.89E-04	4.89E-03	--	4.89E-04
189	Secondary School K	673235.3	4860885.0	7.54E-03	--	7.54E-04	5.07E-03	--	5.07E-04	5.07E-03	--	5.07E-04
190	Secondary Schook L	684252.7	4866500.5	1.20E-02	--	1.20E-03	7.36E-03	--	7.36E-04	7.36E-03	--	7.36E-04
191	Secondary School M	673914.1	4859551.7	9.10E-03	--	9.10E-04	5.36E-03	--	5.36E-04	5.36E-03	--	5.36E-04
192	Secondary School N	675051.5	4864177.2	7.51E-03	--	7.51E-04	4.61E-03	--	4.61E-04	4.61E-03	--	4.61E-04
193	Adult School	685276.1	4866019.8	1.18E-02	--	1.18E-03	6.72E-03	--	6.72E-04	6.72E-03	--	6.72E-04
194	Bow. Valley Cons. 1	685356.6	4864521.2	1.24E-02	--	1.24E-03	7.06E-03	--	7.06E-04	7.06E-03	--	7.06E-04
195	Bow. Valley Cons. 2	685627.7	4864167.8	1.17E-02	--	1.17E-03	6.70E-03	--	6.70E-04	6.70E-03	--	6.70E-04
196	Bow. Valley Cons. 4	685852.7	4863640.2	1.09E-02	--	1.09E-03	5.98E-03	--	5.98E-04	5.98E-03	--	5.98E-04
197	Bow. Valley Cons. 5	686163.1	4863621.5	1.06E-02	--	1.06E-03	5.67E-03	--	5.67E-04	5.67E-03	--	5.67E-04
198	Bow. Valley Cons. 6	685931.9	4863380.6	1.10E-02	--	1.10E-03	5.66E-03	--	5.66E-04	5.66E-03	--	5.66E-04
199	Maple Grove 1	681688.5	4864717.0	1.15E-02	--	1.15E-03	6.71E-03	--	6.71E-04	6.71E-03	--	6.71E-04
200	Maple Grove 2	681768.9	4864631.8	1.19E-02	--	1.19E-03	6.87E-03	--	6.87E-04	6.87E-03	--	6.87E-04
201	Maple Grove 3	681894.9	4864506.8	1.21E-02	--	1.21E-03	7.29E-03	--	7.29E-04	7.29E-03	--	7.29E-04
202	Maple Grove 4	681974.8	4864443.2	1.26E-02	--	1.26E-03	7.65E-03	--	7.65E-04	7.65E-03	--	7.65E-04
203	Maple Grove 5	681942.2	4864676.7	1.17E-02	--	1.17E-03	7.03E-03	--	7.03E-04	7.03E-03	--	7.03E-04
204	Maple Grove 6	682053.2	4864586.2	1.24E-02	--	1.24E-03	7.52E-03	--	7.52E-04	7.52E-03	--	7.52E-04

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
205	Maple Grove 7	682168.5	4864631.3	1.28E-02	--	1.28E-03	7.76E-03	--	7.76E-04	7.76E-03	--	7.76E-04
206	Maple Grove 8	682261.7	4864520.9	1.39E-02	--	1.39E-03	8.33E-03	--	8.33E-04	8.33E-03	--	8.33E-04
207	Maple Grove 9	682382.1	4864589.4	1.43E-02	--	1.43E-03	8.48E-03	--	8.48E-04	8.48E-03	--	8.48E-04
208	Maple Grove 10	682459.8	4864499.2	1.53E-02	--	1.53E-03	8.98E-03	--	8.98E-04	8.98E-03	--	8.98E-04
209	Port Darlington 1	686227.8	4861159.0	1.53E-02	--	1.53E-03	8.22E-03	--	8.22E-04	8.22E-03	--	8.22E-04
210	Port Darlington 2	686184.8	4861252.0	1.51E-02	--	1.51E-03	8.16E-03	--	8.16E-04	8.16E-03	--	8.16E-04
211	Port Darlington 3	686151.2	4861286.8	1.48E-02	--	1.48E-03	8.02E-03	--	8.02E-04	8.02E-03	--	8.02E-04
212	Port Darlington 4	686351.1	4861341.6	1.51E-02	--	1.51E-03	8.12E-03	--	8.12E-04	8.12E-03	--	8.12E-04
213	Port Darlington 5	686406.8	4861448.7	1.50E-02	--	1.50E-03	8.12E-03	--	8.12E-04	8.12E-03	--	8.12E-04
214	Port Darlington 6	686504.5	4861604.0	1.49E-02	--	1.49E-03	8.06E-03	--	8.06E-04	8.06E-03	--	8.06E-04
215	Port Darlington 7	686703.0	4861789.3	1.40E-02	--	1.40E-03	7.64E-03	--	7.64E-04	7.64E-03	--	7.64E-04
216	Port Darlington 8	686895.8	4861960.2	1.29E-02	--	1.29E-03	7.11E-03	--	7.11E-04	7.11E-03	--	7.11E-04
217	Port Darlington 9	686867.4	4862119.7	1.20E-02	--	1.20E-03	6.64E-03	--	6.64E-04	6.64E-03	--	6.64E-04
218	Port Darlington 10	687190.7	4862048.8	1.20E-02	--	1.20E-03	6.64E-03	--	6.64E-04	6.64E-03	--	6.64E-04
219	Port Darlington 11	687524.4	4862126.8	1.17E-02	--	1.17E-03	6.47E-03	--	6.47E-04	6.47E-03	--	6.47E-04
220	Campground 1	678646.3	4860337.7	2.43E-02	--	2.43E-03	1.28E-02	--	1.28E-03	1.28E-02	--	1.28E-03
221	Campground 2	678410.2	4860148.6	1.79E-02	--	1.79E-03	9.45E-03	--	9.45E-04	9.45E-03	--	9.45E-04
222	Campground 3	678651.0	4860054.4	1.61E-02	--	1.61E-03	9.16E-03	--	9.16E-04	9.16E-03	--	9.16E-04
223	Campground 4	678725.9	4859860.7	1.53E-02	--	1.53E-03	9.48E-03	--	9.48E-04	9.48E-03	--	9.48E-04
224	Campground 5	678511.1	4859808.6	1.40E-02	--	1.40E-03	8.72E-03	--	8.72E-04	8.72E-03	--	8.72E-04
225	Campground 6	678869.5	4859696.0	1.33E-02	--	1.33E-03	8.40E-03	--	8.40E-04	8.40E-03	--	8.40E-04
226	Campground 7	678723.9	4860201.8	2.05E-02	--	2.05E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
227	Campground 8	678796.0	4860011.4	1.60E-02	--	1.60E-03	9.60E-03	--	9.60E-04	9.60E-03	--	9.60E-04
228	Campground 9	678852.7	4859854.2	1.56E-02	--	1.56E-03	9.57E-03	--	9.57E-04	9.57E-03	--	9.57E-04
229	Solina 1	681099.6	4861677.2	2.19E-02	--	2.19E-03	1.29E-02	--	1.29E-03	1.29E-02	--	1.29E-03
230	Solina 2	681115.7	4861857.7	2.19E-02	--	2.19E-03	1.28E-02	--	1.28E-03	1.28E-02	--	1.28E-03
231	Solina 3	680987.4	4861983.5	1.88E-02	--	1.88E-03	1.10E-02	--	1.10E-03	1.10E-02	--	1.10E-03
232	Solina 4	680965.0	4862068.1	1.84E-02	--	1.84E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
233	Solina 5	681021.5	4862086.7	1.88E-02	--	1.88E-03	1.09E-02	--	1.09E-03	1.09E-02	--	1.09E-03
234	Solina 6	680939.8	4862124.3	1.81E-02	--	1.81E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
235	Solina 7	680988.2	4862183.6	1.83E-02	--	1.83E-03	1.06E-02	--	1.06E-03	1.06E-02	--	1.06E-03
236	Solina 8	680984.6	4862209.8	1.82E-02	--	1.82E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
237	Solina 9	680958.6	4862294.9	1.79E-02	--	1.79E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
238	Solina 10	680858.0	4862324.3	1.76E-02	--	1.76E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
239	Solina 11	680990.3	4862403.5	1.78E-02	--	1.78E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
240	Recreational 1	681545.0	4860865.0	1.88E-02	--	1.88E-03	1.08E-02	--	1.08E-03	1.08E-02	--	1.08E-03
241	Recreational 2	681563.7	4860687.4	1.80E-02	--	1.80E-03	1.09E-02	--	1.09E-03	1.09E-02	--	1.09E-03
242	Recreational 3	681579.7	4860610.0	1.84E-02	--	1.84E-03	1.14E-02	--	1.14E-03	1.14E-02	--	1.14E-03
243	Recreational 6	681876.6	4860254.4	2.04E-02	--	2.04E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
244	Recreational 7	682166.9	4860324.4	2.16E-02	--	2.16E-03	1.22E-02	--	1.22E-03	1.22E-02	--	1.22E-03
245	Darlington 1	679565.4	4861052.9	2.00E-02	--	2.00E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
246	Darlington 2	679452.9	4861051.4	2.03E-02	--	2.03E-03	1.19E-02	--	1.19E-03	1.19E-02	--	1.19E-03
247	Darlington 3	679130.5	4860948.8	2.16E-02	--	2.16E-03	1.22E-02	--	1.22E-03	1.22E-02	--	1.22E-03
248	Darlington 4	679112.6	4860941.9	2.17E-02	--	2.17E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
249	Darlington 5	679057.6	4860994.1	2.19E-02	--	2.19E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
250	Darlington 6	679075.2	4860931.6	2.19E-02	--	2.19E-03	1.24E-02	--	1.24E-03	1.24E-02	--	1.24E-03
251	Darlington 7	678814.3	4860843.1	2.58E-02	--	2.58E-03	1.42E-02	--	1.42E-03	1.42E-02	--	1.42E-03
252	Darlington 8	678840.4	4860777.1	2.63E-02	--	2.63E-03	1.45E-02	--	1.45E-03	1.45E-02	--	1.45E-03
253	Light Ind. 1	680000.1	4861034.1	1.79E-02	--	1.79E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
254	Light Ind. 2	680060.7	4861056.4	1.79E-02	--	1.79E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
255	Light Ind. 3	680291.2	4861151.6	1.66E-02	--	1.66E-03	9.66E-03	--	9.66E-04	9.66E-03	--	9.66E-04
256	Light Ind. 4	680536.3	4861204.6	1.60E-02	--	1.60E-03	9.88E-03	--	9.88E-04	9.88E-03	--	9.88E-04
257	Light Ind. 5	680350.4	4861290.6	1.76E-02	--	1.76E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
258	Light Ind. 6	680306.9	4861275.6	1.72E-02	--	1.72E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
259	Light Ind. 7	680267.2	4861262.4	1.69E-02	--	1.69E-03	9.86E-03	--	9.86E-04	9.86E-03	--	9.86E-04
260	Light Ind. 8	680233.6	4861250.7	1.72E-02	--	1.72E-03	9.80E-03	--	9.80E-04	9.80E-03	--	9.80E-04
261	Light Ind. 9	680175.3	4861227.5	1.75E-02	--	1.75E-03	9.90E-03	--	9.90E-04	9.90E-03	--	9.90E-04
262	Light Ind. 10	680092.5	4861185.1	1.80E-02	--	1.80E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
263	Light Ind. 11	680071.6	4861246.6	1.80E-02	--	1.80E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
264	Light Ind. 12	680021.4	4861186.9	1.81E-02	--	1.81E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
265	Future Industrial 7	680816.2	4860219.3	9.09E-03	--	9.09E-04	6.06E-03	--	6.06E-04	6.06E-03	--	6.06E-04
266	Future Industrial 8	680398.0	4860731.8	1.09E-02	--	1.09E-03	6.11E-03	--	6.11E-04	6.11E-03	--	6.11E-04
267	Future Industrial 1	680359.6	4859959.2	6.69E-03	--	6.69E-04	4.70E-03	--	4.70E-04	4.70E-03	--	4.70E-04
268	Future Industrial 2	680083.7	4859985.7	6.73E-03	--	6.73E-04	4.48E-03	--	4.48E-04	4.48E-03	--	4.48E-04
269	Future Industrial 3	680819.9	4860705.3	1.24E-02	--	1.24E-03	6.98E-03	--	6.98E-04	6.98E-03	--	6.98E-04
270	Future Industrial 4	681070.0	4859937.2	2.02E-02	--	2.02E-03	1.34E-02	--	1.34E-03	1.34E-02	--	1.34E-03
271	Future Industrial 5	679898.8	4860067.4	8.98E-03	--	8.98E-04	5.70E-03	--	5.70E-04	5.70E-03	--	5.70E-04
272	Future Industrial 6	680134.8	4860694.1	1.25E-02	--	1.25E-03	7.00E-03	--	7.00E-04	7.00E-03	--	7.00E-04

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
273	Future Industrial 11	680253.7	4860255.2	8.27E-03	--	8.27E-04	4.93E-03	--	4.93E-04	4.93E-03	--	4.93E-04
274	Future Industrial 12	679901.2	4860511.8	1.31E-02	--	1.31E-03	8.24E-03	--	8.24E-04	8.24E-03	--	8.24E-04
275	Commercial Farmer	679867.8	4860445.4	1.32E-02	--	1.32E-03	8.38E-03	--	8.38E-04	8.38E-03	--	8.38E-04
276	Farmer	679277.0	4859981.5	1.40E-02	--	1.40E-03	8.77E-03	--	8.77E-04	8.77E-03	--	8.77E-04
277	Residence	679387.2	4860648.9	2.25E-02	--	2.25E-03	1.32E-02	--	1.32E-03	1.32E-02	--	1.32E-03
278	Barn	679261.9	4860574.2	2.50E-02	--	2.50E-03	1.42E-02	--	1.42E-03	1.42E-02	--	1.42E-03
279	Residence	680150.7	4861295.7	1.76E-02	--	1.76E-03	9.90E-03	--	9.90E-04	9.90E-03	--	9.90E-04
280	Residence	679939.8	4861213.4	1.81E-02	--	1.81E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
281	Farmer	680855.7	4861456.9	1.91E-02	--	1.91E-03	1.17E-02	--	1.17E-03	1.17E-02	--	1.17E-03
282	Farmer	681386.2	4861673.3	2.77E-02	--	2.77E-03	1.53E-02	--	1.53E-03	1.53E-02	--	1.53E-03
283	Residence	680683.5	4861597.9	1.72E-02	--	1.72E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
284	Business	680064.3	4861343.7	1.79E-02	--	1.79E-03	1.00E-02	--	1.00E-03	1.00E-02	--	1.00E-03
285	Farmer	679680.1	4861213.5	1.92E-02	--	1.92E-03	1.14E-02	--	1.14E-03	1.14E-02	--	1.14E-03
286	Farmer	681344.8	4861792.9	2.63E-02	--	2.63E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
287	Youth Centre	685644.2	4864814.8	1.26E-02	--	1.26E-03	7.18E-03	--	7.18E-04	7.18E-03	--	7.18E-04
288	Bowmanville Arena	685462.9	4864615.2	1.27E-02	--	1.27E-03	7.21E-03	--	7.21E-04	7.21E-03	--	7.21E-04
289	Bowmanville Rec Complex	684160.3	4864604.5	1.48E-02	--	1.48E-03	7.99E-03	--	7.99E-04	7.99E-03	--	7.99E-04
290	Recreation Complex	684586.6	4862406.3	1.34E-02	--	1.34E-03	7.06E-03	--	7.06E-04	7.06E-03	--	7.06E-04
291	Superdog Central	681487.7	4865723.3	9.91E-03	--	9.91E-04	6.13E-03	--	6.13E-04	6.13E-03	--	6.13E-04
292	Equestrian Centre	681567.1	4863670.7	1.42E-02	--	1.42E-03	8.34E-03	--	8.34E-04	8.34E-03	--	8.34E-04
293	Flea Market	678574.6	4862819.4	1.15E-02	--	1.15E-03	6.57E-03	--	6.57E-04	6.57E-03	--	6.57E-04
294	Equestrian Centre	680030.8	4867320.2	8.18E-03	--	8.18E-04	5.28E-03	--	5.28E-04	5.28E-03	--	5.28E-04
295	Courtice Community Complex	678099.3	4864629.8	7.72E-03	--	7.72E-04	4.92E-03	--	4.92E-04	4.92E-03	--	4.92E-04
296	Former Restaurant	679830.2	4860702.2	1.64E-02	--	1.64E-03	9.49E-03	--	9.49E-04	9.49E-03	--	9.49E-04
297	Commercial	679364.8	4861016.0	2.03E-02	--	2.03E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
298	GM Oshawa Headquarters	676418.3	4860463.7	1.36E-02	--	1.36E-03	7.37E-03	--	7.37E-04	7.37E-03	--	7.37E-04
299	Farm A?	682972.3	4862201.9	1.99E-02	--	1.99E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
300	Farm B?	683546.9	4861959.7	1.71E-02	--	1.71E-03	9.02E-03	--	9.02E-04	9.02E-03	--	9.02E-04
301	Farm C?	682547.5	4862321.1	2.41E-02	--	2.41E-03	1.25E-02	--	1.25E-03	1.25E-02	--	1.25E-03
302	Farm D?	683238.3	4862393.3	1.84E-02	--	1.84E-03	9.89E-03	--	9.89E-04	9.89E-03	--	9.89E-04
303	Farm E?	682512.6	4862858.0	2.41E-02	--	2.41E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
304	Farm F?	683129.1	4863649.4	1.93E-02	--	1.93E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
305	Bennett 1	688209.3	4862512.1	1.02E-02	--	1.02E-03	5.72E-03	--	5.72E-04	5.72E-03	--	5.72E-04
306	Bennett 2	687990.0	4863221.3	9.18E-03	--	9.18E-04	5.24E-03	--	5.24E-04	5.24E-03	--	5.24E-04
307	Bennett 3	688818.4	4862836.3	8.94E-03	--	8.94E-04	5.09E-03	--	5.09E-04	5.09E-03	--	5.09E-04
308	Bennett 4	689045.1	4863365.5	8.83E-03	--	8.83E-04	5.08E-03	--	5.08E-04	5.08E-03	--	5.08E-04
309	Bennett 5	688270.5	4863763.1	9.03E-03	--	9.03E-04	5.05E-03	--	5.05E-04	5.05E-03	--	5.05E-04
310	Bennett 6	689908.5	4863100.5	8.18E-03	--	8.18E-04	4.72E-03	--	4.72E-04	4.72E-03	--	4.72E-04
311	Bennett 7	688929.9	4864392.0	9.45E-03	--	9.45E-04	5.09E-03	--	5.09E-04	5.09E-03	--	5.09E-04
312	Bennett 8	689684.2	4863837.7	8.47E-03	--	8.47E-04	4.90E-03	--	4.90E-04	4.90E-03	--	4.90E-04
313	Soper 1	687557.9	4862512.4	1.01E-02	--	1.01E-03	5.69E-03	--	5.69E-04	5.69E-03	--	5.69E-04
314	Soper 2	687241.9	4863171.7	9.43E-03	--	9.43E-04	5.35E-03	--	5.35E-04	5.35E-03	--	5.35E-04
315	Soper 3	687023.2	4863903.8	9.53E-03	--	9.53E-04	5.36E-03	--	5.36E-04	5.36E-03	--	5.36E-04
316	Soper 4	688158.2	4865389.3	9.80E-03	--	9.80E-04	5.71E-03	--	5.71E-04	5.71E-03	--	5.71E-04
317	Soper 5	685027.3	4868253.9	1.07E-02	--	1.07E-03	6.72E-03	--	6.72E-04	6.72E-03	--	6.72E-04
318	Soper 6	687287.4	4867037.3	1.03E-02	--	1.03E-03	6.11E-03	--	6.11E-04	6.11E-03	--	6.11E-04
319	Soper 7	685683.2	4867148.1	1.12E-02	--	1.12E-03	6.58E-03	--	6.58E-04	6.58E-03	--	6.58E-04
320	Soper 8	686748.7	4865874.7	1.08E-02	--	1.08E-03	6.32E-03	--	6.32E-04	6.32E-03	--	6.32E-04
321	Bowmanville 1	687026.3	4862368.4	1.04E-02	--	1.04E-03	5.84E-03	--	5.84E-04	5.84E-03	--	5.84E-04
322	Bowmanville 2	686625.7	4863020.3	1.00E-02	--	1.00E-03	5.42E-03	--	5.42E-04	5.42E-03	--	5.42E-04
323	Bowmanville 3	683380.3	4865365.9	1.47E-02	--	1.47E-03	8.46E-03	--	8.46E-04	8.46E-03	--	8.46E-04
324	Bowmanville 4	683111.4	4867150.3	9.70E-03	--	9.70E-04	5.95E-03	--	5.95E-04	5.95E-03	--	5.95E-04
325	Bowmanville 5	682452.2	4869417.5	7.21E-03	--	7.21E-04	4.67E-03	--	4.67E-04	4.67E-03	--	4.67E-04
326	Bowmanville 6	684778.5	4864888.2	1.35E-02	--	1.35E-03	7.43E-03	--	7.43E-04	7.43E-03	--	7.43E-04
327	Bowmanville 7	684549.5	4866404.4	1.18E-02	--	1.18E-03	7.21E-03	--	7.21E-04	7.21E-03	--	7.21E-04
328	Upper Tooley 1	679944.8	4864883.1	1.09E-02	--	1.09E-03	6.76E-03	--	6.76E-04	6.76E-03	--	6.76E-04
329	Upper Tooley 2	679055.1	4863885.8	1.01E-02	--	1.01E-03	6.38E-03	--	6.38E-04	6.38E-03	--	6.38E-04
330	Upper Tooley 3	679714.0	4862767.4	1.37E-02	--	1.37E-03	8.41E-03	--	8.41E-04	8.41E-03	--	8.41E-04
331	Upper Tooley 4	678898.8	4861800.6	1.76E-02	--	1.76E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
332	Upper Tooley 5	680353.5	4862156.5	2.00E-02	--	2.00E-03	1.10E-02	--	1.10E-03	1.10E-02	--	1.10E-03
333	Upper Tooley 6	679818.1	4861625.7	1.62E-02	--	1.62E-03	9.20E-03	--	9.20E-04	9.20E-03	--	9.20E-04
334	Robinson 1	678434.8	4860943.1	2.53E-02	--	2.53E-03	1.35E-02	--	1.35E-03	1.35E-02	--	1.35E-03
335	Robinson 2	677752.6	4861240.6	1.87E-02	--	1.87E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
336	Robinson 3	677642.2	4861787.2	1.57E-02	--	1.57E-03	9.18E-03	--	9.18E-04	9.18E-03	--	9.18E-04
337	Robinson 4	678532.7	4862143.6	1.57E-02	--	1.57E-03	9.13E-03	--	9.13E-04	9.13E-03	--	9.13E-04
338	Robinson 5	678005.1	4862784.9	1.24E-02	--	1.24E-03	7.42E-03	--	7.42E-04	7.42E-03	--	7.42E-04
339	Robinson 6	677882.7	4860587.7	2.19E-02	--	2.19E-03	1.15E-02	--	1.15E-03	1.15E-02	--	1.15E-03
340	F/B 1	677443.1	4867862.1	6.73E-03	--	6.73E-04	4.52E-03	--	4.52E-04	4.52E-03	--	4.52E-04

