Review of an Application for s.5 Approval Under the Oakville Health Protection Air Quality Bylaw 2010-035, Submitted by the New Oakville Hospital

Review conducted by:

Franco DiGiovanni Ph.D., Airzone One Ltd., 222 Matheson Boulevard East, Mississauga, Ontario L4Z 1X1. Tel: 905-890-6957 ext. 102, Fax: 905-890-8629, email: fdi-giovanni@airzoneone.com

Introduction

On February 1, 2010 the Town of Oakville (the "Town") enacted the Health Protection Air Quality (HPAQ) Bylaw 2010-035 to help protect Oakville residents against the harmful effects of airborne $PM_{2.5}$ (Fine Particulate Matter, or FPM). Sources of airborne FPM that occur in Oakville are emitted from sources in Oakville, the surrounding GTA as well as further afield.

The bylaw contains two main elements; an air emissions reporting requirement for facilities in Oakville, and, a major-source permitting requirement. The permitting requirement, stipulated under s.5 (for proposed facilities) and s.6 (for existing facilities), requires that facilities that are "major emitters" of FPM and precursor substances within Oakville conduct an air quality impact assessment. If the impacts of FPM exceed a town screening threshold, then the facility must conduct a health impact assessment, and also, lower its emissions and/or present its case before the public and Town Council to seek approval for its emissions. The Town requires an assessment of average and maximal impacts of emitted FPM in order to inform Council on the range of impacts expected by such a facility; Council will then take this range of impacts (including any health impacts) into consideration in rendering its decision.

The Applicant is Subject to the Permitting Requirements Under the Bylaw

The New Oakville Hospital (NOH) is a proposed operation within Oakville that meets the bylaw definition of a "facility." EllisDon Corporation (EllisDon) has applied for approval of hospital emissions under the Oakville HPAQ bylaw and were aided by consultants Golder Associates Ltd. (Golder) and Rowan, Williams, Davis and Irwin Inc. (RWDI). The Applicant indicated that the facility was a major emitter of directly emitted FPM. Therefore, the facility is subject to the permitting requirements under s.5 of the bylaw.

Further, the Applicant identified the facility itself as a sensitive receptor (as per s.3.2.1.4 of the Town Guide); this requires an assessment of impacts on hospital property as well as a separate assessment of impacts at receptors on the hospital building itself. These results are to be included in the overall assessment summary.

Town Guidance Available and Provided

In addition to the bylaw, the Town provides guidance documents to assist applicants in meeting the requirements of the bylaw. Specifically, the "Guidance for Implementation of Oakville Health Protection Air Quality By-Law 2010-035 Section 5 and 6 and approval requirements for

major emitters v. 5 June 2011" (henceforth the "Town Guide") and the "Section 5/6 comments table for focus group."

In addition, the bylaw (s.5.(2)) "encourages a potential applicant to consult with the Town to receive input on whether the facility is likely to be a source of a major emission and, if so, on appropriate methods of addressing application requirements." A pre-application consultation was held on 24 January 2012 with EllisDon and Golder staff present and data files were supplied to EllisDon/Golder in September 2011.

Phase 1 Application Completeness Review Conducted

The Application was received by Town staff on 16 March 2012 and the Phase 1 review for Application completeness was initiated. A finalized version of the Application was submitted electronically by EllisDon on 27 July 2012 and electronic modelling files were supplied on 26 July 2012. This review report is based on those files.

Summary of Phase 2 Peer Review of Application Documents

Section 9(2) of the Bylaw requires that the reviewer communicate the results of the review based on items 3(a) to (e) of section 5 of the bylaw in a "peer review report." This report constitutes the review report that is "not to exceed 10 pages, excluding appendices, which sets out, in concise, non-technical language the results of the review on items 3(a) to (e), of section 5 or 6 of this by-law."

This section includes a summary of the Phase 2 review but a more detailed technical review is provided in the Appendices to this report. The Appendices also contain a checklist of application materials required versus those supplied by the Applicant and a review of the pollutant dispersion modelling assessment.

The overall conclusion of the review is that further information and justification is required to confirm the results of FPM impact assessment provided as part of the Application. The Applicant indicated that impacts are below the Town threshold of 0.2 $\mu g\ m^{-3}$ (annual basis) and so there is no requirement for a health impact assessment nor any appraisal required for mitigation of emissions. These conclusions require more verification due to a number of questions with the assessment. For example, some of the pollutant emission rates calculated seem to be under-estimated. Additionally, the analysis of pollutant impacts for receptors on the hospital building did not account for worst-case emissions, as required by the bylaw.