Table A - 3. Annual Exposure Point Concentrations and Concentration Ratios - Operational Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011			December 2009			July 2009		
				Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Total Particulate Matter ([SPM]+[PM2.5]) µg/m³	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
341	F/B 2	679667.4	4866611.4	8.87E-03	--	8.87E-04	5.67E-03	--	5.67E-04	5.67E-03	--	5.67E-04
342	F/B 3	678655.0	4867470.1	8.07E-03	--	8.07E-04	5.19E-03	--	5.19E-04	5.19E-03	--	5.19E-04
343	F/B 4	676191.2	4866844.7	6.47E-03	--	6.47E-04	4.22E-03	--	4.22E-04	4.22E-03	--	4.22E-04
344	F/B 5	678273.3	4866093.0	7.98E-03	--	7.98E-04	5.30E-03	--	5.30E-04	5.30E-03	--	5.30E-04
345	F/B 6	681241.2	4867098.8	8.70E-03	--	8.70E-04	5.71E-03	--	5.71E-04	5.71E-03	--	5.71E-04
346	F/B 7	682165.3	4868082.3	7.94E-03	--	7.94E-04	5.09E-03	--	5.09E-04	5.09E-03	--	5.09E-04
347	F/B 8	679366.6	4868628.3	7.43E-03	--	7.43E-04	4.87E-03	--	4.87E-04	4.87E-03	--	4.87E-04
348	F/B 9	680310.1	4869967.1	6.54E-03	--	6.54E-04	4.44E-03	--	4.44E-04	4.44E-03	--	4.44E-04
349	F/B 10	676487.3	4869291.6	6.17E-03	--	6.17E-04	4.17E-03	--	4.17E-04	4.17E-03	--	4.17E-04
350	F/B 11	676851.4	4865409.3	7.52E-03	--	7.52E-04	4.76E-03	--	4.76E-04	4.76E-03	--	4.76E-04
351	F/B 12	681153.3	4868682.2	7.42E-03	--	7.42E-04	5.06E-03	--	5.06E-04	5.06E-03	--	5.06E-04
352	F/B 13	675416.3	4859833.9	1.07E-02	--	1.07E-03	6.22E-03	--	6.22E-04	6.22E-03	--	6.22E-04
353	Second 1	675153.4	4860552.8	9.79E-03	--	9.79E-04	5.73E-03	--	5.73E-04	5.73E-03	--	5.73E-04
354	Second 2	675297.5	4860891.3	1.05E-02	--	1.05E-03	6.27E-03	--	6.27E-04	6.27E-03	--	6.27E-04
355	Second 3	675647.2	4860644.9	1.11E-02	--	1.11E-03	6.35E-03	--	6.35E-04	6.35E-03	--	6.35E-04
356	Second 4	675670.5	4860076.5	1.02E-02	--	1.02E-03	5.82E-03	--	5.82E-04	5.82E-03	--	5.82E-04
357	Second 5	676043.3	4860319.1	1.16E-02	--	1.16E-03	6.39E-03	--	6.39E-04	6.39E-03	--	6.39E-04
358	Second 6	675923.4	4859821.4	1.18E-02	--	1.18E-03	6.74E-03	--	6.74E-04	6.74E-03	--	6.74E-04
359	McLaughlin Bay 1	676714.7	4860903.8	1.62E-02	--	1.62E-03	8.85E-03	--	8.85E-04	8.85E-03	--	8.85E-04
360	McLaughlin Bay 2	677310.8	4860528.2	1.81E-02	--	1.81E-03	9.62E-03	--	9.62E-04	9.62E-03	--	9.62E-04
361	McLaughlin Bay 3	676563.5	4860260.1	1.30E-02	--	1.30E-03	7.05E-03	--	7.05E-04	7.05E-03	--	7.05E-04
362	McLaughlin Bay 4	676699.5	4859696.6	1.44E-02	--	1.44E-03	8.14E-03	--	8.14E-04	8.14E-03	--	8.14E-04
363	McLaughlin Bay 5	677560.0	4860060.1	1.40E-02	--	1.40E-03	8.03E-03	--	8.03E-04	8.03E-03	--	8.03E-04
364	McLaughlin Bay 6	678204.5	4859832.5	1.26E-02	--	1.26E-03	7.85E-03	--	7.85E-04	7.85E-03	--	7.85E-04
365	Harmony Creek 1	674178.3	4861024.2	8.01E-03	--	8.01E-04	5.30E-03	--	5.30E-04	5.30E-03	--	5.30E-04
366	Harmony Creek 2	674592.0	4862605.3	8.86E-03	--	8.86E-04	5.58E-03	--	5.58E-04	5.58E-03	--	5.58E-04
367	Harmony Creek 3	672863.4	4862808.0	8.12E-03	--	8.12E-04	5.16E-03	--	5.16E-04	5.16E-03	--	5.16E-04
368	Harmony Creek 4	675671.6	4864469.0	7.49E-03	--	7.49E-04	4.68E-03	--	4.68E-04	4.68E-03	--	4.68E-04
369	Harmony Creek 5	672443.1	4864713.0	6.00E-03	--	6.00E-04	4.15E-03	--	4.15E-04	4.15E-03	--	4.15E-04
370	Harmony Creek 6	674830.5	4866909.6	5.98E-03	--	5.98E-04	3.82E-03	--	3.82E-04	3.82E-03	--	3.82E-04
371	Harmony Creek 7	675799.9	4868594.1	5.95E-03	--	5.95E-04	3.90E-03	--	3.90E-04	3.90E-03	--	3.90E-04
372	Westside 1	686082.6	4862776.6	1.02E-02	--	1.02E-03	5.75E-03	--	5.75E-04	5.75E-03	--	5.75E-04
373	Westside 2	685778.7	4862137.9	1.22E-02	--	1.22E-03	6.71E-03	--	6.71E-04	6.71E-03	--	6.71E-04
374	Westside 3	685084.2	4862827.4	1.27E-02	--	1.27E-03	6.53E-03	--	6.53E-04	6.53E-03	--	6.53E-04
375	Darlington 1	680977.5	4865674.4	1.03E-02	--	1.03E-03	6.49E-03	--	6.49E-04	6.49E-03	--	6.49E-04
376	Darlington 2	680913.9	4863967.1	1.36E-02	--	1.36E-03	7.89E-03	--	7.89E-04	7.89E-03	--	7.89E-04
377	Darlington 3	682602.8	4863659.6	2.06E-02	--	2.06E-03	1.11E-02	--	1.11E-03	1.11E-02	--	1.11E-03
378	Darlington 4	682206.4	4862910.4	2.43E-02	--	2.43E-03	1.28E-02	--	1.28E-03	1.28E-02	--	1.28E-03
379	Darlington 5	683223.2	4861114.0	2.38E-02	--	2.38E-03	1.24E-02	--	1.24E-03	1.24E-02	--	1.24E-03
380	Darlington 6	683947.7	4862362.0	1.64E-02	--	1.64E-03	8.58E-03	--	8.58E-04	8.58E-03	--	8.58E-04
381	Darlington 7	685361.9	4861143.4	1.49E-02	--	1.49E-03	7.99E-03	--	7.99E-04	7.99E-03	--	7.99E-04
382	Bennett ECO/HH	688606.4	4862634.8	9.47E-03	--	9.47E-04	5.34E-03	--	5.34E-04	5.34E-03	--	5.34E-04
383	Oshawa ECO/HH	673884.9	4859128.9	9.09E-03	--	9.09E-04	5.45E-03	--	5.45E-04	5.45E-03	--	5.45E-04
384	Oshawa Creek 1	671671.2	4862793.7	7.72E-03	--	7.72E-04	5.01E-03	--	5.01E-04	5.01E-03	--	5.01E-04
385	Oshawa Creek 2	671668.5	4861589.5	7.32E-03	--	7.32E-04	4.93E-03	--	4.93E-04	4.93E-03	--	4.93E-04
386	Oshawa Creek 3	672820.2	4861287.2	7.66E-03	--	7.66E-04	5.13E-03	--	5.13E-04	5.13E-03	--	5.13E-04
387	Oshawa Creek 4	672360.3	4860262.6	6.95E-03	--	6.95E-04	4.75E-03	--	4.75E-04	4.75E-03	--	4.75E-04
388	Oshawa Creek 5	673921.2	4860115.0	7.11E-03	--	7.11E-04	4.74E-03	--	4.74E-04	4.74E-03	--	4.74E-04
389	Oshawa Creek 6	673154.0	4859421.9	8.67E-03	--	8.67E-04	5.11E-03	--	5.11E-04	5.11E-03	--	5.11E-04
390	Farmer	677409.8	4861051.4	2.06E-02	--	2.06E-03	1.10E-02	--	1.10E-03	1.10E-02	--	1.10E-03
391	Commercial Market	688276.3	4864698.5	9.01E-03	--	9.01E-04	5.26E-03	--	5.26E-04	5.26E-03	--	5.26E-04

Notes:

"--" - No CWS annual standard available

WHO Benchmark (Annual) - 10 µg/m³

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011			December 2009			July 2009		
				Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
1	Campground 10	678526.8	4859996.8	1.89E-02	--	1.89E-03	1.26E-02	--	1.26E-03	1.26E-02	--	1.26E-03
2	ECO 2	675490.4	4860360.1	1.36E-02	--	1.36E-03	8.42E-03	--	8.42E-04	8.42E-03	--	8.42E-04
3	Recreational 5	681642.0	4860349.3	2.64E-02	--	2.64E-03	1.76E-02	--	1.76E-03	1.76E-02	--	1.76E-03
4	ECO 4	676831.5	4859840.9	1.74E-02	--	1.74E-03	1.11E-02	--	1.11E-03	1.11E-02	--	1.11E-03
5	Bow. Valley Cons. 3	685767.2	4863879.0	1.45E-02	--	1.45E-03	9.17E-03	--	9.17E-04	9.17E-03	--	9.17E-04
6	ECO 6	679647.8	4859989.3	1.36E-02	--	1.36E-03	9.79E-03	--	9.79E-04	9.79E-03	--	9.79E-04
7	ECO 7	681578.8	4862070.1	3.74E-02	--	3.74E-03	2.27E-02	--	2.27E-03	2.27E-02	--	2.27E-03
8	ECO 8	679735.5	4861048.6	2.60E-02	--	2.60E-03	1.71E-02	--	1.71E-03	1.71E-02	--	1.71E-03
9	ECO 9	687219.7	4864249.3	1.24E-02	--	1.24E-03	7.99E-03	--	7.99E-04	7.99E-03	--	7.99E-04
10	ECO 10	686519.0	4861987.6	1.63E-02	--	1.63E-03	1.00E-02	--	1.00E-03	1.00E-02	--	1.00E-03
11	ECO 11	679870.4	4859737.9	8.27E-03	--	8.27E-04	6.37E-03	--	6.37E-04	6.37E-03	--	6.37E-04
12	Recreational 4	681575.5	4860557.7	2.45E-02	--	2.45E-03	1.69E-02	--	1.69E-03	1.69E-02	--	1.69E-03
13	Future Industrial 9	680704.5	4859857.8	1.40E-02	--	1.40E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
14	Future Industrial 10	680608.0	4860719.6	1.47E-02	--	1.47E-03	9.97E-03	--	9.97E-04	9.97E-03	--	9.97E-04
15	Harmony Creek	673992.4	4865641.4	7.82E-03	--	7.82E-04	5.47E-03	--	5.47E-04	5.47E-03	--	5.47E-04
16	Farewell Creek	678079.2	4868822.7	9.22E-03	--	9.22E-04	6.73E-03	--	6.73E-04	6.73E-03	--	6.73E-04
17	Farmer	681378.6	4860335.0	2.26E-02	--	2.26E-03	1.59E-02	--	1.59E-03	1.59E-02	--	1.59E-03
18	Watson Farm	682883.4	4864219.7	2.32E-02	--	2.32E-03	1.43E-02	--	1.43E-03	1.43E-02	--	1.43E-03
19	Racanski Farm	678929.2	4865530.2	1.21E-02	--	1.21E-03	8.69E-03	--	8.69E-04	8.69E-03	--	8.69E-04
20	Zoo	687216.8	4864835.3	1.33E-02	--	1.33E-03	8.55E-03	--	8.55E-04	8.55E-03	--	8.55E-04
21	Cedar Crest Beach	686652.1	4861660.9	1.92E-02	--	1.92E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
22	Darlington Prov Park Beach	677844.6	4859718.2	1.56E-02	--	1.56E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
23	OPG 1	682258.1	4860045.0	2.32E-02	--	2.32E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
24	OPG 2	682551.4	4859889.1	2.45E-02	--	2.45E-03	1.50E-02	--	1.50E-03	1.50E-02	--	1.50E-03
25	OPG 3	682824.6	4859759.3	2.61E-02	--	2.61E-03	1.53E-02	--	1.53E-03	1.53E-02	--	1.53E-03
26	OPG 4	683021.6	4859937.3	2.74E-02	--	2.74E-03	1.59E-02	--	1.59E-03	1.59E-02	--	1.59E-03
27	OPG 5	683318.2	4859677.8	2.39E-02	--	2.39E-03	1.40E-02	--	1.40E-03	1.40E-02	--	1.40E-03
28	OPG 6	683306.9	4860023.0	2.78E-02	--	2.78E-03	1.58E-02	--	1.58E-03	1.58E-02	--	1.58E-03
29	OPG 7	683718.6	4859915.8	2.51E-02	--	2.51E-03	1.45E-02	--	1.45E-03	1.45E-02	--	1.45E-03
30	OPG 8	682702.0	4859998.6	2.58E-02	--	2.58E-03	1.54E-02	--	1.54E-03	1.54E-02	--	1.54E-03
31	OPG 9	684347.7	4861184.6	2.25E-02	--	2.25E-03	1.34E-02	--	1.34E-03	1.34E-02	--	1.34E-03
32	OPG 10	682157.2	4861228.2	2.82E-02	--	2.82E-03	1.81E-02	--	1.81E-03	1.81E-02	--	1.81E-03
33	St. Mary|s 1	684557.0	4861070.0	2.37E-02	--	2.37E-03	1.40E-02	--	1.40E-03	1.40E-02	--	1.40E-03
34	St. Mary|s 2	684657.3	4861320.8	2.08E-02	--	2.08E-03	1.24E-02	--	1.24E-03	1.24E-02	--	1.24E-03
35	St. Mary|s 3	684905.3	4861154.4	2.09E-02	--	2.09E-03	1.24E-02	--	1.24E-03	1.24E-02	--	1.24E-03
36	Court. Subdivision 1	677328.4	4862976.1	1.45E-02	--	1.45E-03	9.82E-03	--	9.82E-04	9.82E-03	--	9.82E-04
37	Court. Subdivision 2	676187.9	4862611.1	1.51E-02	--	1.51E-03	9.37E-03	--	9.37E-04	9.37E-03	--	9.37E-04
38	Court. Subdivision 3	675974.8	4863484.1	1.14E-02	--	1.14E-03	7.60E-03	--	7.60E-04	7.60E-03	--	7.60E-04
39	Court. Subdivision 4	676606.1	4863214.1	1.25E-02	--	1.25E-03	8.37E-03	--	8.37E-04	8.37E-03	--	8.37E-04
40	Court. Subdivision 5	676827.1	4863591.4	1.21E-02	--	1.21E-03	8.26E-03	--	8.26E-04	8.26E-03	--	8.26E-04
41	Court. Subdivision 6	677200.4	4864074.9	1.13E-02	--	1.13E-03	7.83E-03	--	7.83E-04	7.83E-03	--	7.83E-04
42	Court. Subdivision 7	677719.8	4863625.1	1.25E-02	--	1.25E-03	8.37E-03	--	8.37E-04	8.37E-03	--	8.37E-04
43	Court. Subdivision 8	678271.6	4864200.6	1.07E-02	--	1.07E-03	7.66E-03	--	7.66E-04	7.66E-03	--	7.66E-04
44	Court. Subdivision 9	678184.4	4863373.6	1.35E-02	--	1.35E-03	8.68E-03	--	8.68E-04	8.68E-03	--	8.68E-04
45	Court. Subdivision 10	677179.7	4862499.5	1.66E-02	--	1.66E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
46	Bow. Subdivision 1	683536.7	4864215.2	2.19E-02	--	2.19E-03	1.31E-02	--	1.31E-03	1.31E-02	--	1.31E-03
47	Bow. Subdivision 2	683770.0	4863915.1	2.09E-02	--	2.09E-03	1.25E-02	--	1.25E-03	1.25E-02	--	1.25E-03
48	Bow. Subdivision 3	683671.0	4863534.1	2.25E-02	--	2.25E-03	1.34E-02	--	1.34E-03	1.34E-02	--	1.34E-03
49	Bow. Subdivision 4	684501.9	4863847.4	1.92E-02	--	1.92E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
50	Bow. Subdivision 5	684242.9	4863518.8	1.96E-02	--	1.96E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
51	Bow. Subdivision 6	684271.4	4863201.5	1.83E-02	--	1.83E-03	1.12E-02	--	1.12E-03	1.12E-02	--	1.12E-03
52	Bow. Subdivision 7	683992.6	4862628.1	2.06E-02	--	2.06E-03	1.20E-02	--	1.20E-03	1.20E-02	--	1.20E-03
53	Bow. Subdivision 8	684608.2	4862956.8	1.80E-02	--	1.80E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
54	Bow. Subdivision 9	684777.3	4863330.5	1.67E-02	--	1.67E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
55	Bow. Subdivision 10	685266.0	4863243.1	1.61E-02	--	1.61E-03	9.32E-03	--	9.32E-04	9.32E-03	--	9.32E-04
56	Osh/Court Subdivision 1	677396.8	4860977.3	2.69E-02	--	2.69E-03	1.61E-02	--	1.61E-03	1.61E-02	--	1.61E-03
57	Osh/Court Subdivision 2	676633.5	4860816.8	1.98E-02	--	1.98E-03	1.20E-02	--	1.20E-03	1.20E-02	--	1.20E-03
58	Osh/Court Subdivision 3	676916.0	4861925.0	1.84E-02	--	1.84E-03	1.19E-02	--	1.19E-03	1.19E-02	--	1.19E-03
59	Osh/Court Subdivision 4	676730.5	4861317.1	2.25E-02	--	2.25E-03	1.35E-02	--	1.35E-03	1.35E-02	--	1.35E-03
60	Osh/Court Subdivision 5	676087.2	4861392.3	1.91E-02	--	1.91E-03	1.17E-02	--	1.17E-03	1.17E-02	--	1.17E-03
61	Osh/Court Subdivision 6	676177.1	4861722.2	1.74E-02	--	1.74E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
62	Osh/Court Subdivision 7	675670.7	4861783.2	1.60E-02	--	1.60E-03	1.00E-02	--	1.00E-03	1.00E-02	--	1.00E-03
63	Osh/Court Subdivision 8	676050.8	4862055.7	1.71E-02	--	1.71E-03	1.09E-02	--	1.09E-03	1.09E-02	--	1.09E-03
64	Osh/Court Subdivision 9	676636.9	4862134.3	1.79E-02	--	1.79E-03	1.12E-02	--	1.12E-03	1.12E-02	--	1.12E-03
65	Osh/Court Subdivision 10	676571.3	4861634.8	1.86E-02	--	1.86E-03	1.14E-02	--	1.14E-03	1.14E-02	--	1.14E-03
66	Bow. Subdivision 11	684649.2	4863182.7	1.74E-02	--	1.74E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
67	Daycare B	685172.4	4863933.1	1.62E-02	--	1.62E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
68	Daycare C	685452.0	4863104.4	1.58E-02	--	1.58E-03	9.03E-03	--	9.03E-04	9.03E-03	--	9.03E-04

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E (m)	UTM N (m)	July 2011 Particulate Matter PM2.5 Process Upset µg/m3	July 2011 Concentration Ratio CWS Standard	July 2011 Concentration Ratio WHO Benchmark	December 2009 Particulate Matter PM2.5 Process Upset µg/m3	December 2009 Concentration Ratio CWS Standard	December 2009 Concentration Ratio WHO Benchmark	July 2009 Particulate Matter PM2.5 Process Upset µg/m3	July 2009 Concentration Ratio CWS Standard	July 2009 Concentration Ratio WHO Benchmark
69	Daycare D	685527.7	4864693.3	1.65E-02	--	1.65E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
70	Daycare E	685735.4	4864790.8	1.61E-02	--	1.61E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
71	Daycare F	685520.3	4864854.3	1.65E-02	--	1.65E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
72	Daycare G	685441.9	4864878.0	1.66E-02	--	1.66E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
73	Daycare H	686364.8	4864707.8	1.46E-02	--	1.46E-03	9.37E-03	--	9.37E-04	9.37E-03	--	9.37E-04
74	Daycare I	685721.6	4865127.3	1.60E-02	--	1.60E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
75	Daycare J	678256.3	4863565.4	1.29E-02	--	1.29E-03	8.24E-03	--	8.24E-04	8.24E-03	--	8.24E-04
76	Daycare K	677694.1	4864043.7	1.16E-02	--	1.16E-03	7.76E-03	--	7.76E-04	7.76E-03	--	7.76E-04
77	Daycare L	676479.5	4862526.2	1.59E-02	--	1.59E-03	9.83E-03	--	9.83E-04	9.83E-03	--	9.83E-04
78	Daycare M	678320.9	4864763.5	1.01E-02	--	1.01E-03	7.38E-03	--	7.38E-04	7.38E-03	--	7.38E-04
79	Daycare N	678513.4	4865058.0	1.08E-02	--	1.08E-03	7.96E-03	--	7.96E-04	7.96E-03	--	7.96E-04
80	Daycare O	672788.7	4863936.6	8.64E-03	--	8.64E-04	6.69E-03	--	6.69E-04	6.69E-03	--	6.69E-04
81	Daycare P	673952.8	4863592.5	9.62E-03	--	9.62E-04	7.10E-03	--	7.10E-04	7.10E-03	--	7.10E-04
82	Daycare Q	671751.8	4864887.7	7.44E-03	--	7.44E-04	5.86E-03	--	5.86E-04	5.86E-03	--	5.86E-04
83	Daycare R	685714.4	4864667.4	1.63E-02	--	1.63E-03	1.04E-02	--	1.04E-03	1.04E-02	--	1.04E-03
84	Daycare S	684177.9	4863618.2	2.02E-02	--	2.02E-03	1.21E-02	--	1.21E-03	1.21E-02	--	1.21E-03
85	Daycare T	678423.6	4864480.4	1.08E-02	--	1.08E-03	7.58E-03	--	7.58E-04	7.58E-03	--	7.58E-04
86	Daycare U	685330.5	4863435.1	1.55E-02	--	1.55E-03	9.45E-03	--	9.45E-04	9.45E-03	--	9.45E-04
87	Daycare V	685153.2	4863236.9	1.64E-02	--	1.64E-03	9.51E-03	--	9.51E-04	9.51E-03	--	9.51E-04
88	Daycare W	672679.0	4862044.9	1.05E-02	--	1.05E-03	7.62E-03	--	7.62E-04	7.62E-03	--	7.62E-04
89	Daycare X	672076.5	4865285.8	7.48E-03	--	7.48E-04	5.59E-03	--	5.59E-04	5.59E-03	--	5.59E-04
90	Daycare Y	672638.0	4859664.4	9.92E-03	--	9.92E-04	6.92E-03	--	6.92E-04	6.92E-03	--	6.92E-04
91	Daycare Z	673735.9	4858958.0	1.09E-02	--	1.09E-03	7.38E-03	--	7.38E-04	7.38E-03	--	7.38E-04
92	Daycare AA	673121.8	4863385.9	9.46E-03	--	9.46E-04	7.19E-03	--	7.19E-04	7.19E-03	--	7.19E-04
93	Daycare BB	673904.8	4862282.2	1.23E-02	--	1.23E-03	8.00E-03	--	8.00E-04	8.00E-03	--	8.00E-04
94	Daycare CC	671471.6	4861795.3	9.47E-03	--	9.47E-04	7.13E-03	--	7.13E-04	7.13E-03	--	7.13E-04
95	Daycare DD	673057.3	4862625.6	1.09E-02	--	1.09E-03	7.57E-03	--	7.57E-04	7.57E-03	--	7.57E-04
96	Daycare EE	674917.1	4863957.2	9.86E-03	--	9.86E-04	6.87E-03	--	6.87E-04	6.87E-03	--	6.87E-04
97	Daycare FF	671356.6	4862954.4	9.86E-03	--	9.86E-04	7.18E-03	--	7.18E-04	7.18E-03	--	7.18E-04
98	Daycare GG	671675.5	4862705.8	1.00E-02	--	1.00E-03	7.28E-03	--	7.28E-04	7.28E-03	--	7.28E-04
99	Daycare HH	671604.8	4860138.1	8.97E-03	--	8.97E-04	6.82E-03	--	6.82E-04	6.82E-03	--	6.82E-04
100	Daycare II	670945.2	4857983.8	7.41E-03	--	7.41E-04	5.46E-03	--	5.46E-04	5.46E-03	--	5.46E-04
101	Daycare JJ	677514.6	4864744.1	1.02E-02	--	1.02E-03	7.06E-03	--	7.06E-04	7.06E-03	--	7.06E-04
102	Daycare KK	676519.9	4862680.1	1.50E-02	--	1.50E-03	9.36E-03	--	9.36E-04	9.36E-03	--	9.36E-04
103	Daycare LL	677660.6	4863601.3	1.26E-02	--	1.26E-03	8.44E-03	--	8.44E-04	8.44E-03	--	8.44E-04
104	Court. Subdivision 11	677665.8	4863406.6	1.32E-02	--	1.32E-03	8.86E-03	--	8.86E-04	8.86E-03	--	8.86E-04
105	Daycare NN	674866.3	4864667.2	8.98E-03	--	8.98E-04	6.29E-03	--	6.29E-04	6.29E-03	--	6.29E-04
106	Daycare OO	673201.0	4864746.4	7.99E-03	--	7.99E-04	5.96E-03	--	5.96E-04	5.96E-03	--	5.96E-04
107	Daycare PP	674794.5	4864915.4	8.71E-03	--	8.71E-04	6.07E-03	--	6.07E-04	6.07E-03	--	6.07E-04
108	Hospital	686324.2	4864395.8	1.46E-02	--	1.46E-03	9.30E-03	--	9.30E-04	9.30E-03	--	9.30E-04
109	Hospital (Children Is)	676057.8	4862180.9	1.71E-02	--	1.71E-03	1.08E-02	--	1.08E-03	1.08E-02	--	1.08E-03
110	Hospital	671233.2	4863615.9	9.22E-03	--	9.22E-04	6.94E-03	--	6.94E-04	6.94E-03	--	6.94E-04
111	Comm. Resp. Services	676045.4	4863902.5	1.08E-02	--	1.08E-03	7.43E-03	--	7.43E-04	7.43E-03	--	7.43E-04
112	Hospital	671712.7	4862364.1	9.74E-03	--	9.74E-04	7.33E-03	--	7.33E-04	7.33E-03	--	7.33E-04
113	Retirement Residence A	684199.9	4864120.3	1.98E-02	--	1.98E-03	1.17E-02	--	1.17E-03	1.17E-02	--	1.17E-03
114	Retirement Residence B	685483.9	4865150.9	1.63E-02	--	1.63E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
115	Retirement Residence C	686844.0	4864732.1	1.40E-02	--	1.40E-03	8.94E-03	--	8.94E-04	8.94E-03	--	8.94E-04
116	Retirement Residence D	673481.7	4863343.4	9.60E-03	--	9.60E-04	7.27E-03	--	7.27E-04	7.27E-03	--	7.27E-04
117	Retirement Residence E	671825.2	4864399.0	7.92E-03	--	7.92E-04	6.21E-03	--	6.21E-04	6.21E-03	--	6.21E-04
118	Retirement Residence F	671606.3	4864536.0	7.78E-03	--	7.78E-04	6.12E-03	--	6.12E-04	6.12E-03	--	6.12E-04
119	Retirement Residence G	671357.1	4862958.7	9.86E-03	--	9.86E-04	7.18E-03	--	7.18E-04	7.18E-03	--	7.18E-04
120	Retirement Residence H	671514.0	4862262.9	9.70E-03	--	9.70E-04	7.31E-03	--	7.31E-04	7.31E-03	--	7.31E-04
121	Retirement Residence I	672602.2	4863075.9	1.00E-02	--	1.00E-03	7.36E-03	--	7.36E-04	7.36E-03	--	7.36E-04
122	Retirement Residence J	671719.1	4862893.1	1.00E-02	--	1.00E-03	7.24E-03	--	7.24E-04	7.24E-03	--	7.24E-04
123	Retirement Residence K	686718.0	4865648.7	1.42E-02	--	1.42E-03	9.27E-03	--	9.27E-04	9.27E-03	--	9.27E-04
124	Retirement Residence L	676168.7	4865669.9	9.07E-03	--	9.07E-04	6.53E-03	--	6.53E-04	6.53E-03	--	6.53E-04
125	Retirement Residence M	676118.5	4863980.7	1.08E-02	--	1.08E-03	7.42E-03	--	7.42E-04	7.42E-03	--	7.42E-04
126	Bow. Subdivision 12	684649.2	4863182.7	1.74E-02	--	1.74E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
127	Primary School B	685384.8	4863575.3	1.51E-02	--	1.51E-03	9.51E-03	--	9.51E-04	9.51E-03	--	9.51E-04
128	Primary School C	685021.6	4863952.9	1.68E-02	--	1.68E-03	1.06E-02	--	1.06E-03	1.06E-02	--	1.06E-03
129	Primary School D	686237.0	4864085.5	1.41E-02	--	1.41E-03	8.98E-03	--	8.98E-04	8.98E-03	--	8.98E-04
130	Primary School E	686719.0	4863734.7	1.30E-02	--	1.30E-03	7.87E-03	--	7.87E-04	7.87E-03	--	7.87E-04
131	Primary School F	686357.0	4864754.9	1.46E-02	--	1.46E-03	9.37E-03	--	9.37E-04	9.37E-03	--	9.37E-04
132	Primary School G	685502.0	4865013.4	1.64E-02	--	1.64E-03	1.04E-02	--	1.04E-03	1.04E-02	--	1.04E-03
133	Primary School H	686726.7	4866061.5	1.41E-02	--	1.41E-03	9.18E-03	--	9.18E-04	9.18E-03	--	9.18E-04
134	Primary School I	685186.2	4866568.2	1.51E-02	--	1.51E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
135	Primary School J	685965.3	4866979.0	1.43E-02	--	1.43E-03	9.15E-03	--	9.15E-04	9.15E-03	--	9.15E-04
136	Primary School K	677709.9	4864726.5	1.02E-02	--	1.02E-03	7.01E-03	--	7.01E-04	7.01E-03	--	7.01E-04

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	µg/m3			µg/m3			µg/m3		
137	Primary School L	675988.3	4864270.2	1.03E-02	--	1.03E-03	7.16E-03	--	7.16E-04	7.16E-03	--	7.16E-04
138	Primary School M	676608.7	4862739.0	1.46E-02	--	1.46E-03	9.27E-03	--	9.27E-04	9.27E-03	--	9.27E-04
139	Primary School N	677222.2	4863759.1	1.19E-02	--	1.19E-03	8.20E-03	--	8.20E-04	8.20E-03	--	8.20E-04
140	Primary School O	678154.9	4863872.7	1.20E-02	--	1.20E-03	7.69E-03	--	7.69E-04	7.69E-03	--	7.69E-04
141	Court. Subdivision 12	678309.6	4863600.8	1.28E-02	--	1.28E-03	8.12E-03	--	8.12E-04	8.12E-03	--	8.12E-04
142	Primary School Q	677010.6	4862470.6	1.66E-02	--	1.66E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
143	Primary School R	677431.3	4866694.7	8.75E-03	--	8.75E-04	6.53E-03	--	6.53E-04	6.53E-03	--	6.53E-04
144	Primary School S	675266.2	4863562.9	1.09E-02	--	1.09E-03	7.44E-03	--	7.44E-04	7.44E-03	--	7.44E-04
145	Primary School T	673479.2	4860029.4	9.44E-03	--	9.44E-04	6.97E-03	--	6.97E-04	6.97E-03	--	6.97E-04
146	Primary School U	670856.0	4860710.6	9.12E-03	--	9.12E-04	6.90E-03	--	6.90E-04	6.90E-03	--	6.90E-04
147	Primary School V	672660.2	4863909.2	8.72E-03	--	8.72E-04	6.74E-03	--	6.74E-04	6.74E-03	--	6.74E-04
148	Primary School W	672735.2	4859232.9	1.08E-02	--	1.08E-03	7.24E-03	--	7.24E-04	7.24E-03	--	7.24E-04
149	Primary School X	673575.8	4862688.6	1.09E-02	--	1.09E-03	7.72E-03	--	7.72E-04	7.72E-03	--	7.72E-04
150	Primary School Y	673710.3	4861969.0	1.19E-02	--	1.19E-03	7.83E-03	--	7.83E-04	7.83E-03	--	7.83E-04
151	Primary School Z	672366.0	4859928.1	9.14E-03	--	9.14E-04	6.78E-03	--	6.78E-04	6.78E-03	--	6.78E-04
152	Primary School AA	672561.7	4866047.1	7.87E-03	--	7.87E-04	5.28E-03	--	5.28E-04	5.28E-03	--	5.28E-04
153	Primary School BB	675095.1	4862930.4	1.20E-02	--	1.20E-03	8.06E-03	--	8.06E-04	8.06E-03	--	8.06E-04
154	Primary School CC	673242.6	4865197.9	8.14E-03	--	8.14E-04	5.72E-03	--	5.72E-04	5.72E-03	--	5.72E-04
155	Primary School DD	674164.9	4863031.3	1.05E-02	--	1.05E-03	7.65E-03	--	7.65E-04	7.65E-03	--	7.65E-04
156	Primary School EE	671905.6	4864697.8	7.60E-03	--	7.60E-04	5.99E-03	--	5.99E-04	5.99E-03	--	5.99E-04
157	Primary School FF	673294.9	4858774.5	9.65E-03	--	9.65E-04	6.66E-03	--	6.66E-04	6.66E-03	--	6.66E-04
158	Primary School GG	671659.7	4863120.0	9.94E-03	--	9.94E-04	7.20E-03	--	7.20E-04	7.20E-03	--	7.20E-04
159	Primary School HH	673853.4	4866711.0	7.69E-03	--	7.69E-04	5.32E-03	--	5.32E-04	5.32E-03	--	5.32E-04
160	Primary School II	672616.7	4862114.9	1.06E-02	--	1.06E-03	7.63E-03	--	7.63E-04	7.63E-03	--	7.63E-04
161	Primary School JJ	673567.2	4861899.5	1.15E-02	--	1.15E-03	7.77E-03	--	7.77E-04	7.77E-03	--	7.77E-04
162	Primary School KK	671791.0	4861954.2	9.89E-03	--	9.89E-04	7.40E-03	--	7.40E-04	7.40E-03	--	7.40E-04
163	Primary School LL	673762.3	4864210.6	8.75E-03	--	8.75E-04	6.46E-03	--	6.46E-04	6.46E-03	--	6.46E-04
164	Primary School MM	672238.8	4864621.3	7.76E-03	--	7.76E-04	6.06E-03	--	6.06E-04	6.06E-03	--	6.06E-04
165	Primary School NN	673213.6	4858677.0	9.26E-03	--	9.26E-04	6.43E-03	--	6.43E-04	6.43E-03	--	6.43E-04
166	Primary School OO	675474.8	4863221.7	1.21E-02	--	1.21E-03	7.98E-03	--	7.98E-04	7.98E-03	--	7.98E-04
167	Primary School PP	672441.8	4858748.6	9.23E-03	--	9.23E-04	6.50E-03	--	6.50E-04	6.50E-03	--	6.50E-04
168	Primary School QQ	672796.8	4864438.2	8.08E-03	--	8.08E-04	6.20E-03	--	6.20E-04	6.20E-03	--	6.20E-04
169	Primary School RR	671351.4	4863284.0	9.65E-03	--	9.65E-04	7.08E-03	--	7.08E-04	7.08E-03	--	7.08E-04
170	Primary School SS	673213.9	4862125.5	1.12E-02	--	1.12E-03	7.69E-03	--	7.69E-04	7.69E-03	--	7.69E-04
171	Primary School TT	671017.9	4860953.7	9.08E-03	--	9.08E-04	6.89E-03	--	6.89E-04	6.89E-03	--	6.89E-04
172	Primary School UU	670991.0	4861089.8	9.01E-03	--	9.01E-04	6.84E-03	--	6.84E-04	6.84E-03	--	6.84E-04
173	Primary School VV	674150.1	4862294.8	1.26E-02	--	1.26E-03	8.12E-03	--	8.12E-04	8.12E-03	--	8.12E-04
174	Primary School WW	672005.2	4861707.9	9.93E-03	--	9.93E-04	7.41E-03	--	7.41E-04	7.41E-03	--	7.41E-04
175	Primary School XX	684172.1	4863615.6	2.02E-02	--	2.02E-03	1.21E-02	--	1.21E-03	1.21E-02	--	1.21E-03
176	Primary School YY	683923.3	4866636.4	1.58E-02	--	1.58E-03	1.06E-02	--	1.06E-03	1.06E-02	--	1.06E-03
177	Primary School ZZ	680446.0	4865770.5	1.31E-02	--	1.31E-03	9.10E-03	--	9.10E-04	9.10E-03	--	9.10E-04
178	Vacant School	685612.9	4864520.0	1.61E-02	--	1.61E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
179	Secondary School A	686291.4	4865064.3	1.46E-02	--	1.46E-03	9.47E-03	--	9.47E-04	9.47E-03	--	9.47E-04
180	Secondary School B	683875.0	4864741.7	2.01E-02	--	2.01E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
181	Secondary School C	684650.3	4866460.3	1.52E-02	--	1.52E-03	1.04E-02	--	1.04E-03	1.04E-02	--	1.04E-03
182	Secondary School D	678099.5	4864838.2	9.84E-03	--	9.84E-04	7.08E-03	--	7.08E-04	7.08E-03	--	7.08E-04
183	Secondary School E	678467.0	4863431.2	1.29E-02	--	1.29E-03	8.54E-03	--	8.54E-04	8.54E-03	--	8.54E-04
184	Secondary School F	674144.9	4862762.7	1.07E-02	--	1.07E-03	7.89E-03	--	7.89E-04	7.89E-03	--	7.89E-04
185	Secondary School G	673816.0	4864357.1	8.55E-03	--	8.55E-04	6.31E-03	--	6.31E-04	6.31E-03	--	6.31E-04
186	Secondary School H	673145.4	4858569.0	8.98E-03	--	8.98E-04	6.27E-03	--	6.27E-04	6.27E-03	--	6.27E-04
187	Secondary School I	671291.7	4863581.3	9.36E-03	--	9.36E-04	7.00E-03	--	7.00E-04	7.00E-03	--	7.00E-04
188	Secondary School J	671443.2	4861664.9	9.41E-03	--	9.41E-04	7.09E-03	--	7.09E-04	7.09E-03	--	7.09E-04
189	Secondary School K	673235.3	4860885.0	9.80E-03	--	9.80E-04	7.35E-03	--	7.35E-04	7.35E-03	--	7.35E-04
190	Secondary School L	684252.7	4866500.5	1.56E-02	--	1.56E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
191	Secondary School M	673914.1	4859551.7	1.18E-02	--	1.18E-03	7.77E-03	--	7.77E-04	7.77E-03	--	7.77E-04
192	Secondary School N	675051.5	4864177.2	9.77E-03	--	9.77E-04	6.69E-03	--	6.69E-04	6.69E-03	--	6.69E-04
193	Adult School	685276.1	4866019.8	1.53E-02	--	1.53E-03	9.75E-03	--	9.75E-04	9.75E-03	--	9.75E-04
194	Bow. Valley Cons. 1	685356.6	4864521.2	1.61E-02	--	1.61E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
195	Bow. Valley Cons. 2	685627.7	4864167.8	1.52E-02	--	1.52E-03	9.71E-03	--	9.71E-04	9.71E-03	--	9.71E-04
196	Bow. Valley Cons. 4	685852.7	4863640.2	1.42E-02	--	1.42E-03	8.66E-03	--	8.66E-04	8.66E-03	--	8.66E-04
197	Bow. Valley Cons. 5	686163.1	4863621.5	1.38E-02	--	1.38E-03	8.22E-03	--	8.22E-04	8.22E-03	--	8.22E-04
198	Bow. Valley Cons. 6	685931.9	4863380.6	1.43E-02	--	1.43E-03	8.21E-03	--	8.21E-04	8.21E-03	--	8.21E-04
199	Maple Grove 1	681688.5	4864717.0	1.50E-02	--	1.50E-03	9.72E-03	--	9.72E-04	9.72E-03	--	9.72E-04
200	Maple Grove 2	681768.9	4864631.8	1.55E-02	--	1.55E-03	9.96E-03	--	9.96E-04	9.96E-03	--	9.96E-04
201	Maple Grove 3	681894.9	4864506.8	1.58E-02	--	1.58E-03	1.06E-02	--	1.06E-03	1.06E-02	--	1.06E-03
202	Maple Grove 4	681974.8	4864443.2	1.64E-02	--	1.64E-03	1.11E-02	--	1.11E-03	1.11E-02	--	1.11E-03
203	Maple Grove 5	681942.2	4864676.7	1.52E-02	--	1.52E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
204	Maple Grove 6	682053.2	4864586.2	1.61E-02	--	1.61E-03	1.09E-02	--	1.09E-03	1.09E-02	--	1.09E-03

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
				Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
		(m)	(m)	µg/m3			µg/m3			µg/m3		
205	Maple Grove 7	682168.5	4864631.3	1.67E-02	--	1.67E-03	1.12E-02	--	1.12E-03	1.12E-02	--	1.12E-03
206	Maple Grove 8	682261.7	4864520.9	1.81E-02	--	1.81E-03	1.21E-02	--	1.21E-03	1.21E-02	--	1.21E-03
207	Maple Grove 9	682382.1	4864589.4	1.85E-02	--	1.85E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
208	Maple Grove 10	682459.8	4864499.2	1.99E-02	--	1.99E-03	1.30E-02	--	1.30E-03	1.30E-02	--	1.30E-03
209	Port Darlington 1	686227.8	4861159.0	1.99E-02	--	1.99E-03	1.19E-02	--	1.19E-03	1.19E-02	--	1.19E-03
210	Port Darlington 2	686184.8	4861252.0	1.96E-02	--	1.96E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
211	Port Darlington 3	686151.2	4861286.8	1.92E-02	--	1.92E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
212	Port Darlington 4	686351.1	4861341.6	1.96E-02	--	1.96E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
213	Port Darlington 5	686406.8	4861448.7	1.96E-02	--	1.96E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
214	Port Darlington 6	686504.5	4861604.0	1.93E-02	--	1.93E-03	1.17E-02	--	1.17E-03	1.17E-02	--	1.17E-03
215	Port Darlington 7	686703.0	4861789.3	1.82E-02	--	1.82E-03	1.11E-02	--	1.11E-03	1.11E-02	--	1.11E-03
216	Port Darlington 8	686895.8	4861960.2	1.68E-02	--	1.68E-03	1.03E-02	--	1.03E-03	1.03E-02	--	1.03E-03
217	Port Darlington 9	686867.4	4862119.7	1.56E-02	--	1.56E-03	9.63E-03	--	9.63E-04	9.63E-03	--	9.63E-04
218	Port Darlington 10	687190.7	4862048.8	1.56E-02	--	1.56E-03	9.63E-03	--	9.63E-04	9.63E-03	--	9.63E-04
219	Port Darlington 11	687524.4	4862126.8	1.52E-02	--	1.52E-03	9.39E-03	--	9.39E-04	9.39E-03	--	9.39E-04
220	Campground 1	678646.3	4860337.7	3.16E-02	--	3.16E-03	1.85E-02	--	1.85E-03	1.85E-02	--	1.85E-03
221	Campground 2	678410.2	4860148.6	2.33E-02	--	2.33E-03	1.37E-02	--	1.37E-03	1.37E-02	--	1.37E-03
222	Campground 3	678651.0	4860054.4	2.10E-02	--	2.10E-03	1.33E-02	--	1.33E-03	1.33E-02	--	1.33E-03
223	Campground 4	678725.9	4859860.7	1.99E-02	--	1.99E-03	1.37E-02	--	1.37E-03	1.37E-02	--	1.37E-03
224	Campground 5	678511.1	4859808.6	1.81E-02	--	1.81E-03	1.26E-02	--	1.26E-03	1.26E-02	--	1.26E-03
225	Campground 6	678869.5	4859696.0	1.73E-02	--	1.73E-03	1.22E-02	--	1.22E-03	1.22E-02	--	1.22E-03
226	Campground 7	678723.9	4860201.8	2.67E-02	--	2.67E-03	1.56E-02	--	1.56E-03	1.56E-02	--	1.56E-03
227	Campground 8	678796.0	4860011.4	2.08E-02	--	2.08E-03	1.39E-02	--	1.39E-03	1.39E-02	--	1.39E-03
228	Campground 9	678852.7	4859854.2	2.02E-02	--	2.02E-03	1.39E-02	--	1.39E-03	1.39E-02	--	1.39E-03
229	Solina 1	681099.6	4861677.2	2.85E-02	--	2.85E-03	1.87E-02	--	1.87E-03	1.87E-02	--	1.87E-03
230	Solina 2	681115.7	4861857.7	2.85E-02	--	2.85E-03	1.86E-02	--	1.86E-03	1.86E-02	--	1.86E-03
231	Solina 3	680987.4	4861983.5	2.45E-02	--	2.45E-03	1.60E-02	--	1.60E-03	1.60E-02	--	1.60E-03
232	Solina 4	680965.0	4862068.1	2.39E-02	--	2.39E-03	1.55E-02	--	1.55E-03	1.55E-02	--	1.55E-03
233	Solina 5	681021.5	4862086.7	2.44E-02	--	2.44E-03	1.58E-02	--	1.58E-03	1.58E-02	--	1.58E-03
234	Solina 6	680939.8	4862124.3	2.36E-02	--	2.36E-03	1.52E-02	--	1.52E-03	1.52E-02	--	1.52E-03
235	Solina 7	680988.2	4862183.6	2.38E-02	--	2.38E-03	1.53E-02	--	1.53E-03	1.53E-02	--	1.53E-03
236	Solina 8	680984.6	4862209.8	2.37E-02	--	2.37E-03	1.52E-02	--	1.52E-03	1.52E-02	--	1.52E-03
237	Solina 9	680958.6	4862294.9	2.33E-02	--	2.33E-03	1.49E-02	--	1.49E-03	1.49E-02	--	1.49E-03
238	Solina 10	680858.0	4862324.3	2.29E-02	--	2.29E-03	1.46E-02	--	1.46E-03	1.46E-02	--	1.46E-03
239	Solina 11	680990.3	4862403.5	2.31E-02	--	2.31E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
240	Recreational 1	681545.0	4860865.0	2.44E-02	--	2.44E-03	1.56E-02	--	1.56E-03	1.56E-02	--	1.56E-03
241	Recreational 2	681563.7	4860687.4	2.34E-02	--	2.34E-03	1.58E-02	--	1.58E-03	1.58E-02	--	1.58E-03
242	Recreational 3	681579.7	4860610.0	2.39E-02	--	2.39E-03	1.65E-02	--	1.65E-03	1.65E-02	--	1.65E-03
243	Recreational 6	681876.6	4860254.4	2.65E-02	--	2.65E-03	1.72E-02	--	1.72E-03	1.72E-02	--	1.72E-03
244	Recreational 7	682166.9	4860324.4	2.80E-02	--	2.80E-03	1.76E-02	--	1.76E-03	1.76E-02	--	1.76E-03
245	Darlington 1	679565.4	4861052.9	2.60E-02	--	2.60E-03	1.71E-02	--	1.71E-03	1.71E-02	--	1.71E-03
246	Darlington 2	679452.9	4861051.4	2.64E-02	--	2.64E-03	1.72E-02	--	1.72E-03	1.72E-02	--	1.72E-03
247	Darlington 3	679130.5	4860948.8	2.80E-02	--	2.80E-03	1.77E-02	--	1.77E-03	1.77E-02	--	1.77E-03
248	Darlington 4	679112.6	4860941.9	2.82E-02	--	2.82E-03	1.78E-02	--	1.78E-03	1.78E-02	--	1.78E-03
249	Darlington 5	679057.6	4860994.1	2.84E-02	--	2.84E-03	1.78E-02	--	1.78E-03	1.78E-02	--	1.78E-03
250	Darlington 6	679075.2	4860931.6	2.85E-02	--	2.85E-03	1.79E-02	--	1.79E-03	1.79E-02	--	1.79E-03
251	Darlington 7	678814.3	4860843.1	3.35E-02	--	3.35E-03	2.05E-02	--	2.05E-03	2.05E-02	--	2.05E-03
252	Darlington 8	678840.4	4860777.1	3.42E-02	--	3.42E-03	2.10E-02	--	2.10E-03	2.10E-02	--	2.10E-03
253	Light Ind. 1	680000.1	4861034.1	2.33E-02	--	2.33E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
254	Light Ind. 2	680060.7	4861056.4	2.32E-02	--	2.32E-03	1.46E-02	--	1.46E-03	1.46E-02	--	1.46E-03
255	Light Ind. 3	680291.2	4861151.6	2.16E-02	--	2.16E-03	1.40E-02	--	1.40E-03	1.40E-02	--	1.40E-03
256	Light Ind. 4	680536.3	4861204.6	2.08E-02	--	2.08E-03	1.43E-02	--	1.43E-03	1.43E-02	--	1.43E-03
257	Light Ind. 5	680350.4	4861290.6	2.28E-02	--	2.28E-03	1.50E-02	--	1.50E-03	1.50E-02	--	1.50E-03
258	Light Ind. 6	680306.9	4861275.6	2.23E-02	--	2.23E-03	1.49E-02	--	1.49E-03	1.49E-02	--	1.49E-03
259	Light Ind. 7	680267.2	4861262.4	2.20E-02	--	2.20E-03	1.43E-02	--	1.43E-03	1.43E-02	--	1.43E-03
260	Light Ind. 8	680233.6	4861250.7	2.23E-02	--	2.23E-03	1.42E-02	--	1.42E-03	1.42E-02	--	1.42E-03
261	Light Ind. 9	680175.3	4861227.5	2.28E-02	--	2.28E-03	1.44E-02	--	1.44E-03	1.44E-02	--	1.44E-03
262	Light Ind. 10	680092.5	4861185.1	2.34E-02	--	2.34E-03	1.47E-02	--	1.47E-03	1.47E-02	--	1.47E-03
263	Light Ind. 11	680071.6	4861246.6	2.34E-02	--	2.34E-03	1.47E-02	--	1.47E-03	1.47E-02	--	1.47E-03
264	Light Ind. 12	680021.4	4861186.9	2.35E-02	--	2.35E-03	1.49E-02	--	1.49E-03	1.49E-02	--	1.49E-03
265	Future Industrial 7	680816.2	4860219.3	1.18E-02	--	1.18E-03	8.79E-03	--	8.79E-04	8.79E-03	--	8.79E-04
266	Future Industrial 8	680398.0	4860731.8	1.41E-02	--	1.41E-03	8.86E-03	--	8.86E-04	8.86E-03	--	8.86E-04
267	Future Industrial 1	680359.6	4859959.2	8.69E-03	--	8.69E-04	6.82E-03	--	6.82E-04	6.82E-03	--	6.82E-04
268	Future Industrial 2	680083.7	4859985.7	8.75E-03	--	8.75E-04	6.50E-03	--	6.50E-04	6.50E-03	--	6.50E-04
269	Future Industrial 3	680819.9	4860705.3	1.61E-02	--	1.61E-03	1.01E-02	--	1.01E-03	1.01E-02	--	1.01E-03
270	Future Industrial 4	681070.0	4859937.2	2.62E-02	--	2.62E-03	1.94E-02	--	1.94E-03	1.94E-02	--	1.94E-03
271	Future Industrial 5	679898.8	4860067.4	1.17E-02	--	1.17E-03	8.26E-03	--	8.26E-04	8.26E-03	--	8.26E-04
272	Future Industrial 6	680134.8	4860694.1	1.62E-02	--	1.62E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