Sincerely,

Franco DiGiovanni, Ph.D.
Senior Air Quality Modeller

Appendix 1: Provision of Application Material by Applicant

Application Item	Elaboration of Application Item	Applicant Submissions and Commentary
1. Executive Summary	Provide a summary of the application: The proponent, the facility, the project, the conclusions and the bases for the assessment of the application.	Provided (p.i of Application report).
2. Introduction	Background to the project.	Provided (p.1 of Application report).
3. Facility Description	The description must include the following items, together with a brief description of the basis for the information provided:	
3.1 Overview	Details of the nature of the facility, including what the facility produces.	Provided (p.2 of Application report).
3.2 Location	Provide facility address and at least two separate maps with: (i) the facility's general location in the town; and, (ii) details in the environs within 3 km of the facility (site). All maps must clearly identify the facility and its surroundings. The detailed map(s) should include nearby significant sources (e.g., highways, major roads) of FPM and precursors and sensitive receptors (e.g., health care facilities, schools and residential areas). All maps must be in UTM/WGS84 datum coordinates. These maps may be used to provide base maps for concentration and risk contour mapping results.	Provided (p.2 of Application report).
3.3 Buildings	Provide drawings and other information to identify on-site or off-site buildings that could influence near field plume dispersion (building downwash). The building data must be consistent with that used in dispersion modelling to assess building downwash.	Provided (pp.2-3 of Application report).

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3.4 Raw materials, Products and Processes	(i) Identify any raw materials that are relevant to estimating health-risk air pollutant air emissions;	Provided (p.3 of Application report).
	(ii) Identify all processes (including a simplified process flow diagram) that are relevant to the air contaminants emitted from the facility;	Provided (p.3 of Application report; process flow diagrams are not applicable in this case).
	(iii) Provide the maximum and average daily, monthly and annual process flow-through rates for any processes that may contribute to the major emission;	Maximum and average annual flow rates relevant to diesel-fired emergency generators, natural gas-fired boilers and cooling towers provided in Appendix C of Application.
	(iv) Provide information on the variability of process rates on an annual basis;	Not applicable for maximal flow rates as conservative values used; no information provided on variability of average flow rates.
	(v) Provide the hours of operation (hours/day, days/week, weeks/year) for average and maximum operational activity;	Provided (p.3 of Application report).
	(vi) Provide the relationship between the average and maximum process rate(s) and operating conditions/hours of operation;	Some information provided in ss.2.4-2.7.5 of the Application report.
	(vii) Provide information on the variability of production rates around the average;	No information was provided on variability of fuel consumption rates around the average.
	(viii) Set out the planned maintenance periods	Provided in Table 1.

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3.5 Emission Sources and Processes	(i) Identify all sources (point, fugitive/area, line etc.) at the facility.	Provided (p.4 of Application report).
	(ii) Include drawings of the facility and other information (text) to allow identification of all sources and processes at the facility.	Provided (p. 4 of Application report).
	(iii) Include a table with the identification/ID code, SCC codes and the annual average and maximum emissions of health-risk air pollutants for each source.	Provided (Table 4) – SCC codes not included.
3.6 Emission Control Equipment and Procedures and Emissions Monitoring	(i) Summarise all relevant existing emission control devices (on stacks/vents) and emission or pollution prevention practices.	Provided (in Table 2 of Application report).
	(ii) Associate each device/measure with pollutants emitted and emission sources.	Provided (in Table 2 of Application report).
	(iii) Indicate the control efficiency for each device/practice.	Provided (in Table 2 of Application report).
	(iv) Indicate all continuous emission monitoring (CEM) and other monitoring to determine the effectiveness or efficacy of emission control(s).	Provided (on p.4 of Application report).