				July 2011			December 2009			July 2009		
Receptor	Name	UTM E (m)	UTM N (m)	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
273	Future Industrial 11	680253.7	4860255.2	1.08E-02	--	1.08E-03	7.16E-03	--	7.16E-04	7.16E-03	--	7.16E-04
274	Future Indsutrial 12	679901.2	4860511.8	1.70E-02	--	1.70E-03	1.19E-02	--	1.19E-03	1.19E-02	--	1.19E-03
275	Commercial Farmer	679867.8	4860445.4	1.72E-02	--	1.72E-03	1.22E-02	--	1.22E-03	1.22E-02	--	1.22E-03
276	Farmer	679277.0	4859981.5	1.81E-02	--	1.81E-03	1.27E-02	--	1.27E-03	1.27E-02	--	1.27E-03
277	Residence	679387.2	4860648.9	2.92E-02	--	2.92E-03	1.92E-02	--	1.92E-03	1.92E-02	--	1.92E-03
278	Barn	679261.9	4860574.2	3.25E-02	--	3.25E-03	2.06E-02	--	2.06E-03	2.06E-02	--	2.06E-03
279	Residence	680150.7	4861295.7	2.28E-02	--	2.28E-03	1.44E-02	--	1.44E-03	1.44E-02	--	1.44E-03
280	Residence	679939.8	4861213.4	2.35E-02	--	2.35E-03	1.52E-02	--	1.52E-03	1.52E-02	--	1.52E-03
281	Farmer	680855.7	4861456.9	2.48E-02	--	2.48E-03	1.69E-02	--	1.69E-03	1.69E-02	--	1.69E-03
282	Farmer	681386.2	4861673.3	3.60E-02	--	3.60E-03	2.22E-02	--	2.22E-03	2.22E-02	--	2.22E-03
283	Residence	680683.5	4861597.9	2.24E-02	--	2.24E-03	1.50E-02	--	1.50E-03	1.50E-02	--	1.50E-03
284	Business	680064.3	4861343.7	2.32E-02	--	2.32E-03	1.46E-02	--	1.46E-03	1.46E-02	--	1.46E-03
285	Farmer	679680.1	4861213.5	2.49E-02	--	2.49E-03	1.66E-02	--	1.66E-03	1.66E-02	--	1.66E-03
286	Farmer	681344.8	4861792.9	3.42E-02	--	3.42E-03	2.15E-02	--	2.15E-03	2.15E-02	--	2.15E-03
287	Youth Centre	685644.2	4864814.8	1.64E-02	--	1.64E-03	1.04E-02	--	1.04E-03	1.04E-02	--	1.04E-03
288	Bowmanville Arena	685462.9	4864615.2	1.65E-02	--	1.65E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
289	Bowmanville Rec Complex	684160.3	4864604.5	1.93E-02	--	1.93E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
290	Recreation Complex	684586.6	4862406.3	1.75E-02	--	1.75E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
291	Superdog Central	681487.7	4865723.3	1.29E-02	--	1.29E-03	8.89E-03	--	8.89E-04	8.89E-03	--	8.89E-04
292	Equestrian Centre	681567.1	4863670.7	1.84E-02	--	1.84E-03	1.21E-02	--	1.21E-03	1.21E-02	--	1.21E-03
293	Flea Market	678574.6	4862819.4	1.49E-02	--	1.49E-03	9.53E-03	--	9.53E-04	9.53E-03	--	9.53E-04
294	Equestrian Centre	680030.8	4867320.2	1.06E-02	--	1.06E-03	7.66E-03	--	7.66E-04	7.66E-03	--	7.66E-04
295	Courtice Community Complex	678099.3	4864629.8	1.00E-02	--	1.00E-03	7.13E-03	--	7.13E-04	7.13E-03	--	7.13E-04
296	Former Restaurant	679830.2	4860702.2	2.13E-02	--	2.13E-03	1.38E-02	--	1.38E-03	1.38E-02	--	1.38E-03
297	Commercial	679364.8	4861016.0	2.64E-02	--	2.64E-03	1.71E-02	--	1.71E-03	1.71E-02	--	1.71E-03
298	GM Oshawa Headquarters	676418.3	4860463.7	1.76E-02	--	1.76E-03	1.07E-02	--	1.07E-03	1.07E-02	--	1.07E-03
299	Farm A?	682972.3	4862201.9	2.59E-02	--	2.59E-03	1.55E-02	--	1.55E-03	1.55E-02	--	1.55E-03
300	Farm B?	683546.9	4861959.7	2.23E-02	--	2.23E-03	1.31E-02	--	1.31E-03	1.31E-02	--	1.31E-03
301	Farm C?	682547.5	4862321.1	3.14E-02	--	3.14E-03	1.81E-02	--	1.81E-03	1.81E-02	--	1.81E-03
302	Farm D?	683238.3	4862393.3	2.39E-02	--	2.39E-03	1.43E-02	--	1.43E-03	1.43E-02	--	1.43E-03
303	Farm E?	682512.6	4862858.0	3.13E-02	--	3.13E-03	1.79E-02	--	1.79E-03	1.79E-02	--	1.79E-03
304	Farm F?	683129.1	4863649.4	2.50E-02	--	2.50E-03	1.47E-02	--	1.47E-03	1.47E-02	--	1.47E-03
305	Bennett 1	688209.3	4862512.1	1.33E-02	--	1.33E-03	8.30E-03	--	8.30E-04	8.30E-03	--	8.30E-04
306	Bennett 2	687990.0	4863221.3	1.19E-02	--	1.19E-03	7.59E-03	--	7.59E-04	7.59E-03	--	7.59E-04
307	Bennett 3	688818.4	4862836.3	1.16E-02	--	1.16E-03	7.37E-03	--	7.37E-04	7.37E-03	--	7.37E-04
308	Bennett 4	689045.1	4863365.5	1.15E-02	--	1.15E-03	7.37E-03	--	7.37E-04	7.37E-03	--	7.37E-04
309	Bennett 5	688270.5	4863763.1	1.17E-02	--	1.17E-03	7.32E-03	--	7.32E-04	7.32E-03	--	7.32E-04
310	Bennett 6	689908.5	4863100.5	1.06E-02	--	1.06E-03	6.84E-03	--	6.84E-04	6.84E-03	--	6.84E-04
311	Bennett 7	688929.9	4864392.0	1.23E-02	--	1.23E-03	7.38E-03	--	7.38E-04	7.38E-03	--	7.38E-04
312	Bennett 8	689684.2	4863837.7	1.10E-02	--	1.10E-03	7.10E-03	--	7.10E-04	7.10E-03	--	7.10E-04
313	Soper 1	687557.9	4862512.4	1.32E-02	--	1.32E-03	8.25E-03	--	8.25E-04	8.25E-03	--	8.25E-04
314	Soper 2	687241.9	4863171.7	1.23E-02	--	1.23E-03	7.75E-03	--	7.75E-04	7.75E-03	--	7.75E-04
315	Soper 3	687023.2	4863903.8	1.24E-02	--	1.24E-03	7.77E-03	--	7.77E-04	7.77E-03	--	7.77E-04
316	Soper 4	688158.2	4865389.3	1.27E-02	--	1.27E-03	8.28E-03	--	8.28E-04	8.28E-03	--	8.28E-04
317	Soper 5	685027.3	4868253.9	1.39E-02	--	1.39E-03	9.75E-03	--	9.75E-04	9.75E-03	--	9.75E-04
318	Soper 6	687287.4	4867037.3	1.34E-02	--	1.34E-03	8.85E-03	--	8.85E-04	8.85E-03	--	8.85E-04
319	Soper 7	685683.2	4867148.1	1.45E-02	--	1.45E-03	9.54E-03	--	9.54E-04	9.54E-03	--	9.54E-04
320	Soper 8	686748.7	4865874.7	1.40E-02	--	1.40E-03	9.16E-03	--	9.16E-04	9.16E-03	--	9.16E-04
321	Bowmanville 1	687026.3	4862368.4	1.36E-02	--	1.36E-03	8.47E-03	--	8.47E-04	8.47E-03	--	8.47E-04
322	Bowmanville 2	686625.7	4863020.3	1.30E-02	--	1.30E-03	7.85E-03	--	7.85E-04	7.85E-03	--	7.85E-04
323	Bowmanville 3	683380.3	4865365.9	1.91E-02	--	1.91E-03	1.23E-02	--	1.23E-03	1.23E-02	--	1.23E-03
324	Bowmanville 4	683111.4	4867150.3	1.26E-02	--	1.26E-03	8.63E-03	--	8.63E-04	8.63E-03	--	8.63E-04
325	Bowmanville 5	682452.2	4869417.5	9.37E-03	--	9.37E-04	6.76E-03	--	6.76E-04	6.76E-03	--	6.76E-04
326	Bowmanville 6	684778.5	4864888.2	1.76E-02	--	1.76E-03	1.08E-02	--	1.08E-03	1.08E-02	--	1.08E-03
327	Bowmanville 7	684549.5	4866404.4	1.53E-02	--	1.53E-03	1.05E-02	--	1.05E-03	1.05E-02	--	1.05E-03
328	Upper Tooley 1	679944.8	4864883.1	1.42E-02	--	1.42E-03	9.80E-03	--	9.80E-04	9.80E-03	--	9.80E-04
329	Upper Tooley 2	679055.1	4863885.8	1.31E-02	--	1.31E-03	9.25E-03	--	9.25E-04	9.25E-03	--	9.25E-04
330	Upper Tooley 3	679714.0	4862767.4	1.78E-02	--	1.78E-03	1.22E-02	--	1.22E-03	1.22E-02	--	1.22E-03
331	Upper Tooley 4	678898.8	4861800.6	2.28E-02	--	2.28E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
332	Upper Tooley 5	680353.5	4862156.5	2.60E-02	--	2.60E-03	1.60E-02	--	1.60E-03	1.60E-02	--	1.60E-03
333	Upper Tooley 6	679818.1	4861625.7	2.11E-02	--	2.11E-03	1.33E-02	--	1.33E-03	1.33E-02	--	1.33E-03
334	Robinson 1	678434.8	4860943.1	3.29E-02	--	3.29E-03	1.96E-02	--	1.96E-03	1.96E-02	--	1.96E-03
335	Robinson 2	677752.6	4861240.6	2.43E-02	--	2.43E-03	1.48E-02	--	1.48E-03	1.48E-02	--	1.48E-03
336	Robinson 3	677642.2	4861787.2	2.04E-02	--	2.04E-03	1.33E-02	--	1.33E-03	1.33E-02	--	1.33E-03
337	Robinson 4	678532.7	4862143.6	2.04E-02	--	2.04E-03	1.32E-02	--	1.32E-03	1.32E-02	--	1.32E-03
338	Robinson 5	678005.1	4862784.9	1.61E-02	--	1.61E-03	1.08E-02	--	1.08E-03	1.08E-02	--	1.08E-03
339	Robinson 6	677882.7	4860587.7	2.85E-02	--	2.85E-03	1.67E-02	--	1.67E-03	1.67E-02	--	1.67E-03
340	F/B 1	677443.1	4867862.1	8.75E-03	--	8.75E-04	6.55E-03	--	6.55E-04	6.55E-03	--	6.55E-04

Table A - 4. Annual Exposure Point Concentrations and Concentration Ratios - Process Upset Scenario

Receptor	Name	UTM E	UTM N	July 2011			December 2009			July 2009		
		(m)	(m)	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark	Particulate Matter PM2.5 Process Upset µg/m3	Concentration Ratio CWS Standard	Concentration Ratio WHO Benchmark
341	F/B 2	679667.4	4866611.4	1.15E-02	--	1.15E-03	8.22E-03	--	8.22E-04	8.22E-03	--	8.22E-04
342	F/B 3	678655.0	4867470.1	1.05E-02	--	1.05E-03	7.52E-03	--	7.52E-04	7.52E-03	--	7.52E-04
343	F/B 4	676191.2	4866844.7	8.41E-03	--	8.41E-04	6.12E-03	--	6.12E-04	6.12E-03	--	6.12E-04
344	F/B 5	678273.3	4866093.0	1.04E-02	--	1.04E-03	7.69E-03	--	7.69E-04	7.69E-03	--	7.69E-04
345	F/B 6	681241.2	4867098.8	1.13E-02	--	1.13E-03	8.27E-03	--	8.27E-04	8.27E-03	--	8.27E-04
346	F/B 7	682165.3	4868082.3	1.03E-02	--	1.03E-03	7.37E-03	--	7.37E-04	7.37E-03	--	7.37E-04
347	F/B 8	679366.6	4868628.3	9.66E-03	--	9.66E-04	7.06E-03	--	7.06E-04	7.06E-03	--	7.06E-04
348	F/B 9	680310.1	4869967.1	8.50E-03	--	8.50E-04	6.43E-03	--	6.43E-04	6.43E-03	--	6.43E-04
349	F/B 10	676487.3	4869291.6	8.02E-03	--	8.02E-04	6.05E-03	--	6.05E-04	6.05E-03	--	6.05E-04
350	F/B 11	676851.4	4865409.3	9.77E-03	--	9.77E-04	6.91E-03	--	6.91E-04	6.91E-03	--	6.91E-04
351	F/B 12	681153.3	4868682.2	9.65E-03	--	9.65E-04	7.33E-03	--	7.33E-04	7.33E-03	--	7.33E-04
352	F/B 13	675416.3	4859833.9	1.39E-02	--	1.39E-03	9.02E-03	--	9.02E-04	9.02E-03	--	9.02E-04
353	Second 1	675153.4	4860552.8	1.27E-02	--	1.27E-03	8.30E-03	--	8.30E-04	8.30E-03	--	8.30E-04
354	Second 2	675297.5	4860891.3	1.37E-02	--	1.37E-03	9.09E-03	--	9.09E-04	9.09E-03	--	9.09E-04
355	Second 3	675647.2	4860644.9	1.44E-02	--	1.44E-03	9.20E-03	--	9.20E-04	9.20E-03	--	9.20E-04
356	Second 4	675670.5	4860076.5	1.32E-02	--	1.32E-03	8.44E-03	--	8.44E-04	8.44E-03	--	8.44E-04
357	Second 5	676043.3	4860319.1	1.51E-02	--	1.51E-03	9.27E-03	--	9.27E-04	9.27E-03	--	9.27E-04
358	Second 6	675923.4	4859821.4	1.54E-02	--	1.54E-03	9.77E-03	--	9.77E-04	9.77E-03	--	9.77E-04
359	McLaughlin Bay 1	676714.7	4860903.8	2.11E-02	--	2.11E-03	1.28E-02	--	1.28E-03	1.28E-02	--	1.28E-03
360	McLaughlin Bay 2	677310.8	4860528.2	2.35E-02	--	2.35E-03	1.39E-02	--	1.39E-03	1.39E-02	--	1.39E-03
361	McLaughlin Bay 3	676563.5	4860260.1	1.69E-02	--	1.69E-03	1.02E-02	--	1.02E-03	1.02E-02	--	1.02E-03
362	McLaughlin Bay 4	676699.5	4859696.6	1.87E-02	--	1.87E-03	1.18E-02	--	1.18E-03	1.18E-02	--	1.18E-03
363	McLaughlin Bay 5	677560.0	4860060.1	1.82E-02	--	1.82E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
364	McLaughlin Bay 6	678204.5	4859832.5	1.64E-02	--	1.64E-03	1.14E-02	--	1.14E-03	1.14E-02	--	1.14E-03
365	Harmony Creek 1	674178.3	4861024.2	1.04E-02	--	1.04E-03	7.69E-03	--	7.69E-04	7.69E-03	--	7.69E-04
366	Harmony Creek 2	674592.0	4862605.3	1.15E-02	--	1.15E-03	8.09E-03	--	8.09E-04	8.09E-03	--	8.09E-04
367	Harmony Creek 3	672863.4	4862808.0	1.06E-02	--	1.06E-03	7.49E-03	--	7.49E-04	7.49E-03	--	7.49E-04
368	Harmony Creek 4	675671.6	4864469.0	9.74E-03	--	9.74E-04	6.79E-03	--	6.79E-04	6.79E-03	--	6.79E-04
369	Harmony Creek 5	672443.1	4864713.0	7.80E-03	--	7.80E-04	6.01E-03	--	6.01E-04	6.01E-03	--	6.01E-04
370	Harmony Creek 6	674830.5	4866909.6	7.77E-03	--	7.77E-04	5.55E-03	--	5.55E-04	5.55E-03	--	5.55E-04
371	Harmony Creek 7	675799.9	4868594.1	7.73E-03	--	7.73E-04	5.66E-03	--	5.66E-04	5.66E-03	--	5.66E-04
372	Westside 1	686082.6	4862776.6	1.32E-02	--	1.32E-03	8.33E-03	--	8.33E-04	8.33E-03	--	8.33E-04
373	Westside 2	685778.7	4862137.9	1.58E-02	--	1.58E-03	9.73E-03	--	9.73E-04	9.73E-03	--	9.73E-04
374	Westside 3	685084.2	4862827.4	1.65E-02	--	1.65E-03	9.47E-03	--	9.47E-04	9.47E-03	--	9.47E-04
375	Darlington 1	680977.5	4865674.4	1.34E-02	--	1.34E-03	9.41E-03	--	9.41E-04	9.41E-03	--	9.41E-04
376	Darlington 2	680913.9	4863967.1	1.77E-02	--	1.77E-03	1.14E-02	--	1.14E-03	1.14E-02	--	1.14E-03
377	Darlington 3	682602.8	4863659.6	2.68E-02	--	2.68E-03	1.61E-02	--	1.61E-03	1.61E-02	--	1.61E-03
378	Darlington 4	682206.4	4862910.4	3.16E-02	--	3.16E-03	1.86E-02	--	1.86E-03	1.86E-02	--	1.86E-03
379	Darlington 5	683223.2	4861114.0	3.10E-02	--	3.10E-03	1.80E-02	--	1.80E-03	1.80E-02	--	1.80E-03
380	Darlington 6	683947.7	4862362.0	2.13E-02	--	2.13E-03	1.24E-02	--	1.24E-03	1.24E-02	--	1.24E-03
381	Darlington 7	685361.9	4861143.4	1.94E-02	--	1.94E-03	1.16E-02	--	1.16E-03	1.16E-02	--	1.16E-03
382	Bennett ECO/HH	688606.4	4862634.8	1.23E-02	--	1.23E-03	7.74E-03	--	7.74E-04	7.74E-03	--	7.74E-04
383	Oshawa ECO/HH	673884.9	4859128.9	1.18E-02	--	1.18E-03	7.90E-03	--	7.90E-04	7.90E-03	--	7.90E-04
384	Oshawa Creek 1	671671.2	4862793.7	1.00E-02	--	1.00E-03	7.26E-03	--	7.26E-04	7.26E-03	--	7.26E-04
385	Oshawa Creek 2	671668.5	4861589.5	9.51E-03	--	9.51E-04	7.15E-03	--	7.15E-04	7.15E-03	--	7.15E-04
386	Oshawa Creek 3	672820.2	4861287.2	9.95E-03	--	9.95E-04	7.43E-03	--	7.43E-04	7.43E-03	--	7.43E-04
387	Oshawa Creek 4	672360.3	4860262.6	9.03E-03	--	9.03E-04	6.89E-03	--	6.89E-04	6.89E-03	--	6.89E-04
388	Oshawa Creek 5	673921.2	4860115.0	9.25E-03	--	9.25E-04	6.87E-03	--	6.87E-04	6.87E-03	--	6.87E-04
389	Oshawa Creek 6	673154.0	4859421.9	1.13E-02	--	1.13E-03	7.41E-03	--	7.41E-04	7.41E-03	--	7.41E-04
390	Farmer	677409.8	4861051.4	2.67E-02	--	2.67E-03	1.59E-02	--	1.59E-03	1.59E-02	--	1.59E-03
391	Commercial Market	688276.3	4864698.5	1.17E-02	--	1.17E-03	7.63E-03	--	7.63E-04	7.63E-03	--	7.63E-04

Notes:

"--" - No CWS annual standard available

WHO Benchmark (Annual) - 10 µg/m^3

APPENDIX B

Toxicological Profile ($PM_{2.5}$)

7.0 PARTICULATE MATTER (TSP, $PM_{2.5}$ AND PM_{10})

Total suspended particulate (TSP) or particulate matter (PM) consists of minute solid or liquid particles that remain suspended in air and can be inhaled into the respiratory system. Particles are not defined on the basis of their chemical composition, and may include a broad range of chemical species. Particles in the atmosphere have been characterized according to size mainly because of the different health effects from particles of different diameters. The smaller the particle size, the farther the particle can penetrate the lungs. Particulate matter in the atmosphere, as described in the current assessment, is composed of three groups: TSP, inhalable coarse particles (PM_{10} and $PM_{2.5-10}$) and fine or respirable particles ($PM_{2.5}$). It is important to recognize that TSP contains all particles smaller than 44 microns; PM_{10} contains all particles with a mean aerodynamic diameter of less than 10 microns; and $PM_{2.5}$ contains particles smaller than 2.5 microns as well as ultrafine PM of less than 0.1 micron (US EPA, 2004).

Particulate matter can cause serious health problems when fine particles get deep into the lungs. Health effects include increased respiratory symptoms (irritation of airways, coughing , difficulty breathing), decreased lung function, aggravated asthma, chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease (US EPA, 2008).

7.1 Assessment of Carcinogenicity

The US EPA and Health Canada have not classified particulate matter (PM) with respect to carcinogenicity. Relatively few studies are available that examine the effects of long term or chronic exposure on health end points. Available studies indicate that long term exposures (16 to 20 years) were associated with increases in mortality, respiratory disease symptoms, decrements in lung function and, possibly, with lung cancer (Health Canada, 1998). However, the effects on mortality cannot be ascribed with certainty to a true chronic effect, since they could equally be the result of cumulative effects of daily variations in PM. Moreover, the association with lung cancer was weak by comparison with other lifestyle factors such as smoking (Health Canada, 1998). Accordingly, particulate matter has been assessed as a non-carcinogen in this risk assessment.

7.2 Susceptible Populations

Epidemiological studies indicate that the elderly, children, and people with chronic lung disease, influenza, or asthma, are especially sensitive to the effects of particulate matter (Health Canada, 1998).

7.3 Selection of Toxicity Reference Values

Numerous sources were consulted in order to obtain toxicological and benchmark values for COPCs. A summary of the reviewed studies, and the rationale for the selection of the TRVs used in the HHRA, is outlined below.

7.3.1 Oral Exposure

7.3.1.1 Non-Carcinogenic Toxicity Reference Values

In this risk assessment, particulate matter is only being evaluated through the inhalation pathway; therefore, a non-carcinogenic oral TRV has not been selected.

7.3.1.2 Carcinogenic Toxicity Reference Values

In this risk assessment, particulate matter is only being evaluated through the inhalation pathway; therefore, a carcinogenic oral TRV has not been selected.

7.3.2 Inhalation Exposure

7.3.2.1 Non-Carcinogenic Toxicity Reference Values

7.3.2.1.1 Acute Inhalation Toxicity Reference Values (1-hour, 24-hour)

Epidemiological studies have indicated that there is little evidence that the dose-response curve for PM includes a threshold (Health Canada, 1998). The lack of a threshold at low concentrations suggests that it would be difficult to identify a level at which no adverse effects would be expected to occur as a result of exposure to particulate matter. Although 1-hour exposure limits have not been specified by government agencies, 24-hour exposure limits for all manner of particulate matter have been specified and selected for use in this risk assessment.

Total Suspended Particulates

Health Canada's National Ambient Air Quality Objectives provide a maximum acceptable annual level of total particulate matter of 120 $\mu g/m^3$. It is a level that is based on the critical effect of respiratory irritation and is also reflective of technological, economic and societal information. Furthermore, it represents the air quality management goal for the protection of the general public and the environment of Canada (Health Canada, 2006). No further information regarding the derivation of this value is available.

The Alberta Ambient Air Quality Objectives and Guidelines (2009) provide a 24-hour average for total particulate matter of 100 $\mu g/m^3$. This value is based on pulmonary effects but with no additional information regarding benchmark derivation provided.

As there is no information available regarding the derivation or basis of the Alberta (2007) 24-hour guideline, the Health Canada National Ambient Air Quality Objective of 120 $\mu g/m^3$ has been selected for this risk assessment even though it is slightly greater than the Alberta value.

$PM_{2.5}$

A number of government organizations have established health-based reference levels for fine particulate matter.

The CEPA/FRAC Working Group (Health Canada) recommended a 24-hour average reference level of 15 $\mu g/m^3$ for $PM_{2.5}$ on the basis of several key epidemiological studies (Health Canada, 1998). The reference level estimates the lowest ambient PM level at which statistically significant increases in health responses can be detected based upon available data and current technology. The reference level should not be interpreted as thresholds of effects, or level at which impacts do not occur (Health Canada, 1999).

The US EPA (2009) established a health-based 24-hour air quality standard of 35 $\mu g/m^3$ for $PM_{2.5}$. This is a primary standard, intended to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.

The Canada Wide Standard (CCME, 2006) for 24-hour $PM_{2.5}$ is 30 $\mu g/m^3$. This Canada-Wide Standard is based on 98th percentile ambient measurements conducted annually and averaged over 3 years. The Ontario Ministry of the Environment (MOE, 2008) Ambient Air Quality Criteria is also 30 $\mu g/m^3$ for $PM_{2.5}$ and is based on the critical effect of respiratory irritation.

As the facility is to be built in Ontario, a reference exposure limit of 30 $\mu g/m^3$ has been selected for further use in this risk assessment, as per the Canada-Wide Standard and the Ontario Ministry of the Environment Ambient Air Quality Criteria.

PM_{10}

Much like fine particulate matter, many of the same government agencies have also established benchmarks for inhalable coarse particulate matter. The CEPA/FRAC Working Group (Health Canada) recommended a 24-hour average reference level of 25 $\mu g/m^3$ for PM_{10} on the basis of several key epidemiological studies (Health Canada, 1998). The reference level estimates the lowest ambient PM level at which statistically significant increases in health responses can be detected based upon available data and current technology. The reference level should not be interpreted as thresholds of effects, or level at which impacts do not occur (Health Canada, 1999).

The US EPA (2009) established a 24-hour health-based air quality standard for PM_{10} of 150 $\mu g/m^3$. Finally, the Ontario Ministry of the Environment (MOE, 2008) Ambient Air Quality Criteria is 50 $\mu g/m^3$ for PM_{10}, is based on based on cardiopulmonary effects and 24-hour averages.

As the facility is to be built in Ontario, a reference exposure limit of 50 $\mu g/m^3$ has been selected for further use in this risk assessment, as per the Ontario Ministry of the Environment Ambient Air Quality Criteria.

7.3.2.1.2 Chronic Inhalation Toxicity Reference Values

Total Suspended Particulates

Health Canada's National Ambient Air Quality Objectives provide a maximum desirable annual level of total particulate matter of 60 $\mu g/m^3$. It is an effects-based level that is also reflective of technological, economic and societal information. Furthermore, it represents the air quality management goal for the protection of the general public and the environment of Canada (Health Canada, 2006). No further information regarding the derivation of this value is available. This value was selected for further use in the risk assessment.

$PM_{2.5}$

A chronic exposure limit was not identified for inhalable fine particulate matter.

PM_{10}

A chronic exposure limit was not identified for inhalable coarse particulate matter.

7.3.2.2 Cancer Inhalation Toxicity Reference Values

In this risk assessment, particulate matter is not being evaluated as a carcinogen; therefore, a carcinogenic inhalation toxicological reference value has not been selected.

7.4 Bioavailability

In this risk assessment, particulate matter is only being evaluated through the inhalation pathway; as a result, oral and dermal bioavailability/absorption factors have not been determined. With regards to the inhalation pathway, it has been conservatively assumed that particulate matter is completely absorbed (i.e. absorption factor is 1).

7.5 Conclusion

The following tables present Particulate Matter (TSP, $PM_{2.5}$, and PM_{10}) TRVs selected for use in this risk assessment.

Table 7-1 Particulate Matter Oral TRVs used in the HHRA

COPC	Toxicity Reference Value	Value (mg/kg/day)	Critical Effect	Reference Type	Source
Particulate Matter (TSP, $PM_{2.5}$, and PM_{10})	Non-carcinogenic TRV	NE			
	Carcinogenic Slope Factor	NE			

NE- Not Evaluated

Table 7-2 Particulate Matter Inhalation TRVs used in the HHRA

COPC	Duration	Value [a]	Critical Effect	Reference Type	Agency
TSP	1-Hour	NV			
	24-Hour	120	Health-Based	Benchmark	Health Canada, 2006
	Annual Average	60	Health-Based	Benchmark	Health Canada, 2006
$PM_{2.5}$	1-Hour	NV			
	24-Hour	30	Health-Based	Benchmark	CCME, 2006
	Annual Average	NV			
PM_{10}	1-Hour	NV			
	24-Hour	50	Health-Based	Benchmark	MOE AAQC, 2005
	Annual Average	NV			

[a] Units: Non-carcinogenic COPC ($\mu g/m^3$) , NV – No Value

7.6 References

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APPENDIX C

Canada-Wide Standards for Particulate Matter (PM) and Ozone

Canadian Council of Ministers of the Environment

CANADA-WIDE STANDARDS

for

PARTICULATE MATTER (PM) and OZONE

CANADA-WIDE STANDARDS for PARTICULATE MATTER (PM) and OZONE

These Canada-Wide Standards (CWSs) for particulate matter (PM) and ozone are established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME) and its Canada-wide Environmental Standards Sub-Agreement.

RATIONALE

Significant adverse effects have been demonstrated for the air pollutants PM and ozone on human health and the environment.

DEFINITIONS

PM10 refers to airborne particles that are 10 microns or less in diameter

PM2.5 refers to airborne particles that are 2.5 microns or less in diameter

PM10-2.5 refers to airborne particles in the size range 2.5 to 10 microns in diameter, known as the coarse fraction of PM10

Ozone refers to an oxygen compound (O3) occurring in the form of a gas in the atmosphere at ground-level

CONTEXT

The long-term air quality management goal for PM and ozone is to minimize the risks of these pollutants to human health and the environment. However, recent scientific evidence indicates that there is no apparent lower threshold for the effects of these two pollutants on human health.

These CWSs for PM and ozone are an important step towards the long-term goal of minimizing the risks they impose to human health and the environment. They represent a balance between the desire to achieve the best health and environmental protection possible in the relative near-term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated levels of PM and ozone in ambient air. As such, while they will significantly reduce the effect of PM and ozone on human health and the environment, they may not be fully protective and may need to be re-visited at some future date. There are also additional benefits to reducing and maintaining ambient levels below the CWSs where possible.

Uncertainty and gaps exist and new data/information that becomes available will be acknowledged. However, Ministers are confident that taking action now to reduce PM and ozone levels will improve ambient air quality and result in benefits to the environment and to human health. Jurisdictions will have considerable flexibility in the detailed design of implementation plans and sectoral emission reduction strategies over the next few years, and an opportunity to reduce information gaps and uncertainties.

In jurisdictions highly impacted by transboundary air pollution from the United States, achieving the CWSs will be strongly dependent on reductions of this transboundary contribution. Also, high background levels of PM and ozone that may occur through natural events (such as forest fires, natural formation and stratospheric intrusion) will need to be considered in assessing achievement of the CWSs.

The CWS for PM established here is for the fraction of PM recognized as having the greatest effect on human health, the fine fraction or PM2.5. The PM2.5 CWS has been established for the interim period prior to the planned review of the standard to be completed by 2005, which will incorporate advancements in scientific, technical and economic information and analysis. The PM2.5 CWS will ensure that PM management efforts are focused on the sources of PM and PM precursor emissions that provide the greatest health benefit. It is acknowledged that health effects are also associated with the coarser fraction of PM, or PM10-2.5, and that actions to reduce the concentrations of these coarser fractions in the atmosphere are needed. Reductions in ambient PM10 levels will occur as ancillary benefits from reducing PM2.5. In addition, some jurisdictions currently have ambient air quality objectives, guidelines or standards related to the coarser fraction of PM. These should continue to be used to design air quality management programs for PM10. CWSs related to the coarser fraction may be a useful addition at a later date.

There are other aspects that should be considered in any future update of these PM and ozone CWSs. Forms of the PM and ozone CWSs other than the relatively short term exposure forms established here, such as seasonal or annual average targets, may also be useful additions at a later date. Since the current CWSs are related primarily to protection of human health, their adequacy for the protection of vegetation, visibility impairment, material damage or other adverse effects may need to be assessed.

PART 1:

NUMERICAL TARGETS and TIMEFRAMES

The CWS and related provisions for PM are:

A CWS for PM2.5 of 30 $\mu g/m^3$, 24 hour averaging time, by year 2010

Achievement to be based on the 98th percentile ambient measurement annually, averaged over 3 consecutive years

The CWS and related provisions for ozone are:

A CWS of 65 ppb, 8-hour averaging time, by 2010

Achievement to be based on the 4th highest measurement annually, averaged over 3 consecutive years

Specific provisions related to transboundary flow of ozone are contained in Section B.3.5, Accounting for Transboundary Flow, of Annex B.

PART 2:

IMPLEMENTATION

Jurisdictions will undertake the following implementation actions:

Development and implementation of jurisdictional implementation plans to achieve the CWSs.

Implementation of continuous improvement, pollution prevention, and keeping-clean-areas-clean programs in areas with ambient concentrations below the CWS levels, in accordance with the guidance provided in Annex A.

In areas where jurisdictional implementation plans need to be augmented by reductions in transboundary flow of pollution from the United States or from other countries to achieve the CWSs, the federal government, with support from the provinces and territories, will aggressively pursue further reductions in the transboundary flow into Canada of PM and ozone and their precursor pollutants.

Establishment and maintenance of the PM and ozone monitoring networks needed to characterise the PM and ozone air quality problems across Canada, design management programs, and track progress.

REVIEW

The CWSs will be reviewed as follows:

(a) by the end of year 2005, complete additional scientific, technical and economic analysis to reduce information gaps and uncertainties and revise or supplement the PM and ozone CWSs as appropriate for year 2015; and report to Ministers in 2003 on the findings of the PM and ozone environmental and health science, including a recommendation on a $PM_{10-2.5}$ CWS.

(b) by the end of year 2010, assess the need, and if appropriate, revise the CWSs for PM and ozone for target years beyond 2015.

REPORTING on PROGRESS

Progress towards meeting the above provisions will be reported as follows:

(a) to the respective publics of each jurisdiction on a regular basis, the timing and scope of reporting to be determined by each jurisdiction

(b) to Ministers and the public, with comprehensive reports at five year intervals beginning in year 2006 and reports on achievement and maintenance of the CWSs annually beginning in 2011, in accordance with guidance provided in Annex B

ADMINISTRATION

Jurisdictions will review and renew Part 2 and Annexes A and B five years from coming into effect.

Any party may withdraw from these Canada-Wide Standards upon three month's notice.

These Canada-Wide Standards come into effect for each jurisdiction on the date of signature by the jurisdiction.

ANNEX A

GUIDANCE FOR CONTINUOUS IMPROVEMENT AND KEEPING-CLEAN-AREAS-CLEAN PROGRAMS FOR PM AND OZONE

In most areas of Canada, ambient levels are lower than the CWSs for PM and ozone established here. Ministers have agreed to include in the CWSs a provision on environmental management in areas where ambient air quality is "better" than the levels set out in the standards.

(a) Continuous Improvement

There are numerous locations across Canada that have ambient levels of PM and/or ozone below the CWS levels but still above the levels associated with observable health effects. There is a need to ensure that the public recognizes that the CWS levels are only a first step to subsequent reductions towards the lowest observable effects levels. It would be wrong to convey the impression that no action is required in these areas or that it would be acceptable to allow pollutant levels to rise to the CWS levels. Jurisdictions should take remedial and preventative actions to reduce emissions from anthropogenic sources in these areas to the extent practicable.

(b) Keeping Clean Areas Clean

Jurisdictions recognize that polluting "up to a limit" is not acceptable and that the best strategy to avoid future problems is keeping clean areas clean. Jurisdictions should work with their stakeholders and the public to establish programs that apply pollution prevention and best management practices, by, for example:

- developing and implementing strategies consistent with the CCME commitment to pollution prevention
- ensuring that new facilities and activities incorporate the best available economically feasible technologies to reduce PM and ozone levels
- requiring that upgrades carried out in the course of normal capital stock turnover incorporate the best available economically feasible technologies to reduce PM and ozone levels
- reviewing new activities that could contribute to an increase in PM and ozone levels with stakeholders and the public in terms of their social, economic and environmental merits

ANNEX B

REPORTING PROTOCOL FOR CANADA-WIDE STANDARDS FOR PARTICULATE AND OZONE

B.1 Introduction

It is intended under the Harmonization Accord and its Standards Sub-Agreement that all jurisdictions will report on a regular basis to their publics and to Ministers of the Canadian Council of Ministers of the Environment on their progress towards achieving the CWSs for particulate matter (PM) and ozone.

This reporting protocol is intended to provide guidance for reporting on all provisions of the CWSs for PM and ozone. Its provisions are designed to help ensure consistency and comparability in the reporting by jurisdictions, and better understanding by the public on how jurisdictions plan to track and report on progress.

B.2 Frequency, Timing and Scope of Reporting

There will be two types of reporting by jurisdictions:

1) Annual Reporting on Achievement of the CWSs

These reports will be completed by each jurisdiction in a standardized "report card" format, the format to be developed and agreed to by all jurisdictions, and provided to Ministers and the public by 30 September of each year, beginning in 2011. These annual reports will be limited in scope containing mainly summary information on levels and trends in ambient PM and ozone concentrations in communities within each jurisdiction, identifying communities where ambient levels are exceeding or approaching the CWS levels. They may also note the reason for any significant change in ambient levels or trends from previous years.

2) Five-Year Reports

These reports will be completed for the year 2005 and for every fifth year thereafter and provided to Ministers and the public by 30 September of the following year. The report for 2005 will be an interim report on progress towards meeting the CWSs, and subsequent reports will focus on achievement of the CWSs applicable at that time.

Five-year reports will be comprehensive, assessing progress on all provisions of the CWSs. The format and general content will be determined and agreed to by all jurisdictions 2 years in advance of the reporting year. They will include, assessment of ambient levels and trends in communities within each jurisdiction, identifying communities

where ambient levels are exceeding or approaching the CWS levels, information on PM and ozone precursor emissions and trends, comprehensive descriptions of smog management efforts, progress with implementation of measures in implementation plans, actions to ensure continuous improvement in areas with ambient levels below the CWS levels but within the effects range, actions to ensure that clean areas are kept clean, actions on co-operation in monitoring and science, and any other provision of the CWSs. The federal government will include in its reports an assessment of trends in U.S. emissions and ambient levels in border regions affecting ambient PM and ozone levels in Canada, and of the effectiveness of U.S. control programs in reducing those emissions and of Canadian efforts to secure such reductions.

The CCME will co-ordinate the collation of the information from the various jurisdictional reports in (1) and (2) above into a national overview report for the public, CCME Ministers and international audiences.

In addition to the reporting in (1) and (2) above, individual jurisdictions may report to their publics on a more frequent basis. The scope and timing of any such reporting would be determined by the jurisdiction.

B.3 Reporting on Achievement of the CWSs

B.3.1 Guidance Document on Achievement Determination

Jurisdictions will co-operate in the preparation and periodic update as required, of a Guidance Document on Achievement Determination for the PM and ozone CWSs. This document will elaborate on information, methodologies, criteria and procedures related to each of the basic elements of achievement reporting identified below.

B.3.2 Communities for CWS Achievement Determination

Jurisdictions will use a community-oriented approach for reporting on achievement of the PM and ozone CWSs. As a basic requirement, jurisdictions will report on CWS achievement for population centres over 100,000. As well, jurisdictions may also report on CWS achievement for communities with population less than 100,000 based on considerations such as regional population density, proximity to sources, local air quality, etc.

To provide consistency and comparability in reporting across jurisdictions, the geographic units for grouping of municipalities (Census Metropolitan Areas (CMAs)/Census Agglomerations (CAs)/Census Subdivisions) established by Statistics Canada will be used as guidance for community identification. Larger CMAs may be subdivided into smaller sub-areas to better capture geographic variation within the CMA. *[refer to the **Guidance Document** for a listing of CMAs and CAs in Canada and suggested criteria for subdividing larger CMAs].*]

B.3.3 Monitoring Sites for Determining Achievement

CWS achievement will be based on community-oriented monitoring sites i.e. sites located where people live, work and play rather than at the expected maximum impact point for specific emission sources. Rural (or background) and source specific sites will not be included for CWS achievement determination. *[See the **Guidance Document** for guidance on selection of community-oriented monitoring sites].*

B.3.4 Calculation Methodologies for Determining Achievement

It is important that common statistical parameters be used by all jurisdictions in reporting on CWS achievement so that there will be consistency and comparability in assessing progress in achieving the CWSs. These parameters stem initially from the basic form and achievement statistics specified for the CWSs. That is:

For $PM_{2.5}$:

> 24-hour averaging time, achievement to be based on 98th percentile annual value, averaged over three consecutive years

For Ozone:

> 8-hour averaging time, achievement to be based on 4th highest annual measurement, averaged over three consecutive years

For PM CWS achievement determination, measurements from each multiple continuous (or daily) population-oriented monitoring station within a CMA/CA or CMA reporting sub-area will be spatially averaged for each year (up to three) for which measurements are available.

For ozone CWS achievement determination, the monitoring station with the highest average ozone concentration within a CMA/CA or CMA reporting sub-area will be used.

*[See the **Guidance Document** for methodology for determination of 98th percentile annual levels for PM2.5 and 4th highest annual levels for ozone from monitors that measure at various frequencies or for which there are less than 365 measurements per year, and methodologies for determining spatial averages]*

B.3.5 Accounting for Transboundary Pollution

Communities for which jurisdictions demonstrate (i) that continued exceedance of the CWS levels is primarily due to transboundary flow of PM and ozone or their precursor pollutants from the U.S. or from another province/territory, and (ii) that "best efforts" have been made to reduce contributions to the excess levels from pollution sources within the jurisdiction, will be identified in reporting as "transboundary influenced

communities" that are unable to reach attainment of the CWSs until further reduction in transboundary air pollution flow occurs. Demonstration of transboundary flow influence will be a shared responsibility of the federal government and the affected province/territory, and demonstration of best efforts will include measures in both provincial/territorial and federal implementation plans. *[See the **Guidance Document** for methodologies for demonstrating the influence of transboundary and criteria on what would constitute "best efforts"]*

For the province of Ontario, a 45% reduction in NOx and VOC emissions from 1990 levels by 2010 or earlier, subject to successful negotiations this fall with the U.S. for equivalent reductions, will be considered the province's appropriate level of effort towards achieving the ozone CWS. Any remaining ambient ozone levels above the CWS in Ontario will be considered attributable to the transboundary flow from the U.S. of ozone and its precursor pollutants.

B.3.6 Accounting for Background and Natural Events

Communities for which jurisdictions demonstrate (i) that continued exceedance of the CWS levels is primarily due to naturally occurring local or regional PM and/or ozone and (ii) that "best efforts" have been made to reduce contributions to the excess levels from pollution sources within the jurisdiction, will be identified in reporting as "communities influenced by background or natural events". Demonstration of background or natural influence is the responsibility of the affected jurisdiction, and demonstration of best efforts will include measures in both provincial/territorial and federal implementation plans. *[See the **Guidance Document** for methodologies for demonstrating background or natural influence and criteria on what would constitute "best efforts"]*

B.3.7 Maintenance and Provision of Monitoring Information

It is important to have up-to-date PM and ozone monitoring data. Jurisdictions will maintain their own data on ambient measurements of PM2.5, PM10 and ozone and make it publicly accessible. Accessibility may be accomplished by posting on Internet Sites, which would be linked to the CCME Website.

Jurisdictions will also co-operate in establishing and maintaining a ***Monitoring Protocol***, which will ensure the coordination of monitoring data. This will allow for better co-ordination of monitoring program design and operation, ambient air quality trends analyses, regional source-receptor assessments, transboundary air quality analyses and implementation plan design.

Canada-wide Standards for Particulate Matter (PM) and Ozone

Signed by:

British Columbia	Honourable Joan Sawicki
Alberta	Honourable Halvar Johnson
Saskatchewan	Honourable Buckley Belanger
Manitoba	Honourable Oscar Lathlin
Ontario	Honourable Dan Newman
Environment Canada	Honourable David Anderson
New Brunswick	Honourable Kim Jardine
Nova Scotia	Honourable Michael Baker
Prince Edward Island	Honourable Kevin MacAdam
Newfoundland and Labrador	Honourable Oliver Langdon Honourable Walter Noel
Yukon	Honourable Dale Eftoda
Northwest Territories	Honourable Joseph Handley
Nunavut	Honourable Peter Kilabuk

Note: Québec has not endorsed the Canada-wide Accord on Environmental Harmonization or the Canada-wide Environmental Standards Sub-agreement.

Endorsed by CCME Council of Ministers, June 5-6, 2000, Quebec City

APPENDIX D

WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005. Summary of Risk Assessment (WHO, 2005).

WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide

Global update 2005

Summary of risk assessment

World Health Organization

WHO/SDE/PHE/OEH/06.02

WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide

Global update 2005

Summary of risk assessment

World Health Organization

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Preface

Clean air is considered to be a basic requirement of human health and well-being. However, air pollution continues to pose a significant threat to health worldwide. According to a WHO assessment of the burden of disease due to air pollution, more than 2 million premature deaths each year can be attributed to the effects of urban outdoor air pollution and indoor air pollution (caused by the burning of solid fuels). More than half of this disease burden is borne by the populations of developing countries[1].

The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution. First produced in 1987[2] and updated in 1997,[3] these guidelines are based on expert evaluation of current scientific evidence. Given the wealth of new studies on the health effects of air pollution that have been published in the scientific literature since the completion of the second edition of the *Air quality Guidelines for Europe*, including important new research from low-and middle-income countries where air pollution levels are at their highest, WHO has undertaken to review the accumulated scientific evidence and to consider its implications for its air quality guidelines. The result of this work is presented in this document in the form of revised guideline values for selected air pollutants, which are applicable across all WHO regions. These guidelines are intended to inform policy-makers and to provide appropriate targets for a broad range of policy options for air quality management in different parts of the world.