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3.7 Identification and Quantification of Substances Released to Air	(i) Identify all health-risk air pollutants that would be emitted (proposed facilities) or are emitted (existing facilities) above major emission levels – be sure to include relevant speciated VOCs and directly emitted FPM. (ii) Quantify the average and worst-case rates of daily and annual emissions during operations and the operating conditions that lead to these emissions. (iii) Indicate the methods used to estimate emissions and provide detailed calculations and scenario descriptions.	Provided (in Table 3 of Application report). Provided (in Tables 3 and 4 of Application report). Provided (on p.6 and in Appendices B and C).
4. Evaluation		
4.1 Modelling Approach and Model Selection	The full model report, and electronic files with all model inputs and outputs, are to be provided as supporting material to the application – see below.	
4.2 Model Inputs	Indicate that an electronic file with all model inputs and outputs has been provided (see below).	Provided with Application.
4.2.1 Facility Emissions Estimate Requirements / Estimation Methods (same as ESDM)	Summarise/tabulate (previously defined) emission scenarios and operating conditions that give rise to: (i) average and worst-case annual emission rates, (ii) frequency with which emissions within 90% of the worst-case emissions levels may occur (as per s.3.2.1.2) (iii) variability around the average emission rates	 Provided (as above) for CALPUFF modelling but worst-case annual emission rates were not used in the same structure modelling analysis. Not provided. Not provided (as above.)

Application Item	Elaboration of Application Item	Applicant Submissions and Commentary
4.2.2 Meteorological Data Background Concentrations (ozone, NH_3, FPM), Chemistry Model(s) Used Species Modelled, Grids, Special Receptors Identified	Refer to the model input checklist provided in the Appendix 6.5. Deviations from defaults must be fully explained.	Deviations from TDIs – Applicant used the non-default value for the MSPLIT variable (set to 1) which deviates from the Town's (and US EPA's) default value of 0. See detailed review for discussion. Applicant used alternate terrain data on the premise that the higher (lateral) resolution data is as accurate or more accurate for vertical heights. This was found to be acceptable. The Applicant did not include analysis of impacts due to the FPM precursors sulphur dioxide and oxides of nitrogen as emissions were below the major emitter threshold. This was found to be acceptable assuming the stated emission rates. The facility itself and grounds were identified as a sensitive receptor and so on-site and same-structure receptors were evaluated. This identification found to be acceptable.

Application Item	Elaboration of Application Item	Applicant Submissions and Commentary
5. Mapping	Present these as: a) Model numerical outputs must be provided in the form of Summary Values tables as described earlier. b) For FPM, provide concentration contour maps of appropriate scale(s) showing concentration contours within the affected airshed (also identifying the boundaries of Oakville - co-ordinates will be supplied by the Town), for each emission scenario, for: i. the TFI FPM concentration, AND, ii. the cumulative FPM concentration when the TFI concentrations and the background FPM concentration are added, resulting in a total of four (4) maps and four (4) values. The following are suggested levels for concentration contours: • ≤ 0.2 µg m^{-3} increments for the annual predictions of FPM concentrations. Concentration contour maps should be superimposed on suitable base maps (base maps which also show the locations of sensitive receptors) and locations of maxima (as per the Summary Values table). In providing the concentration isopleths for the worst-case scenario, applicants should indicate (as per s.3.3.3) the frequency with which emissions will be within 90-100% of the worst-case emissions levels.	Summary Values Table was provided as Table 11. The table did not include the higher impact values found in the same-structure contamination study. Please update the Table. Mapping of model output was not provided as it was indicated that impacts were below the Town's 0.2 µg m^{-3} (annual) threshold value.

Application Item	Elaboration of Application Item	Applicant Submissions and Commentary
6. Health Risk Assessment	Assessments of the public health effects due to the increment caused by the proposed (or existing facility) are required if an affected airshed is formed as a result of facility emissions within the boundaries of the town. Results are to be presented as described in Section 3.4. For health-risk, provide contour maps of appropriate scale(s) showing risk contours at 1 per 100,000 premature death increments based on the annual predictions of risk within the affected airshed for the average and maximal emission scenario, for: i. the TFI risk, AND, ii. the cumulative risk when the TFI concentrations and the background concentrations are added (using the background risk file). The boundaries of Oakville should be clearly identified based on co-ordinates that will be supplied by the town. Risk contour maps should be superimposed on suitable base maps which show the locations of sensitive receptors and locations of maxima (as per the Summary Values Table). In providing the health risk assessment for the worst-case scenario, applicants should indicate (as per s.3.4.1 & s.3.4.2) the frequency with which emissions within 90-100% of the worst-case emissions levels may occur.	The Applicant indicated that impacts were below the Town's 0.2 µg m^{-3} (annual) threshold value and so no health risk assessment was conducted. After responding to all questions and verifications requested in this review the requirement for a health risk assessment should be re-evaluated.