The new information included in this latest update of the *Air quality guidelines* relate to four common air pollutants: particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2). The scope of this review reflects the availability of new evidence on the health effects of these pollutants and their relative importance with regard to current and future health effects of air pollution in each of the WHO regions. For air pollutants not considered in the present document the conclusions presented in the WHO *Air quality guidelines for Europe*[3] remain in effect.

The process leading to the present revision of the air quality guidelines is summarized in the report of the WHO Working Group Meeting, which convened in Bonn, 18–20 October 2005[4]. This report lists the members of the Working Group who reviewed the available evidence and who recommended the guideline values presented here. A full report, to include a detailed assessment of the available scientific evidence, as well as the revised introductory chapters of the WHO *Air quality guidelines* will be published later in 2006.

[1] World health report 2002. Reducing risks, promoting healthy life. Geneva, World Health Organization, 2002.

[2] Air quality guidelines for Europe. Copenhagen, World Health Organization Regional Office for Europe, 1987 (WHO Regional Publications, European Series, No. 23).

[3] Air quality guidelines for Europe, 2nd ed. Copenhagen, World Health Organization Regional Office for Europe, 2000 (WHO Regional Publications, European Series, No. 91).

[4] Available at http://www.euro.who.int/Document/E87950.pdf.

Role of the guidelines in protecting public health

The WHO air quality guidelines (AQGs) are intended for worldwide use but have been developed to support actions to achieve air quality that protects public health in different contexts. Air quality standards, on the other hand, are set by each country to protect the public health of their citizens and as such are an important component of national risk management and environmental policies. National standards will vary according to the approach adopted for balancing health risks, technological feasibility, economic considerations and various other political and social factors, which in turn will depend on, among other things, the level of development and national capability in air quality management. The guideline values recommended by WHO acknowledge this heterogeneity and, in particular, recognize that when formulating policy targets, governments should consider their own local circumstances carefully before adopting the guidelines directly as legally based standards.

The WHO AQGs are based on the now extensive body of scientific evidence relating to air pollution and its health consequences. Although this information base has gaps and uncertainties, it offers a strong foundation for the recommended guidelines. Several key findings that have emerged in recent years merit special mention. Firstly, the evidence for ozone (O_3) and particulate matter (PM) indicates that there are risks to health at concentrations currently found in many cities in developed countries. Moreover, as research has not identified thresholds below which adverse effects do not occur, it must be stressed that the guideline values provided here cannot fully protect human health.

Secondly, an increasing range of adverse health effects has been linked to air pollution, and at ever-lower concentrations. This is especially true of airborne particulate matter. New studies use more refined methods and more subtle but sensitive indicators of effects, such as physiological measures (e.g. changes in lung function, inflammation markers). Therefore the updated guidelines could be based both on these sensitive indicators, in addition to the most critical population health indicators, such as mortality and unscheduled hospitalizations.

Thirdly, as our understanding of the complexity of the air pollution mixture has improved, the limitations of controlling air pollution through guidelines for single pollutants have become increasingly apparent. Nitrogen dioxide (NO_2), for example, is a product of combustion processes and is generally found in the atmosphere in close association with other primary pollutants, including ultrafine (UF) particles. It is itself toxic and is also a precursor of ozone, with which it coexists along with a number of other photochemically generated oxidants. Concentrations of NO_2 are often strongly correlated with those of other toxic pollutants, and being the easier to measure, is often used as a surrogate for the pollutant mixture as a whole. Achieving guideline concentrations for individual pollutants such as NO_2 may therefore bring public health benefits that exceed those anticipated on the basis of estimates of a single pollutant's toxicity.

The present revision of the WHO *Air quality guidelines for Europe* provides new guideline values for three of the four pollutants examined. For two of them (particulate matter and ozone), it is possible to derive a quantitative relationship between the concentration of the pollutant as monitored in ambient air and specific health outcomes (usually mortality). These relationships are invaluable for health impact assessments and allow insights into the mortality and morbidity burdens from current levels of air pollution, as well as what health improvements could be expected under different air pollution reduction scenarios. The burden-of-disease estimates can also be used for the purpose of estimating the costs and benefits of interventions that reduce air pollution. Approaches to, and the

limitations of, health impact assessments are summarized in the full report supporting the updated guidelines.

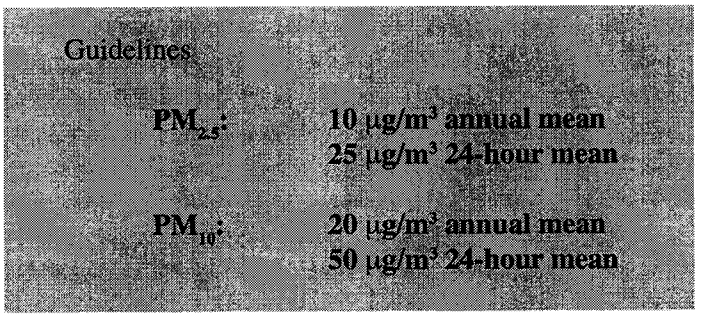
Air pollutant concentrations should be measured at monitoring sites that are representative of population exposures. Air pollution levels may be higher in the vicinity of specific sources of air pollution, such as roads, power plants and large stationary sources, and so protection of populations living in such situations may require special measures to bring the pollution levels to below the guideline values.

The following sections of this document present the WHO AQGs for PM, ozone, NO_2 and SO_2, and in each case give the rationale for the decision to revise the guideline value or to retain the existing value. As noted above, the epidemiological evidence indicates that the possibility of adverse health effects remains even if the guideline value is achieved, and for this reason some countries might decide to adopt lower concentrations than the WHO guideline values as their national air quality standards.

In addition to guideline values, **interim targets** are given for each pollutant. These are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. If these targets were to be achieved, one could expect significant reductions in risks for acute and chronic health effects from air pollution. Progress towards the guideline values should, however, be the ultimate objective of air quality management and health risk reduction in all areas.

Air quality guidelines and their rationale

Particulate matter



Rationale

The evidence on airborne particulate matter (PM) and its public health impact is consistent in showing adverse health effects at exposures that are currently experienced by urban populations in both developed and developing countries. The range of health effects is broad, but are predominantly to the respiratory and cardiovascular systems. All population is affected, but susceptibility to the pollution may vary with health or age. The risk for various outcomes has been shown to increase with exposure and there is little evidence to suggest a threshold below which no adverse health effects would be anticipated. In fact, the low end of the range of concentrations at which adverse health effects has been demonstrated is not greatly above the background concentration, which for particles smaller than 2.5 μm ($PM_{2.5}$) has been estimated to be 3–5 μg/m³ in both the United States and western Europe. The epidemiological evidence shows adverse effects of PM following both short-term and long-term exposures.

As thresholds have not been identified, and given that there is substantial inter-individual variability in exposure and in the response in a given exposure, it is unlikely that any standard or guideline value will lead to complete protection for every individual against all possible adverse health effects of particulate matter. Rather, the standard-setting process needs to aim at achieving the lowest concentrations possible in the context of local constraints, capabilities and public health priorities. Quantitative risk assessment offers one way of comparing alternative control scenarios and of estimating the residual risk associated with a particular guideline value. Both the United States Environmental Protection Agency and the European Commission have recently used this approach to revise their air quality standards for PM. Countries are encouraged to consider adopting an increasingly stringent set of standards, tracking progress through the monitoring of emission reductions and declining concentrations of PM. To assist this process, the numerical guideline and interim target values given here reflect the concentrations at which increased mortality responses due to PM air pollution are expected based on current scientific findings.

The choice of indicator for particulate matter also requires consideration. At present, most routine air quality monitoring systems generate data based on the measurement of PM_{10} as opposed to other particulate matter sizes. Consequently, the majority of epidemiological studies use PM_{10} as the exposure indicator. PM_{10} represents the particle mass that enters the respiratory tract and, moreover, it includes both the coarse (particle size between 2.5 and 10 μm) and fine particles (measuring less than 2.5 μm, $PM_{2.5}$) that are considered to contribute to

the health effects observed in urban environments. The former is primarily produced by mechanical processes such as construction activities, road dust re-suspension and wind, whereas the latter originates primarily from combustion sources. In most urban environments, both coarse and fine mode particles are present, but the proportion of particles in these two size ranges is likely to vary substantially between cities around the world, depending on local geography, meteorology and specific PM sources. In some areas, the combustion of wood and other biomass fuels can be an important source of particulate air pollution, the resulting combustion particles being largely in the fine ($PM_{2.5}$) mode. Although few epidemiological studies have compared the relative toxicity of the products of fossil fuel and biomass combustion, similar effect estimates are found for a wide range of cities in both developed and developing countries. It is, therefore, reasonable to assume that the health effects of $PM_{2.5}$ from both of these sources are broadly the same. By the same token, the WHO AQG for PM can also be applied to the indoor environment, specifically in the developing world, where large populations are exposed to high levels of combustion particles derived from indoor stoves and fires.

Although PM_{10} is the more widely reported measure, and also the indicator of relevance to the majority of the epidemiological data, for reasons that are discussed below, the WHO AQGs for PM are based on studies that use $PM_{2.5}$ as an indicator. The $PM_{2.5}$ guideline values are converted to the corresponding PM_{10} guideline values by application of a $PM_{2.5}/PM_{10}$ ratio of 0.5. A $PM_{2.5}/PM_{10}$ ratio of 0.5 is typical of developing country urban areas and is at the bottom of the range found in developed country urban areas (0.5–0.8). When setting local standards, and assuming the relevant data are available, a different value for this ratio, i.e. one that better reflects local conditions, may be employed.

Based on known health effects, both short-term (24-hour) and long-term (annual mean) guidelines are needed for both indicators of PM pollution.

Long-term exposures

An annual average concentration of 10 $\mu g/m^3$ was chosen as the long-term guideline value for $PM_{2.5}$. This represents the lower end of the range over which significant effects on survival were observed in the American Cancer Society's (ACS) study (Pope et al., 2002). Adoption of a guideline at this level places significant weight on the long-term exposure studies that use the ACS and the Harvard Six-Cities data (Dockery et al., 1993; Pope et al., 1995; HEI, 2000, Pope et al., 2002, Jerrett, 2005). In all of these studies, robust associations were reported between long-term exposure to $PM_{2.5}$ and mortality. The historical mean $PM_{2.5}$ concentration was 18 $\mu g/m^3$ (range, 11.0–29.6 $\mu g/m^3$) in the Six-Cities study and 20 $\mu g/m^3$ (range, 9.0–33.5 $\mu g/m^3$) in the ACS study. Thresholds were not apparent in any of these studies, although the precise period(s) and pattern(s) of relevant exposure could not be ascertained. In the ACS study, statistical uncertainty in the risk estimates becomes apparent at concentrations of about 13 $\mu g/m^3$, below which the confidence bounds significantly widen since the concentrations are relatively far from the mean. According to the results of the Dockery et al. (1993) study, the risks are similar in the cities with the lowest long-term $PM_{2.5}$ concentrations (i.e. 11 and 12.5 $\mu g/m^3$). Increases in risk are apparent in the city with the next-lowest long-term $PM_{2.5}$ mean (i.e. 14.9 $\mu g/m^3$), indicating that health effects can be expected when annual mean concentrations are in the range of 11–15 $\mu g/m^3$. Therefore, an annual mean concentration of 10 $\mu g/m^3$ can be considered, according to the available scientific literature, to be below the mean for most likely effects. Selecting a long-term mean $PM_{2.5}$ concentration of 10 $\mu g/m^3$ also places some weight on the results of daily exposure time-series studies that examine the relationships between exposure to $PM_{2.5}$ and acute adverse health outcomes. In these studies, long-term (i.e. three- to four-year) means are reported to be in the range of 13–18 $\mu g/m^3$. Although adverse effects on health cannot be entirely ruled out below these levels, the annual average WHO AQG value represents that concentration of $PM_{2.5}$ that has not only been shown to be achievable in large urban areas in highly devel-

oped countries, but also the attainment of which is expected to significantly reduce the health risks.

Besides the guideline value, three interim targets (IT) are defined for $PM_{2.5}$ (see Table 1). These have been shown to be achievable with successive and sustained abatement measures. Countries may find these interim targets particularly helpful in gauging progress over time in the difficult process of steadily reducing population exposures to PM.

An annual mean $PM_{2.5}$ concentration of 35 μg/m^3 was selected as the IT-1 level. This level corresponds to the highest mean concentrations reported in studies of long-term health effects, and may also reflect higher but unknown historical concentrations that may have contributed to observed health effects. This level has been shown to be associated with significant mortality in the developed world.

The IT-2 interim level of protection is set at 25 μg/m^3 and relies, as its basis, on the studies of long-term exposure and mortality. This value is greater than the mean concentration at which effects have been observed in such studies, and is likely to be associated with significant health impacts from both long-term and daily exposures to $PM_{2.5}$. Attainment of this IT-2 value would reduce the health risks of long-term exposure by about 6% (95% CI, 2–11%) relative to the IT-1 value. The recommended IT-3 level is 15 μg/m^3 and places even greater weight on the likelihood of significant effects associated with long-term exposures. This value is close to the mean concentrations that are reported in studies of long-term exposure and provides an additional 6% reduction in mortality risk relative to the IT-2 value. Corresponding AQGs and interim targets are also recommended for PM_{10} (Table 1). This is because a $PM_{2.5}$ guideline alone would not provide protection against the harmful effects of coarse PM (the fraction between 10 and 2.5 μm). However, the quantitative evidence on coarse PM is considered insufficient to derive separate guidelines. In contrast, there is a large body of literature on effects of short-term exposures to PM_{10}, which has been used as a basis for the development of WHO AQGs and interim targets for 24-hour concentrations of PM (see below).

Table 1

WHOair quality guidelines and interim targets for particulate matter: annual mean concentrations[a]

	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	Basis for the selected level
Iinterim target-1 (IT-1)	70	35	These levels are associated with about a 15% higher long-term mortality risk relative to the AQG level.
Interim target-2 (IT-2)	50	25	In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to theIT-1 level.
Interim target-3 (IT-3)	30	15	In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2-11%] relative to the -IT-2 level.
Air quality guideline (AQG)	20	10	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to $PM_{2.5}$

[a] The use of $PM_{2.5}$ guideline value is preferred.

Short-term exposures

Whether the 24-hour or the annual average AQG, is the more restrictive tends to vary between countries, this being largely dependent on the specific characteristics of pollutant sources and their location. When evaluating the WHO AQGs and interim targets, it is generally recommended that the annual average take precedence over the 24-hour average since, at low levels, there is less concern about episodic excursions. Meeting the guideline values for the 24-hour mean will however protect against peaks of pollution that would otherwise lead to substantial excess morbidity or mortality. It is recommended that countries with areas not meeting the 24-hour guideline values undertake immediate action to achieve these levels in the shortest possible time.

Multi-city studies conducted in Europe (29 cities) and in the United States (20 cities) reported short-term mortality effects for PM_{10} of 0.62% and 0.46% per 10 μg/m³ (24-hour mean), respectively (Katsouyanni et al., 2001; Samet et al., 2000). A meta-analysis of data from 29 cities located outside western Europe and North America found a mortality effect of 0.5% per 10 μg/m³ (Cohen et al., 2004), very similar in fact to that derived for Asian cities (0.49% per 10 μg/m³)(HEI International Oversight Committee, 2004). These findings suggest that the health risks associated with short-term exposures to PM_{10} are likely to be similar in cities in developed and developing countries, producing an increase in mortality of around 0.5% for each 10 μg/m³ increment in the daily concentration. Therefore, a PM_{10} concentration of 150 μg/m³ would be expected to translate into roughly a 5% increase in daily mortality, an impact that would be of significant concern, and one for which immediate mitigation actions would be recommended. The IT-2 level of 100 μg/m³ would be associated with approximately a 2.5% increase in daily mortality, and the IT-3 level with a 1.2% increase (Table 2). For PM_{10}, the AQG for the 24-hour average is 50 μg/m³, and reflects the relationship between the distributions of 24-hour means (and its 99th percentile) and annual average concentrations.

Table 2

WHO air quality guidelines and interim targets for particulate matter: 24-hour concentrations[a]

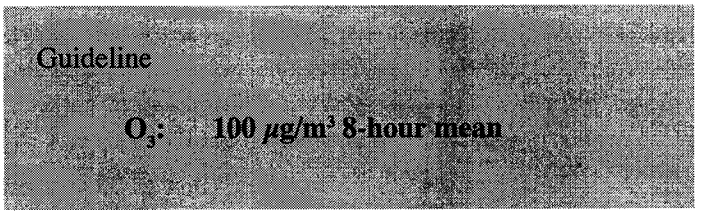
	PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)	Basis for the selected level
Interim target-1 (IT-1)	150	75	Based on published risk coefficients from multi-centre studies and meta-analyses (about 5% increase of short-term mortality over the AQG value).
Interim target-2 (IT-2)	100	50	Based on published risk coefficients from multi-centre studies and meta-analyses (about 2.5% increase of short-term mortality over the AQG value).
Interim target-3 (IT-3)*	75	37.5	Based on published risk coefficients from multi-centre studies and meta-analyses (about 1.2% increase in short-term mortality over the AQG value).
Air quality guideline (AQG)	50	25	Based on relationship between 24-hour and annual PM levels.

[a] 99th percentile (3 days/year).

* For management purposes. Based on annual average guideline values; precise number to be determined on basis of local frequency distribution of daily means. The frequency distribution of daily $PM_{2.5}$ or PM_{10} values usually approximates to a log-normal distribution.

Ultrafine particles (UF), i.e. particles smaller than 0.1 μm in diameter, have recently attracted significant scientific and medical attention. These are usually measured as a number concentration. While there is considerable toxicological evidence of potential detrimental effects of UF particles on human health, the existing body of epidemiological evidence is insufficient to reach a conclusion on the exposure–response relationship of UF particles. Therefore no recommendations can be provided as to guideline concentrations of UF particles at this point in time.

Ozone



Rationale

Since the publication of the second edition of the WHO Air quality guidelines for Europe (WHO, 2000) which sets the guideline value for ozone levels at 120 μg/m³ for an 8-hour daily average, little new information about the health effects of ozone has been obtained from either chamber studies or field studies. Significant additions to the health effects evidence base have, however, come from epidemiological time-series studies. Collectively these studies have revealed positive, small, though convincing, associations between daily mortality and ozone levels, which are independent of the effects of particulate matter. Similar associations have been observed in both North America and Europe. These latest time-series studies have shown health effects at ozone concentrations below the previous guideline of 120 μg/m³ but without clear evidence of a threshold. This finding, together with evidence from both chamber and field studies that indicates that there is considerable individual variation in response to ozone, provides a good case for reducing the WHO AQG for ozone from the existing level of 120 μg/m³ to 100 μg/m³ (daily maximum 8-hour mean).

It is possible that health effects will occur below the new guideline level in some sensitive individuals. Based on time-series studies, the increase in the number of attributable deaths brought forward is estimated to be 1–2% on days when the 8-hour mean ozone concentration reaches 100 μg/m³ over that when ozone levels are at a baseline level of 70 μg/m³ (the estimated background ozone level; see Table 3). There is some evidence that long-term exposure to ozone may have chronic effects but it is not sufficient to recommend an annual guideline.

Ozone is formed in the atmosphere by photochemical reactions in the presence of sunlight and precursor pollutants, such as the oxides of nitrogen (NOx) and volatile organic compounds (VOCs). It is destroyed by reactions with NO_2 and is deposited to the ground. Several studies have shown that ozone concentrations correlate with various other toxic photochemical oxidants arising from similar sources, including the peroxyacyl nitrates, nitric acid and hydrogen peroxide. Measures to control tropospheric ozone levels focus its precursor gas emissions, but are likely to also control the levels and impacts of a number of these other pollutants.

Hemispheric background concentrations of tropospheric ozone vary in time and space but can reach 8-hours average levels of around 80 μg/m³. These arise from both anthropogenic and biogenic emissions (e.g. VOCs from vegetation) of ozone precursors and downward intrusion of stratospheric ozone into the troposphere. Indeed, the proposed guideline value may occasionally be exceeded due to natural causes.

As ozone concentrations increase above the guideline value, health effects at the population level become increasingly numerous and severe. Such effects can occur in places where concentrations are currently high due to human activities or are elevated during episodes of very hot weather.

The 8-hour IT-1 level for ozone has been set at 160 μg/m³ at which measurable, though transient, changes in lung function and lung inflammation have been recorded in controlled chamber tests

in healthy young adults undertaking intermittent exercise. Similar effects were observed in summer camp studies, involving exercising children. Although some would argue that these responses may not necessarily be adverse, and that they were seen only with vigorous exercise, these views are counterbalanced by the possibility that there are substantial numbers of persons in the general population that might be more susceptible to the effects of ozone than the relatively young and generally healthy individuals who participated in the chamber study. Furthermore, chamber studies provide little information about repeated exposures. Based on time-series evidence, exposures at the IT-1 level are associated with an increase in the number of attributable deaths brought forward of 3–5% (see Table 3).

At 8-hour concentrations exceeding 240 μg/m³, significant health effects are considered likely. This conclusion is based on the findings of a large number of clinical inhalation and field studies. Both healthy adults and asthmatics would be expected to experience significant reductions in lung function, as well as airway inflammation that would cause symptoms and alter performance. There are additional concerns about increased respiratory morbidity in children. According to time-series evidence, exposure to concentrations of ozone of this magnitude, would result in a rise in the number of attributable deaths brought forward of 5–9%, relative to exposures at the estimated background level (see Table 3).

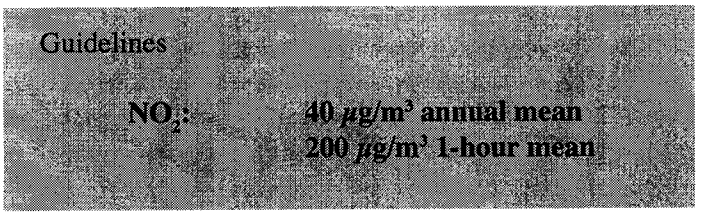
Table 3

WHO air quality guideline and interim target for ozone: 8-hour concentrations

	Daily maximum 8-hour mean ($\mu g/m^3$)	Basis for selected level
High levels	240	Significant health effects; substantial proportion of vulnerable populations affected.
Interim target-1 (IT-1)	160	Important health effects; does not provide adequate protection of public health. Exposure to this level of ozone is associated with: • physiological and inflammatory lung effects in healthy exercising young adults exposed for periods of 6.6 hours; • health effects in children (based on various summer camp studies in which children were exposed to ambient ozone levels). • an estimated 3–5% increase in daily mortality[a] (based on findings of daily time-series studies).
Air quality guideline (AQG)	**100**	Provides adequate protection of public health, though some health effects may occur below this level. Exposure to this level of ozone is associated with: • an estimated 1–2% increase in daily mortality[a] (based on findings of daily time-series studies). • Extrapolation from chamber and field studies based on the likelihood that real-life exposure tends to be repetitive and chamber studies exclude highly sensitive or clinically compromised subjects, or children. • Likelihood that ambient ozone is a marker for related oxidants.

[a] Deaths attributable to ozone. Time-series studies indicate an increase in daily mortality in the range of 0.3–0.5% for every 10 $\mu g/m^3$ increment in 8-hour ozone concentrations above an estimated baseline level of 70 $\mu g/m^3$.

Nitrogen dioxide



Rationale

As an air pollutant, nitrogen dioxide (NO_2) has multiple roles, which are often difficult or sometimes impossible to separate from one another:

i. Animal and human experimental studies indicate that NO_2 – at short-term concentrations exceeding 200 μg/m³ – is a toxic gas with significant health effects. Animal toxicological studies also suggest that long-term exposure to NO_2 at concentrations above current ambient concentrations has adverse effects.

ii. Numerous epidemiological studies have used NO_2 as a marker for the cocktail of combustion-related pollutants, in particular, those emitted by road traffic or indoor combustion sources. In these studies, any observed health effects could also have been associated with other combustion products, such as ultrafine particles, nitrous oxide (NO), particulate matter or benzene. Although several studies – both outdoors and indoors – have attempted to focus on the health risks of NO_2, the contributing effects of these other, highly correlated co-pollutants were often difficult to rule out.

iii. Most atmospheric NO_2 is emitted as NO, which is rapidly oxidized by ozone to NO_2. Nitrogen dioxide, in the presence of hydrocarbons and ultraviolet light, is the main source of tropospheric ozone and of nitrate aerosols, which form an important fraction of the ambient air $PM_{2.5}$ mass.

The current WHO guideline value of 40 μg/m³ (annual mean) was set to protect the public from the health effects of gaseous NO_2. The rationale for this was that because most abatement methods are specific to NO_x, they are not designed to control other co-pollutants, and may even increase their emissions. If, however, NO_2 is monitored as a marker for complex combustion-generated pollution mixtures, a lower annual guideline value should be used (WHO, 2000).

Long-term exposures

There is still no robust basis for setting an annual average guideline value for NO_2 through any direct toxic effect. Evidence has emerged, however, that increases the concern over health effects associated with outdoor air pollution mixtures that include NO_2. For instance, epidemiological studies have shown that bronchitic symptoms of asthmatic children increase in association with annual NO_2 concentration, and that reduced lung function growth in children is linked to elevated NO_2 concentrations within communities already at current North American and European urban ambient air levels. A number of recently published studies have demonstrated that NO_2 can have a higher spatial variation than other traffic-related air pollutants, for example, particle mass. These studies also found adverse effects on the health of children living in metropolitan areas characterized by higher levels of NO_2 even in cases where the overall city-wide NO_2 level was fairly low.

Recent indoor studies have provided evidence of effects on respiratory symptoms among infants at NO_2 concentrations below 40 μg/m³. These associations cannot be completely explained by co-exposure to PM, but it has been suggested that other components in the mixture (such as organic carbon and nitrous acid vapour) might explain part of the observed association.

Taken together, the above findings provide some support for a lowering of the current annual NO_2 guideline value. However, it is unclear to what

extent the health effects observed in epidemiological studies are attributable to NO_2 itself or to the other primary and secondary combustion-related products with which it is typically correlated. Thus it can be argued that the available scientific literature has not accumulated sufficient evidence to justify revising the existing WHO AQG for annual NO_2 concentrations. Nevertheless, since NO_2 concentrations in ambient air are routinely measured but those of other correlated combustion-derived pollutants are not, it seems reasonable to retain a prudent annual average limit value for NO_2. Such a limit allows for the fact that there may be direct toxic effects of chronic NO_2 exposure at low levels. In addition, maintaining the annual guideline value may help to control complex mixtures of combustion-related pollution (mainly from road traffic)

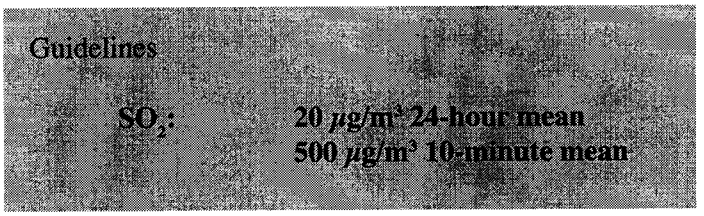
Short-term exposures

A number of short-term experimental human toxicology studies have reported acute health effects following exposure to 1-hour NO_2 concentrations in excess of 500 $\mu g/m^3$. Although the lowest level of NO_2 exposure to show a direct effect on pulmonary function in asthmatics in more than one laboratory is 560 $\mu g/m^3$, studies of bronchial responsiveness among asthmatics suggest an increase in responsiveness at levels upwards from 200 $\mu g/m^3$.

Since the existing WHO AQG short-term NO_2 guideline value of 200 $\mu g/m^3$ (1-hour) has not been challenged by more recent studies, it is retained.

In conclusion, the guideline values for NO_2 remain unchanged in comparison to the existing WHO AQG levels, i.e. 40 $\mu g/m^3$ for annual mean and 200 $\mu g/m^3$ for 1-hour mean.

Sulfur dioxide



Rationale

Short-term exposures

Controlled studies involving exercising asthmatics indicate that a proportion experience changes in pulmonary function and respiratory symptoms after periods of exposure to SO_2 as short as 10 minutes. Based on this evidence, it is recommended that a SO_2 concentration of 500 μg/m³ should not be exceeded over averaging periods of 10 minutes duration. Because short-term SO_2 exposure depends very much on the nature of local sources and the prevailing meteorological conditions, it is not possible to apply a simple factor to this value in order to estimate corresponding guideline values over longer time periods, such as one hour.

Long-term exposures (over 24-hours)

Early estimates of day-to-day changes in mortality, morbidity or lung function in relation to 24-hour average concentrations of SO_2 were necessarily based on epidemiological studies in which people are typically exposed to a mixture of pollutants. As there was little basis for separating the contributions of individual pollutants to the observed health outcomes, prior to 1987, guideline values for SO_2 were linked to corresponding values for PM. This approach led to the setting of an AQG value for SO_2 of 125 μg/m³ as a 24-hour average, after applying an uncertainty factor of 2 to the lowest-observed-adverse-effect level (WHO, 1987). In the second edition of the WHO *Air quality guidelines for Europe* (WHO, 2000), it was noted that later epidemiological studies documented separate and independent adverse public health effects for PM and SO_2, and this led to a separate WHO AQG for SO_2 of 125 μg/m³ (24-hour mean). The latest evidence to emerge includes a study conducted in Hong Kong (Hedley et al., 2002) where a major reduction in the sulfur content of fuels has been achieved over a very short period of time. This has been linked to substantial reductions in health effects (e.g. childhood respiratory disease and all-age mortality). Recent time-series studies on hospital admissions for cardiac disease in Hong Kong and London, produced no evidence of a threshold for health effects at 24-hour SO_2 concentrations in the range of 5–40 μg/m³ (Wong et al., 2002). Twenty-four hour SO_2 levels were significantly associated with daily mortality rates in 12 Canadian cities, which had an average concentration of only 5 μg/m³ (the highest mean SO_2 level was below 10 μg/m³) (Burnett et al., 2004). In the American Cancer Society (ACS) study (see Particulate matter), significant associations between SO_2 and mortality were observed for the 1982–1998 cohort in 126 United States metropolitan areas, in which the mean SO_2 concentration recorded was 18 μg/m³, and the highest mean, 85 μg/m³ (Pope et al., 2002). If there were a threshold for effects in either of these two studies, it would have to be very low.

There is still considerable uncertainty as to whether SO_2 is the pollutant responsible for the observed adverse effects or whether it is a surrogate for ultrafine particles or some other correlated substance. Both Germany (Wichmann et al., 2000) and the Netherlands (Buringh, Fisher & Hoek, 2000) have experienced a strong reduction in SO_2 concentrations over a decade, but although mortality also decreased with time, the association between SO_2 and mortality was not judged to be

causal in either case the fall in mortality and was instead attributed to a similar time trend in a different pollutant (PM).

In consideration of: a) the uncertainty of SO_2 in causality; b) the practical difficulty of attaining levels that are certain to be associated with no effects; and c) the need to provide a greater degree of protection than that provided by the present AQG, and assuming that reduction in exposure to a causal and correlated substance is achieved by reducing SO_2concentrations, there is a basis for revising the 24-hour guideline for SO_2 downwards adopting a prudent precautionary approach to a value of 20 $\mu g/m^3$.

Table 4

WHO air quality guidelines and interim targets for SO_2: 24-hour and 10-minute concentrations

	24-hour average ($\mu g/m^3$)	10-minute average ($\mu g/m^3$)	Basis for selected level
Interim target-1 (IT-1)[a]	125	–	
Interim target-2 (IT-2)	50	–	Intermediate goal based on controlling either motor vehicle emissions, industrial emissions and/or emissions from power production. This would be a reasonable and feasible goal for some developing countries (it could be achieved within a few years) which would lead to significant health improvements that, in turn, would justify further improvements (such as aiming for the AQG value).
Air quality guideline (AQG)	**20**	**500**	

[a] Formerly the WHO Air Quality Guideline (WHO, 2000).

An annual guideline is not needed, since compliance with the 24-hour level will assure low annual average levels. These recommended guideline values for SO_2 are not linked to those for PM. Since the revised 24-hour guideline may be quite difficult for some countries to achieve in the short term, a stepped approach using interim goals is recommended (see Table 4). For instance, a country could move towards compliance with the guideline by controlling emissions from one major source at a time, selecting from among motor vehicle sources, industrial sources and power sources (which would achieve the greatest effect on SO_2 levels for the lowest cost), and follow this up with monitoring of public health and SO_2 levels for health effect gains. Demonstrating health benefits should provide an incentive to mandate controls for the next major source category.

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The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution. Based on a review of the accumulated scientific evidence, the revised guideline values for the most common air pollutants are presented in this document. These guidelines are applicable across all WHO regions and inform policy-makers considering various options for air quality management in different parts of the world about the targets for air quality.

Public Health Ontario | Santé publique Ontario
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

July 20, 2011

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Dear Dr. Kyle:

As requested, some of the scientific staff and I have reviewed the updated modelling for emissions and ground-level concentrations for $PM_{2.5}$ provided in the *Further Evaluation and Updated Risk Assessment for Particulate Matter ($PM_{2.5}$) Facility Emissions* for the Durham York energy from waste project prepared by Stantec Consulting Ltd., dated July 11, 2011. We also reviewed the conclusions of an earlier peer review (from Environmental and Occupational Health Plus) and the conclusions of the Human Health Risk Assessment, completed for the incinerator in December 2009, with respect to the assessment of $PM_{2.5}$ to determine if they are still valid. A listing of the documents that were consulted is included at the end of this letter.

The HHRA completed December 2009 was part of an EA process followed by Durham York Region for the proposed incinerator. The HHRA concluded that chemical emissions from the facility 'would not lead to any adverse health risks to local residents, farmers or other receptors ... under either the initial operating design capacity of 140 000 tpy or the maximum design capacity of 400 000 tpy," with the exception that a "limited number of chemicals under the Process Upset Case of the 400 000 tpy maximum design capacity resulted in slightly elevated potential risks above the government benchmarks for human health." $PM_{2.5}$ was not among these exceptions. Recently, additional modelling predictions for $PM_{2.5}$ emissions and ground-level concentrations were prepared, where both condensable and filterable $PM_{2.5}$ were included (previously only filterable was modelled).

The information below is intended to assist in interpreting and understanding potential health risks associated with low (less than 0.1 $\mu g/m^3$) incremental increases in annual average concentrations of $PM_{2.5}$ in ambient air. Modelling methods, assumptions, input values, and results used in estimating ground-level concentrations and potential health risks were taken as given in the documents provided to us. Similarly, estimates of typical air concentrations of $PM_{2.5}$ in the study area were also used as given. Any changes or errors in these calculations and estimates might change the content of this review. As per your request, the review was confined to the most recent estimates of $PM_{2.5}$.

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Approach

The document containing updated analysis of $PM_{2.5}$ emissions and potential exposures, *Further Evaluation and Updated Risk Assessment for Particulate Matter ($PM_{2.5}$) Facility Emissions*, was reviewed. Where additional information was needed to understand the content of the analysis contained in that document or to perform calculations, the complete HHRA (Dec. 2009) or the authors (Stantec) were consulted directly. Information provided in *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide* (2006) was used to relate increases in mortality to increases in ambient air concentrations of $PM_{2.5}$. A summary of comments and responses written by Dr. Lesbia Smith and Mr. Ross Wilson, Environmental and Occupational Health Plus Inc., dated June 8, 2009, was also reviewed.

The predicted ground-level concentrations of $PM_{2.5}$ from Durham York Region were reviewed, as was the interpretation of the potential for human health effects. The HHRA included analysis of potential exposures, hazards and health risks for two different scenarios: annual capacity of 140 000 tpy and 400 000 tpy. The more recent modelling for $PM_{2.5}$ was restricted to 140 000 tpy and our comments are based on that scenario. We did not review any aspect of the EA process followed by the proponent or the submission for a Certificate of Approval.

Comments

***Potential Health Effects of** $PM_{2.5}$*

A recent review by US EPA (2011) evaluated the strength of evidence from epidemiological, toxicological and human studies of $PM_{2.5}$ of long-term or short-term exposure and several endpoints. With respect to long-term exposure, the strongest evidence for possible health effects is for the following:

- increased mortality due to cardiovascular disease
- increased mortality due to respiratory disease
- other respiratory effects
- developmental and reproductive effects, e.g., low birth weight
- carcinogenic, mutagenic and genotoxic effects, e.g., lung cancer mortality

The most recent evidence suggests that long-term $PM_{2.5}$ exposure in areas with mean concentrations of 13.2-29 $\mu g/ m^3$ leads to increased risk of human mortality (US EPA 2009). In a landmark study, Pope *et al.* (2002) demonstrated that the major contributors to mortality from $PM_{2.5}$ were cardiopulmonary causes and lung cancer. The strongest evidence of mortality comes from mortality due to cardiovascular disease (US EPA 2009). Toxicologic and controlled human studies provide support for a number of potential biologic mechanisms by which $PM_{2.5}$elicits health effects (US EPA 2011). There are likely multiple mechanistic pathways involving the heart, lungs, systemic vasculature and overall oxidative stress that jointly account for observed increased cardiopulmonary morbidity and mortality (Dockery and Pope 2006).

Assessment of Health Impacts

One typical output of an HHRA is a series of hazard quotients (HQs) and/or hazard indices (HIs) and incremental lifetime cancer risks (ILCRs). HQs and ILCRs may be summed across routes and pathways of exposure and chemicals, depending on the potential for joint action between different substances. The calculation of HQs/HIs and ILCRs requires toxicological reference values, which are not available for all substances, e.g., $PM_{2.5}$. As an alternative for $PM_{2.5}$ and other conventional air pollutants, the HHRA

prepared for the EA and the updated analysis present 'concentration ratios' calculated by dividing a predicted ground-level concentration by two different available air guidelines for $PM_{2.5}$ (the Canada-wide Standard and the WHO Guideline).

While comparing predicted ambient concentrations with target or regulatory concentrations can be useful in assessing whether or not there is potential to exceed these levels, it is not particularly informative with respect to potential human health risks. This is because there is no consistent relationship between risks to human health and ambient air quality standards, objectives or targets.

For example, the Canada-wide Standard for $PM_{2.5}$ of 30 $\mu g/m^3$ was established as part of an effort to reduce exposure of Canadians to $PM_{2.5}$. The numerical component of the CWS was based on what was believed to be achievable everywhere in Canada. In practice, this meant looking at what progress could be achieved in reducing levels in the part of the country with the highest $PM_{2.5}$ concentrations in ambient air. While the numerical component of the Canada-wide Standard for particulate matter is frequently referenced, the standard also contains language on keeping clean areas clean, which is an integral and important part of the standard, in addition to the numerical target. The authors of the CWS recognized that no threshold of effect had been identified, and to my knowledge no one claims that meeting the numerical target provides complete protection against adverse effects on health.

The WHO Air Quality Guideline of 10 $\mu g/m^3$ is a target ambient air concentration. The target level was set at a concentration which the WHO believed would "significantly reduce the health risks" (the precise improvement was not quantifiable due to statistical uncertainty) and which had been "shown to be achievable in large urban areas in highly developed countries..." In a review of the available epidemiological work on associations between ambient air concentrations of $PM_{2.5}$ and rates of mortality, WHO observed that health effects have been observed epidemiologically, *starting* at concentrations ranging between 11-15 $\mu g/m^3$ (WHO 2006). WHO has also developed a series of interim targets, recognizing that many cities will have difficulty reaching 10 $\mu g/m^3$. It should be appreciated that unlike the US EPA, Environment Canada and the Ontario MOE, WHO has no responsibility or authority for regulating emissions or ambient air concentrations, and is not accountable for the achievement of its target levels.

According to the WHO assessment, exposure to $PM_{2.5}$ at concentrations below 10 $\mu g/m^3$ may elicit toxic effects, but epidemiological methods are not able to demonstrate any associations. WHO assumes a linear dose-response relationship for exposure to $PM_{2.5}$ concentrations in excess of 11-15 $\mu g/m^3$.

While for 'compliance' purposes, comparison of predicted $PM_{2.5}$ concentrations with targets or standards may be helpful, it doesn't give much insight into how large or small the potential health impacts may be. For this reason, we have provided an alternative approach below.

Analysis of Potential Health Effects Associated with Energy from Waste Facility

According to the WHO, the observed relationship between exposure to $PM_{2.5}$ and mortality due to respiratory or cardiovascular disease increases by 6% for every 10 $\mu g/m^3$ increase in ambient air concentration of $PM_{2.5}$. Below 11-15 $\mu g/m^3$, the precise shape of the dose-response relationship is uncertain, but assuming that the slope of the line at approximately 10 $\mu g/m^3$ is the same as at higher concentrations, a series of estimates of increased mortality was computed for different operating scenarios developed for the planned incinerator (see Table 1 below), using the upper and lower limits of the 6% increase per 10 $\mu g/m^3$ of $PM_{2.5}$ as per the WHO assessment.

The mortality calculations assume that predicted ground-level concentrations from the air dispersion modelling are close to potential exposures in the breathing zone of people; crude mortality data from Durham for 2005 have been used for baseline mortality risks.

Table 1 below provides comparisons between the 2009 and 2011 predictions provided by Stantec, based on Project and Upset Scenarios and using annual average concentrations from any receptor location or all receptor locations combined.

Table 1: Potential Mortality Attributable to Predicted Emissions from the Energy for Waste facility

Scenario	Increased Mortality, percent*	Annual Additional Number of Deaths per 100 000 People	Annual Additional Number of Deaths per Population of Study Area (per 168 000 people)
2009 Predictions Highest annual average at any one receptor location, Project and Upset Scenario, 0.02 $\mu g/m^3$	0.004%-0.02%	0.02-0.1	N/A
2011 Predictions Annual average over all receptor locations, Project Scenario, 0.01 $\mu g/m^3$	0.002% to 0.011%	0.01 – 0.06	0.02-0.1
Annual average over all receptor locations, Upset Scenario, 0.013 $\mu g/m^3$	0.0026% - 0.0143%	0.01-0.08	0.02-0.1
Highest annual average at any one receptor location, Project Scenario, 0.03 $\mu g/m^3$	0.006%-0.03%	0.03-0.2	N/A
Highest annual average at any one receptor location, added to baseline, Upset Scenario, 0.04 $\mu g/m^3$	0.008%-0.04%	0.04-0.2	N/A

*Note: Ranges correspond to the 95% confidence intervals in the WHO air quality guidelines.

With respect to the above estimates , it should be appreciated that:

- WHO estimates that increased mortality due to exposure to $PM_{2.5}$ is observable starting at ambient air concentrations of 11-15 $\mu g/m^3$. The annual average $PM_{2.5}$concentration in the study area is approximately 10 $\mu g/m^3$; 10.2 ug/m^3 and 10.23 $\mu g/m^3$ (the updated prediction for the project scenario of the difference between ambient air concentrations in the study area with and without the incinerator) is outside this range, and the slope from WHO used in calculating the incremental mortality may not be accurate.

- The difference between mortality rates for different scenarios and between the 2009 and 2011 estimates is less than the confidence limits around the estimates. Put another way, predicted

mortality for the different annual average $PM_{2.5}$ concentrations is, when uncertainty is included, the same.

- An increment of 0.03 or 0.04 $\mu g/m^3$ added to the annual average $PM_{2.5}$ concentrations in the area may not be detectable in a monitoring programme.
- The potential increases in mortality due to emissions, regardless of the scenario (whether Project or Upset Scenario, or whether using the 2009 or 2011 predictions for $PM_{2.5}$ emissions and ground-level concentrations), would not be detectable in an epidemiological study.

Acceptable Risks

Estimating the magnitude of a potential exposure to a hazardous substance, or the magnitude of a potential health risk is based on a scientific and technical assessment. In contrast, the acceptability of potential health risks is inherently a personal and/or social judgement. The acceptability of a potential health risk will vary between different individuals and in different contexts.

In their June 8, 2009 letter, Dr. Smith and Mr. Wilson state: "Overall, this review team holds the opinion that this industrial installation, if it performs as specified and assumed in this SSHHRA, will not pose unacceptable risks to persons in the vicinity of the site, and by extension, to those residents beyond. Said differently, this installation as proposed will not pose an unacceptable public health risk."

The risks estimated in the table above are within the range deemed acceptable by regulatory authorities. In that respect, our assessment and conclusion for $PM_{2.5}$ is consistent with that reached earlier by Dr. L. Smith. However, as a review of many environmental controversies teaches us, acceptability is very much in the 'eye of the beholder' and for some groups and individuals it is unlikely that any degree of risk is acceptable.

Conclusion

While HHRAs are an important tool in assessing the potential risk from proposed new sources of emissions, standard risk assessment outputs may not always provide useful decision criteria for accepting or rejecting proposed facilities. Keeping clean areas clean is important. It is important to verify that a facility is needed, sited optimally, and that emissions are controlled to the greatest extent feasible.

If I need to provide clarification or elaboration on any of the above, please let me know.

Sincerely,

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References

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Documents Reviewed

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Smith, L.F. and Wilson, R. (2009), Review of JW Site Specific Human Health Risk Assessment, May 2009 and Environmental Surveillance , Appendix P – Peer Review Comments

Canadian Council of Ministers of the Environment (2000), Canada-wide Standards for Particulate Matter (PM) and Ozone

World Health Organization (2005), WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Summary of risk assessment

Smith, L. (2007), Energy from Waste Facility in the Region of Durham

Jacques Whitford (2009), Site Specific Human Health and Ecological Risk Assessment – Technical Study Report Report No. 1009497

Jacques Whitford (2009), Final Report, Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities Project No. 1009497.06

Jacques Whitford (2009), Final Report, Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities Project No. 1009497 Appendix C

Stantec Consulting Ltd. (2011), Further Evaluation and Updated Risk Assessment for Particulate Matter ($PM_{2.5}$) Facility Emissions – Durham York Residual Waste Study

Kyle, R.J., (2009), EFW Risk Assessment and Environmental Surveillance, Report No. 2009-COW-01

Kyle, R.J. (2007) Energy from Waste (EFW) Facilities, Report No. 2007-MOH-20

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Health Impact Evaluation and Issues Management

June 8, 2009

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Re: Peer Review of the DRAFT JW SSHHRA Technical Study Report; Durham-York Residual Waste EA Study. May 2009. Report no. 1009497

Dear Doctor Kyle,

In accordance with your mandate, I am attaching the review of the Draft Jacques Whitford (JW) SSHHRA and recommendations for surveillance of the proposed facility.

The detailed review of the Site Specific Human Health Risk Assessment (SSHHRA) was carried out by Ross Wilson, experienced risk assessor and certified toxicologist of the American Board of Toxicology. Mr. Wilson and I participated in the reviewer discussions with JW staff and with other reviewers providing clarifications and justifications of the JW paper, and anticipated changes. Where specific changes were expected and agreed upon by the reviewers and JW, we assumed that these would be made in the Final SSHHRA and made our comments fit accordingly with the agreed upon changes. We also communicated with JW (Dr. Chris Ollson) on several occasions by e-mail and telephone to request additional data, graphs, and related information not available in the Draft SSHHRA report.

Mr. Wilson and I maintained a separate independent approach in carrying out this review which we believe is reflected in our communications with JW and in this report to you. Neither of us has a stated interest in the success or failure of this undertaking and thus, confirm that we do not have a conflict of interest.

Mandate and responses:

1. What are the human health risks? Are the health risks acceptable and if so, according to what standards? If the health risks are acceptable, can the proposed EFW facility be considered "safe"?

Response: Our review supports the findings of the SSHHRA. We find that the key receptors, chemicals and exposure pathways have been evaluated; the methods used to estimate exposures are appropriate; the toxicological reference values used are reasonable and drawn from a variety of reliable international sources; and the risk characterization results are defensible.

We conclude that this SSHHRA is satisfactory. Although it would be possible to use different receptor characteristics, exposure assumptions and toxicological reference values (and, thus, arrive at different Hazard Quotient and Incremental Lifetime Cancer Risk estimates), we consider it unlikely that the conclusions of the SSHHRA would change.

In most cases, we expect the proposed installation will not provide any appreciable change in the concentration of chemicals in air, soil, dust, water or food. For example, the maximum Ground Level Concentration of $PM_{2.5}$ on an annual basis under Normal Operations is expected to be increased by 0.022 $\mu g/m^3$ versus a current baseline concentration of 9.8 $\mu g/m^3$. This, in our opinion, is insignificant. Similarly, the projected increases in the concentration of metals, polycyclic aromatic hydrocarbons, dioxins/furans, polychlorinated biphenyls and other chemicals are very minor relative to current concentrations.