Application Item	Elaboration of Application Item	Applicant Submissions and Commentary
7. Appraisal	Appraise any measures available to the facility that would reduce risks to public health (if an affected airshed is created within the boundaries of the town), including the costs and other implications of implementing such measures, including: 1. List existing emission control technologies. 2. List all additional control technologies that could be used. 3. List any existing emission mitigation plans. 4. List any potential additional emission mitigation techniques. 5. Eliminate any technically-infeasible options and provide the basis for the elimination of the option. 6. Appraise the effectiveness of the remaining control technologies and mitigation techniques. 7. Determine costs (capital and annual operating) and the control effectiveness of remaining control technologies and mitigation techniques. Indicate which control technologies and mitigation techniques will be implemented and provide the rationale for the choice of technologies and techniques.	The Applicant indicated that no affected airshed was caused and therefore no significant health impact. No Appraisal was provided.
8. Additional Information	An applicant may wish to supply additional information if: it seeks an approval on the basis that the public interest favours allowing the major emission of the facility to occur.	No additional information was provided.

Appendix 2: Detailed Technical Critique of Application for Approval

Application Item 3.3: Issue of Alteration of Building Shape:
The Applicant did not use the full hospital building shape for dispersion modelling purposes but rather a highly simplified version. Use of a "simplified" shape requires analysis for the effect that the simplification had on the dispersion modelling results (e.g., a sensitivity analysis). The Applicant is requested to provide this.

Application Item 3.4(iii): Issue of Maximal Annual Gas Consumption:
The Applicant indicated that maximal annual gas consumption would be 125% of the average value based on an analysis by Enermodal Engineering. However, a description of that analysis, provided in Appendix D of the Application, does not explicitly mention this 125% factor. I recommend that verification of this factor be a condition of the permit to be issued.

Application Item 3.4(iv): No Information Provided on Variability of Fuel Consumption:
No information was provided on the possible variability of fuel consumption (especially natural gas) around the average. The Applicant is requested to provide this information so as to provide Council perspective on the average emission rates, and therefore average impacts estimated.

Application Item 3.5(i): No Evaluation of Lab Fume Hood Exhausts:
The Applicant indicated that no emissions of FPM or precursors were expected from the hospital lab fume hoods. While it is reasonable not to have information at this stage, I recommend that a re-evaluation of these emissions be conducted, as a Condition of Approval, when the hospital is fully operating.

Application Item 3.7(iii): Emission Rates Calculated:
1. The Applicant indicated that the emissions from the diesel-fired generators should be based on the lower ("nominal") of the range of data provided by the manufacturer (in Appendix B of the Application report). This was justified based on the maintenance level expected for the generators; however, the manufacturer information provided does not mention maintenance level as a factor for the range of emission data provided. Please provide further justification/explanation.

2. In Appendix C of the Application report the diesel generator's sulphur dioxide emissions are calculated based on an assumed 30% operating load and fuel input rate. However, examination of the manufacturer data indicates that the diesel fuel consumption rate at 30% operating load is 66 gallons per hour. This has an equivalent fuel weight usage of 469 pounds/hour or 9,043,980 BTU/hr energy equivalent. This is almost three times as much as the energy equivalent value used by the Applicant and would result in emissions almost three times as much. The calculations need to be explained or revisited. If, as a result of any recalculations prompted by this review, annual emissions for pre-cursor compounds are found to be above major emitter limits, then it is mandatory that they be included in the impact analysis.

3. For directly emitted particulate matter (PM) from the hospital's gas-fired boilers, the Applicant used the US EPA emission factor of 7.6 pounds of PM emitted per million cubic feet of

gas burnt. However, the manufacturer data provided in Appendix B of the Application report indicates an emission rate of 0.01 pounds of PM emitted per million BTU of gas burnt; this is equivalent to 10.2 pounds per million of cubic feet of gas, a value 1.3 times higher than used by the Applicant. Further clarification of this is required.

Application Item 4.2.1(i): Same Structure Contamination Analysis Did Not Use Worst-Case Emissions (as required) to Predict Worst-Case Impacts:
This is required by the Town in order to provide Council with information on the upper limit of FPM impacts at receptors on the hospital.

Application Item 4.2.1(ii): No Estimate Provided of Frequency of Worst-Case Emissions:
This is required by the Town in order to provide Council with information on the frequency with which worst-case impacts can occur.