It is noted that specific risk estimates will vary from the draft SSHRA that we reviewed versus the final SSHRA that JW will issue in the future; however, based on our current information, it is not expected that the overall conclusions of the SSHRA will change based on the information provided to us.

Overall, this review team holds the opinion that this industrial installation, if it performs as specified and assumed in this SSHHRA, will not pose unacceptable risks to persons in the vicinity of the site, and by extension, to those residents beyond. Said differently, this installation as proposed will not pose an unacceptable public health risk.

2. Is the SSHHRA methodology sound and consistent with accepted standards such as Health Canada's Canadian Handbook on Health Impact Assessments and Environment Canada's Discussion Paper on the Precautionary Principle?

   Response: The SSHHRA used methods that are considered to be acceptable and does meet accepted standards. The SSHRA follows an accepted risk assessment

approach consistent with Health Canada risk assessment guidance provided in various documents that include but are not limited to:

- CCME (Canadian Council of Ministers of the Environment). 2006. A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. CCME, Winnipeg, Manitoba.

- Health Canada. 2004a. Federal Contaminated Site Risk Assessment in Canada - Part I and II: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Health Canada, Ottawa, Ontario.

- Health Canada, 2004b. Canadian Handbook on Health Impact Assessment. Ministry of Health. Health Canada, Ottawa, Ontario.

- Health Canada. 2008. Federal Contaminated Site Risk Assessment in Canada - Part V: Guidance on Human Health Detailed Quantitative Risk Assessment of Chemicals ($DQRA_{CHEM}$). Health Canada, Ottawa, Ontario.

With respect to the *precautionary principle*, we consider that the SSHHRA meets the requirements of this approach. As noted by Environment Canada (2001)[1], the precautionary principle is "a distinctive approach to managing threats of serious or irreversible harm where there is scientific uncertainty." It represents a regulatory philosophy whereby regulatory action will be taken in the absence of full scientific certainty of risk. Although we don't know with full certainty the actual risks posed by the chemicals released, this uncertainty does not preclude use of risk assessment as part of decision-making process (i.e., it is not a reason to not complete the risk assessment).

Use of the precautionary principle is also inherently found within the methods of the SSHHRA. It can be found through the use of conservative (protective) factors to estimate risks when there is not full certainty of the input parameters (e.g., 95^{th} percentile concentrations, exaggerated time spent at the site, toxicity reference values with uncertainty factors, etc.). The implementation of an environmental surveillance program also is considered to meet the objectives of the precautionary principle.

3. What environmental surveillance program should be recommended to Regional Council and the MOE, taking into account your earliest report to me, the best practices review, and public concern?

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[1] **Environment Canada. 2001. A Canadian Perspective on the Precautionary Approach/Principle: Discussion Document. Environment Canada, Ottawa, Ontario. Available at:** http://www.ec.gc.ca/econom/discussion_e.htm

Response: The surveillance program suitable to this facility is expected to consist of facility operations monitoring, stack measurements, and environmental media measurements to confirm compliance. Specifically, there is great concern among certain members of the general public about chemicals arising from the facility operations themselves, dioxins and furans.

The standards applied for these chemicals should meet or exceed the more stringent of the Ontario Guidelines or EU directive chemical emissions standards in accordance with the JW Best Practices Review.[2]

In the case of the need for monitoring of environmental media, this is considered to be useful and is recommended. The modelers have predicted that the facility will not appreciably contribute to increased concentrations in the environment. Air and soil monitoring is recommended to ensure compliance. However, if concentrations are found to be greater than those assumed in the SSHHRA, additional flora and fauna monitoring will help to reassure that human health is protected and may also alleviate some of the concern in the general public.

4. Is there any other human health related advice I should be providing Regional Council and the MOE?

   Response: This facility is not likely to pose an unacceptable public health risk, if it functions as assumed in the JW SSHHRA Report. In addition, the environmental surveillance which is likely to be in place will ensure compliance with the emissions requirements by providing hard data to support any conclusions on environmental and health impacts.

   Notwithstanding, communities may expect that the Medical Officer of Health provide ongoing relevant health information as required by the Ontario Public Health Standards and Protocols. Details of what the public expects may be explored through community consultations or other sources of data gathering about community residents available to local public health agencies in Ontario (i.e., Rapid Surveys).

5. Is there any human health reason that the completed EA shouldn't be forwarded to the MOE to complete the process?

   Response: In our opinion, there is no reason relating to the human health impacts forecast by this SSHHRA that precludes forwarding to the MOE to complete the process, provided that the Final Report is in concordance with the caveats expressed in our review.

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[2] **Final Report: Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities. February 2009.**

6. Surveillance

Although the act of sampling and chemical analysis of human tissues such as blood or urine is relatively easy, there are more difficult challenges in entertaining human testing. Among these challenges are: 1. the use of humans as sentinels to test exposure hypotheses which are predicted by the SSHHRA to be below a significant signal; 2. The methodological challenges of obtaining large groups to examine given the very low level of exposure forecast; 3. the ethical issues of selective participation, individual interpretation and potential demand of the use of results for diagnostic, prognostic or therapeutic purposes. Interpretation of the significance of individual results is available for a limited number of substances and not for the vast majority of chemicals of concern. For these important reasons, ethical and medical, human biological monitoring is not recommended as a facility surveillance tool in this circumstance.

The above constitutes our team deliberations and is a summary of our report to you, attached.

Lesbia F. Smith, MD
Ross Wilson, MSc, DABT

Review of JW Site Specific Human Health Risk Assessment, May 2009 and Environmental Surveillance

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08 June 2009

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Introduction

Dr. Lesbia F. Smith (Environmental & Occupational Health Plus Inc.) has been retained as consultant to Dr. Robert Kyle, Commissioner & Medical Officer of Health of the Region of Durham, to review documents arising from the Environmental Assessment process for an energy from waste (EFW) facility to be sited in the Region of Durham. The site selected for the facility is in Clarington. The team undertaking the current Review and development of environmental surveillance advice are Lesbia F. Smith, medical doctor and environmental health specialist, and Ross Wilson, risk assessor and diplomate of the American Board of Toxicology. The team draws its experience for this project from involvement throughout the process as external reviewer for the Generic Risk Assessment[1] (Dr. Smith), authoring the report on health effects of EFW facilities[2] (Dr. Smith), reviewing the methodology report on JW Report on Best Practices[3] (Dr. Smith), Reviewer of the JW DRAFT Best Practices Report[4] (Dr. Smith), numerous risk assessments and standard setting documents in support of risk assessment (Mr. Wilson) and public health protection (Mr. Wilson and Dr. Smith). Details of these activities are highlighted in our Curricula Vitae.

The purpose of this report is to provide Dr. Kyle with an assessment of the Draft JW Site Specific Human Health Risk Assessment, May 2009, and to update advice on environmental surveillance for the proposed facility in consideration of the various reports and public concerns.

Mandate

The specific questions posed of the review team are as follows:

1. What are the human health risks? Are the health risks acceptable and if so, according to what standards? If the health risks are acceptable, can the proposed EFW facility be considered "safe"?

2. Is the SSHHERA methodology sound and consistent with accepted standards such as Health Canada's Canadian Handbook on Health Impact Assessments and Environment Canada's Discussion Paper on the Precautionary Principle?

3. What environmental surveillance program should be recommended to Regional Council and the MOE, taking into account your earliest report to me, the best practices review, and public concern?

4. Is there any other human health related advice I should be providing Regional Council and the MOE?

5. Is there any human health reason that the completed EA shouldn't be forwarded to the MOE to complete the process?

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[1] Smith LF. York-Durham EFW Peer Review of the Generic Risk Assessment, May 2007
[2] Smith LF. Energy from Waste Facility in the Region of Durham September 28, 2007
[3] JW. Methodology for a Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities. October 2008.
[4] JW. Final Report: Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities. February 2009

The responses to these questions arise from the review of the SSHHRA and consideration of surveillance approaches from the Best Practices Review, and relevant literature.

Review of the Site Specific Human Health Risk Assessment

Scope of the Review

The focus of the review is to examine the conclusions of the Jacques Whitford Environment Limited (JW) site specific human health risk assessment (SSHHRA) and to determine if they are scientifically-defensible and accurate. The main document considered in this review was **JW. 2009**. *Site Specific Human Health and Ecological Risk Assessment – Technical Study Report. May 2009. Draft report.* To supplement the above report, JW provided additional information on various aspects of the SSHHRA through email and telephone correspondence with the review team. This review of the SSHHRA has considered all of the above information available to June 5, 2009.

Validation of exposure point concentrations is considered to be outside of the mandate of this review. We note that this review of the SSHHRA has not evaluated the accuracy of the exposure point concentrations (from the air modelling of emissions) and thus, all of the exposure point concentrations assumed in the SSHHRA are assumed to be accurate.

Review Comments

Review comments are organized within the SSHHRA framework, by responding to a series of review questions, as provided below.

Does the SSHHRA follow the generally accepted SSHHRA framework?

The JW SSHHRA generally follows the accepted framework. The SSHHRA is presented in a straightforward and easy to follow manner. The SSHHRA is based on guidance that is consistent with Health Canada (HC), the World Health Organization (WHO) and the US Environmental Protection Agency (US EPA). These agencies provide a number of guidance documents that are useful for evaluation of health risks from such a facility. Overall, the approach used by JW is considered to follow an acceptable framework for SSHHRA.

Does the SSHHRA problem formulation identify the appropriate chemicals, receptors and exposure pathways?

The SSHHRA has identified the appropriate chemicals, receptors and exposure pathways of concern that are likely to drive human health risks and, thus, require evaluation in the risk assessment. The problem formulation identified the following chemicals requiring evaluation due to their inherent toxic potential *and* presence in stack emissions and other sources of release:

- Criteria pollutants (sulphur dioxide [SO_2], hydrogen chloride, hydrogen fluoride, nitrogen dioxide [NO_2], carbon monoxide [CO], particulate matter [as total, PM_{10} and $PM_{2.5}$] and ammonia);
- Metals and other inorganic elements;

- Polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs);
- Polychlorinated biphenyls (PCBs);
- Chlorinated monocyclic aromatics; and
- Volatile organic compounds (VOCs).

Although other chemicals may be released from the facility, the chemicals evaluated in the JW SSHHRA represent the substances of greater concern from a toxicological perspective and are typically evaluated in such an assessment. Consequently, if there are acceptable risks[5] from these chemicals, we can conclude with reasonable confidence that there will be no unacceptable risks from other chemicals not formally evaluated in the JW SSHHRA because risks would be even lower.

During our discussions with the JW team, we noted that a number of extended explanations would be required in order to fully justify the conclusions. JW committed to provide additional information in their final report on their rationale for not including ozone, dioxin-like PCBs and acrolein in the SSHHRA. In the case of ozone, JW has noted that the exclusion of ozone from such a facility is commonly accepted by air dispersion modelers at the Ontario Ministry of Environment (MOE). In the case of dioxin-like PCBs and acrolein, JW has indicated that they do not consider these chemicals to be key drivers in the SSHHRA and they will provide the justification for this conclusion.

The receptors of concern evaluated in the SSHHRA were *persons* living, working, going to school/daycare, recreating or consuming food from the area. These notional persons or receptors are considered to be representative of the *maximum exposed persons*. It is noted that Figure 3-4 (showing specific receptor locations) was omitted from the original JW SSHHRA report and was subsequently provided to the review team. Persons of all ages were considered in the SSHHRA. It is noted that pregnant women are inherently included in the assessment (i.e., TRVs are developed for protection of all receptors with special emphasis on pregnant women and their fetuses).

The exposure pathways evaluated in the SSHHRA are consistent with HC and US EPA guidance. The JW SSHHRA represented a multi-pathway analysis where the following exposures routes were considered (depending upon the receptor (*person*) of concern):

- Inhalation of air;
- Incidental ingestion and skin contact with soil/dust;
- Ingestion and skin contact with surface water;
- Consumption of plants, livestock (including beef, poultry, pork, milk and eggs), wild game and fish.

Does the SSHHRA exposure assessment accurately estimate exposures from the site?

The exposure assessment has been completed according to available guidance and has used appropriate input parameters and equations to estimate exposure. We consider that the approach used in the JW SSHHRA provides a reasonable estimate of anticipated exposures for the specific receptors. The JW SSHHRA is based on receptor characteristics and exposure equations that are consistent with HC guidance for estimation of exposures.

[5] Acceptable risks from substances emitted refer to their regulatory level of risk as calculated using methods from Health Canada, US EPA, and WHO guidance documents.

Certain issues were identified in the review of the exposure assessment as follows:

- The assumed air concentrations were not provided in the JW SSHHRA. In subsequent correspondence with JW, the assumed air concentrations for Normal Operations and Upset conditions were provided for our consideration. These were absolutely necessary to determine the integrity of the resulting calculations.
- The assumed exposure point concentrations for certain chemicals were not provided in the JW SSHHRA (e.g., many of the PAHs). In subsequent correspondence with JW, the assumed exposure point concentrations were forwarded to our team. These were absolutely necessary to determine the integrity of the resulting calculations.
- Our initial assessment of the rates of fish and wild game consumption was that they were too low. In subsequent correspondence with JW, we were informed that these have been revised and greater consumption rate has now been assumed that is more representative of upper bound consumption. JW has indicated that it is unlikely that such a revision of intake from this pathway will result in any change in conclusions about risk (i.e., risks will still be well below the acceptable level).
- Communications with JW has indicated that the potential for additional chemicals in breast milk will be discussed in the final SSHHRA.
- Communications with JW has indicated that the significance of slightly higher soil ingestion rates will be discussed in the final SSHHRA.

We note that the expected increase in the concentration of chemicals of concern in air, soil, plants and animals attributable to the proposed facility is very small and is not likely not be detectable from current background conditions. This is of particular importance when considering environmental measurements of chemicals of concern as a form of facility operations surveillance.

Overall, it appears that exposure assessment was appropriately completed and is unlikely to underestimate exposures that persons would experience from the facility. We note again that the methods used to estimate exposure point concentrations were not part of the current review. We have assumed, therefore, that the exposure point concentrations presented provide reasonable estimates of environmental concentrations. If other reviewers identify issues with the predicted exposure point concentrations, our conclusions on the adequacy of the exposure assessment would need to be re-visited.

Does the SSHHRA toxicity assessment accurately estimate the potency of the substances?

The toxicity assessment provides a reasonable estimate of the toxicological potency of the substances of concern. Many agencies provide toxicological reference values (TRVs) and for all chemicals of concern, TRVs were identified from MOE, HC, Environment Canada, Alberta Environment, US EPA, WHO, California EPA and Texas Commission on Environmental Quality, Agency for Toxic Substances and Disease Registry (ATSDR) and the Netherlands Institute of Public Health and the Environment (RIVM).

No pre-defined toxicological hierarchy was used to identify toxicological reference values (i.e., the SSHRA was not based on any predetermined rules that one health agency was preferable to another). Instead, TRVs were selected on a chemical-by-chemical basis. Where appropriate, TRVs were identified for short-term (1 hour and 24 hour exposures) and long-term (continuous exposure for a lifetime).

Emphasis was placed on use of inhalation TRVs to evaluate inhalation routes and oral TRVs to evaluate oral and dermal exposures. This is considered to be consistent with health agency guidance.
We consider the approach used by JW acceptable. Although any number of TRVs is available for the same substance, we are not aware of any other values that should have been used and that could have changed the overall conclusions. Notwithstanding the above, certain issues were identified in the review of the toxicity assessment:

- The toxicological reference value for benzene in Table 7-3 was 100 times lower than reported in the Appendix H. However, the correct value (value cited in Appendix H) was used in the JW SSHHRA calculations.
- For criteria pollutants $PM_{2.5}$, SO_2, NO_2 and CO, Health Canada (2004)[6] provides an approach for estimation of *mortality effects* rather than toxicity effects beyond a straight comparison to criteria. In subsequent correspondence, JW stated that consideration of mortality effects would not impact the SSHHRA and has indicated that the rationale for lack of consideration of such effects will be provided in a revised report.
- In some cases, acute toxicity reference values were found to be lower than chronic values (e.g., mercury); however, this was mostly due to variations in approaches by different health agencies and will not influence the SSHHRA results significantly.
- Communications with JW has indicated that the significance of the MOE reference dose for lead (1.8 µg/kg bw/day) will be discussed in the final SSHHRA; however, the conclusions of the SSHRA are not expected to change with this revision. It is also noted that the TRV for lead is currently under review by HC but to date, there is no official position from HC on this. In addition, the exposure that persons in the vicinity of the proposed facility are predicted to be very minor compared to typical non-facility sources of exposure.

Overall, we are not aware of any other TRVs that should have been used and which would have resulted in distinctly contradictory conclusions from those presented in the SSHHRA.

Does the SSHHRA risk characterization accurately represent health risks?

The results of the SSHHRA are considered to accurately represent health risks. Health risks for evaluation of non-carcinogens were presented as Hazard Quotient (HQ) values (acceptable HQ = 0.2 for most chemicals) while risks for carcinogens were provided as Incremental Lifetime Cancer Risks (acceptable Incremental Lifetime Cancer Risk of 1×10^{-6}). This is the usual technical nomenclature to express risks in SSHHRAs.

[6] Health Canada. 2004. Estimated Number of Excess Deaths in Canada Due to Air Pollution. Health Canada, Ottawa, Ontario.

Key Findings

These are the key findings of this review:

- Risk estimates appear to be accurately estimated.
- Although certain changes to certain exposure assumptions are planned for the final HHRA (e.g., rate of fish/wild game consumption) and will alter the risk estimates provided, we consider it unlikely that these changes would alter the overall conclusions of the SSHHRA.
- Although certain risk estimates in Tables 7-15 and 16 are termed "acute", JW provides some of these risk estimates for chronic exposure durations. Communications with JW indicate that these risk estimates will be revised accordingly for the final SSHHRA.
- Communication with JW indicates that the management of "upsets" (facility upset conditions) will be further discussed. We have no criticism of the resulting risks as presented.
- Communications with JW indicate that the risks from mixtures will be further discussed.
- Although *baseline risks* are elevated above HQ values of 1 and Lifetime Cancer Risk estimates of 1×10^{-6}, the increased risks that are estimated from the proposed facility are considered to be acceptable and much lower than these values. In all cases, the concentrations attributed to the project alone and the upset conditions situations scenarios forecast that exposures will be well below acceptable toxicological reference values, and therefore present no unacceptable risks.
- In some cases, HQ values from background sources are greater than 1 and Lifetime Cancer Risks are greater than 1×10^{-6}. However, such scenarios do not mean that absolutely no additional exposures can occur (at least from a regulatory perspective). Instead, health agencies and scientists tend to evaluate issues on a chemical specific "case-by-case" basis. In the case of PCDD/Fs and PCBs, these are the chemicals contributing the greatest background risks; however, the increased exposure from the facility for these chemicals is quite minor by comparison (on the order of 0.5% increase of total exposures - see Table 7-34) and such values do not increase risk significantly. From the scientific perspective, these small increased risks are considered trivial because the greatest component of risk is from non-facility sources (i.e., food).

Summary

Overall, our review supports the findings of the SSHHRA. Our key findings are highlighted below:

- The key receptors, chemicals and exposure pathways have been evaluated.
- The methods used to estimate exposures are considered appropriate.
- The toxicological reference values used are reasonable and drawn from a variety of reliable international sources.
- The risk characterization results are defensible.

Conclusions

We consider this SSHHRA satisfactory. Although it would be possible to use different receptor characteristics, exposure assumptions and toxicological reference values, we consider it unlikely that the overall conclusions of the SSHHRA would change.

In most cases, we expect the proposed installation will not provide any appreciable change in the concentration of chemicals in air, soil, dust, water or food. For example, the maximum Ground Level Concentration of $PM_{2.5}$ on an annual basis is expected to be increased by 0.022 $\mu g/m^3$ versus a current baseline concentration of 9.8 $\mu g/m^3$. This, in our opinion, is insignificant from a health risk perspective. Similarly, the projected increases in the concentration of metals, PAHs, PCDD/Fs, PCBs and other chemicals are very minor relative to current concentrations and would not result in unacceptable health risks.

In the case of the need for monitoring of environmental media, this is considered to be useful and is recommended under some circumstances. The modelers have predicted that the facility will not appreciably contribute to increased concentrations in the environment. Air and soil monitoring is recommended to ensure compliance. However, if concentrations are found to be greater than those assumed in the HHRA, additional flora and fauna monitoring will help to reassure that human health is protected and may also alleviate some of the concern in the general public.

Overall, this review team holds the opinion that this industrial installation, if it performs as specified and assumed in this SSHHRA, will not pose unacceptable risks to persons in the vicinity of the site, and by extension, to those residents beyond. Said differently, this installation as proposed is not likely to pose a public health risk.

Surveillance Issues and Recommendations

Stakeholders have different knowledge, perspectives, professional and lay opinions about what constitutes the proper oversight for an EFW facility as proposed for Durham Region and to be located in Clarington. The calls for public health surveillance once focused on "human biological monitoring". Two reports were commissioned. The first[7] was a review of health studies and potential health effects associated with energy from waste facilities derived from the published literature of studies of communities around energy from waste facilities. Results indicated that there was no evidence for or against actual impacts. The second[8] examined the surveillance practices around the world related to energy from waste facilities, and the role of biological monitoring as a surveillance tool for these facilities. Results indicated that best practices pointed to stack monitoring as the most prevalent practice, followed by environmental monitoring (air, soil), and less frequently on flora or fauna monitoring. Only one country had engaged in human biological monitoring, with some ambiguity as to

[7] Smith LF. Energy from Waste Facility in the Region of Durham September 28, 2007

[8] JW. Final Report: Review of International Best Practices of Environmental Surveillance for Energy-From-Waste Facilities. February 16, 2009

whether the objective of the human-focused programs was specifically for facility monitoring, research, or to satisfy public concern.

Regional stakeholders continue to press for additional reassurances about the health and environmental impacts of this facility. A number of environmental surveillance options have been discussed, including "ground truth" measurements of stack emissions at the pathway level (i.e., soil, air concentrations) for three years, and fauna and flora monitoring. The results of the JW Best Practices Review indicates that the most prevalent practices involve upstream monitoring of facility operations (stack and air emissions), supplemented by air, soil, and rarely, fauna and flora monitoring under some circumstances.

All considered, for this EFW facility, the recommended monitoring of stack, air, soil and environmental monitoring will provide sufficient sentinel signals to protect public health. The addition of a three year period of environmental monitoring will indicate whether new approaches should be taken for additional surveillance or for additional restrictions on the facility. As part of this additional monitoring, further checking of emissions impacts at the receptor level (i.e., flora and fauna) will not add value to the pathway level measurements unless there is evidence of repeated excursions in emissions above what the SSHHRA and the facility operator predict. The biological monitoring of fauna is the wild animal version of testing human "receptors" for chemicals emitted by the facility. If this is done as part of a planned early monitoring, then it means that there may be an expected failure of upstream monitoring of the facility itself. In similar fashion, the use of humans as sentinel monitors of facility operations represents an acceptance of failure of upstream emissions and operations monitoring. Flora and fauna, and human testing are not good sentinels of current operations.

Notwithstanding, monitoring environmental media is considered useful and is recommended under circumstances as follows. The modelers have predicted that the facility will not appreciably contribute to increased concentrations in the environment. However, if concentrations are found to be greater than those assumed in the HHRA, flora and fauna monitoring will help to reassure that human health is protected and may also alleviate some of the concern in the general public.

Although the act of sampling and chemical analysis of human tissues such as blood or urine is relatively easy, there are more difficult challenges in entertaining human testing. Among these challenges are: 1. the use of humans as sentinels to test exposure hypotheses which are predicted by the SSHHRA to be below a significant signal; 2. The methodological challenges of obtaining large groups to examine given the very low level of exposure forecast; 3. the ethical issues of selective participation, individual interpretation and potential demand of the use of results for diagnostic, prognostic or therapeutic purposes. Interpretation of the significance of individual results is available for a limited number of substances and not for the vast majority of chemicals of concern. For these important reasons, ethical and medical, human biological monitoring is not recommended as a facility surveillance tool in this circumstance.

Communities may expect the Medical Officer of Health to provide ongoing relevant health information as required by the Ontario Public Health Standards and Protocols[9]. Details of what the public expects outside the Standards may be explored through community consultations or other sources of data gathering about community residents accessible to local public health agencies or as considered appropriate by the Medical Officer of Health.

[9] Health Protection and Promotion Act, RSO 1990, c. H. 7