Application Item 4.2.2: Did Not Use Town-Approved Dispersion Model:
The Applicant used a variant of the Town-approved dispersion model CALPUFF. The CALPUFF dispersion model is a United States Environmental Protection Agency (US EPA)-approved airborne pollutant dispersion model. The Town has adopted, as default, the US EPA-approved version (v.5.8). However, the Applicant used an alternate version (v.6.263) because of problems they encountered using the approved version. Information is requested on attempts to modify their modelling scenario in order to use the approved version.

Application Item 4.2.2: Did Not Use Town-Approved Model Input Value (for variable MSPLIT):
In the dispersion modelling the variable MSPLIT controls the behaviour of the emitted pollutant cloud. The Town has adopted the US EPA default value of "0" for this variable. However, the Applicant used an alternate value ("1") on the basis that the default value caused a problem with their model calculations.

We attempted to reproduce this problem by running The Applicant's input files with MSPLIT set back to the Town default of "0." The model used by the Applicant and supplied to us (v.6.263) did not function; however, the Applicant also supplied a slightly earlier version of the model (v.6.262) which did work. When running the supplied input files through v.6.262, and MSPLIT set back to the Town default of "0," we encountered no problems and so were not able to reproduce the problem.

Application Item 4.2.2: Same-Structure Analysis Did Not Reference an Averaging Period Conversion Factor Appropriate to Same-Structure Contamination:
The Applicant used a conversion factor to convert hourly average concentrations to annualized concentrations. However, they used a conversion factor that may not be applicable to pollutant dispersion over a building structure; the applicant should review guidance provided by the American Society of Heating, Refrigeration and Air-Conditioning Engineers. This same guidance is recommended by the MOE in their Air Dispersion Guideline for Ontario (March 2009) for same-structure contamination.

Application Item 4.2.2: Same-Structure Analysis Did Not Demonstrate Compliance with the Town FPM Threshold:

The Applicant used a method where impacts at same-structure sensitive receptors were summed from all hospital emissions sources. However, using the example of Table 10 in the Application report, the sum of the impacts at the receptor "Entrances" equals 0.269 µg m^{-3} which is higher than the Town threshold of 0.2. Instead, the sum is presented as 0.182; please provide an explanation.

Application Item 5: Summary Value Table Incomplete:

The Summary Value Table did not incorporate impact values from the same-structure contamination modelling. Please include these in the Summary Value Table

Appendix 3: Verification of Model Output Results Produced by Applicant

Models supplied by the Applicant were CALPUFF v.6.262 and v.6.263, the latter used for the Application assessment.

As part of the review of the NOH application, the modelling files submitted were re-run to attempt to replicate the results presented in the report. The files supplied by the Applicant included the model input files (excluding Town default input files), and the models for CALPUFF and CALPOST (the corresponding data post-processing program). For this part of the review, the focus was on the worst-case scenario grid 2 without SOA.

Due to issues using files provided, the exact modelling scenario described in the Application report could not be replicated and the following table is a summary of the differences; these are described in further detail following the table.

Parameter/File	Applicant Supplied	Replicate Scenario Used	Reason
CALPUFFL.EXE	Version – 6.263	Version – 6.262	Executable 6.263 provided by Applicant did not work.
POSTUTIL.EXE	Did not provide to reviewer.	Version - 1.641 (used with current 6.42 model[and corresponding to CALPOST 6.292]).	Applicant did not provide the file and did not indicate in the report which version was used.
PARMSL.PST	Did not provide to reviewer.	The versions associated with 6.42 model (and corresponding to CALPOST 6.292).	Applicant did not provide the file and did not indicate in the report which version was used.

The models were run in DOS due to difficulties using GUIs (both Lakes Environmental and TRC's GUIs were attempted). Only the file plot files were viewed in the Lakes GUI.

CALPUFF Version 6.263

The executable provided for this model version did not work. The executable was named "calpuff.exe" rather than the "calpuffl.exe" version which is usually provided by TRC (the software developers). The model did not run using a 64-bit Windows 7 or 32-bit Windows XP computer operating environment in a DOS window.

CALPUFF Version 6.262

The Applicant had provided the CALPUFF model version 6.262; an earlier version. This version of the model was able to run using the input files provided and since the version numbers were close it was used to attempt a review.

The Applicant provided the input files for CALPOST and the CALPOST6l.exe program file. They did not provide the paramsl.pst file and postutil.exe file. Since these were not available, the versions that are associated with CALPUFF 6.4 were used (postutil version - 1.641).

Using these models and inputs files, we were able to reproduce the results presented by the Applicant in the Application report.