

TO: William Tigert, CAO  
Town of Ingersoll  
130 Oxford Street  
Ingersoll, ON N5C 2V5

AND TO: Jack D. Coop and Joel Farber, Partners  
Fogler, Rubinoff LLP  
77 King Street West  
Suite 3000, P.O. Box 95  
TD Centre North Tower  
Toronto, ON M5K 1G8

May 23, 2017  
Job/Reference #: J13083

**RE: Technical Review Comments on Air and Odour for an Environmental Assessment (EA) of the proposed Walker Environmental Group Southwestern Landfill**

Dear Sirs:

The Town of Ingersoll has retained Airzone One Ltd. (Airzone) and Tetra Tech Canada Inc. (Tetra Tech) to review new documents recently released by the proponent (Walker Environmental Group) for its environmental assessment of the proposed Southwestern (Ingersoll) Landfill. Based on updates in early 2017, of potential relevance to air quality are two new documents that were released 3 Jan 2017, a third document, “Updated Technical Work Plans”, that was released 12-13 Jan 2017 and a fourth document the March 24, 2017 revised draft “Air Quality Assessment Work Plan”. Specifically, we have reviewed: (A) Interim Report for Alternative Methods (Working Draft), (B) Cumulative Effects Assessment – Updated Technical Work Plans, (C) Facility Characteristics Assumptions, and (D) Revised Draft Air Quality Assessment Work Plan. Below are our comments based on the results of our review of these documents with relevance to air quality. We will also make reference to our comments that were provided to the Ministry of the Environment and Climate Change (MOECC), dated 5 May 2014, based on (then) draft Terms of Reference (ToR).

***(A) Interim Report for Alternative Methods (Working Draft)***

At this time, we have no comments on this report relating to air quality.

***(B) Cumulative Effects Assessment – Updated Technical Work Plans***

In Section 4 of this report, Walker Environmental discusses assessing cumulative effects within a specific study discipline (e.g., air quality), as well as across study disciplines. We are encouraged by this wording and, consequently, expect to see a robust cumulative assessment within the air quality study discipline. This would include, but not necessarily be limited to, inclusion of existing background air quality levels and emissions of common contaminants from non-subject sources (e.g., local industrial facilities, emissions from local traffic, etc.).

***(C) Facility Characteristics Assumptions***

Based on a review of this document, we have generated the following list of potential sources that should be assessed for potential air emissions. This list is not meant to be exhaustive and Walker Environmental should include other sources as needed.

- Haul Roads, both on-site and off-site
- Tailpipe emissions from associated on-site mobile equipment (e.g., compactors, excavators, haul trucks, bulldozers, etc.)
- Non-subject local traffic (e.g., traffic associated with local residents and businesses)
- Haulage, placement, and compaction of selected soils
  - As storage piles
  - During landfill cover
  - During shaping of final cover
- Storm Water Management Facilities
- Leachate Treatment Facilities
- Leachate Balancing/Pre-treatment Pond(s)
- Balancing/Polishing Pond(s)
- Landfill Gas Management Facilities (e.g., flaring, gas utilization operations, etc.)

In addition, we provide the following points:

1. s.1.7.1 – Leachate Quantity – it is provided that “The leachate generation rate is estimated at approximately 124,000 m<sup>3</sup>/yr., or an average of about 340 m<sup>3</sup>/day, at full build-out, based on leachate production estimates prepared for Walker Environmental’s similarly sized South Landfill”. Dependent upon methods used to calculate air emissions related to leachate handling, it may be required to confirm that these are the maximal annual and maximal daily leachate flow rates, to ensure that maximal emissions rates are considered in the impact assessment over appropriate periods of time.
2. s.1.8.3 “Landfill Gas Collection & Destruction” – it is provided that “The landfill gas collection efficiency is estimated at about 85% of the total gas production based on operational experience at Walker Environmental’s South Landfill and other similarly designed landfills.” Dependent upon methods used to calculate air emissions related to LFG, quantitative evidence may be required to provide basis to this claim of collection efficiency.
3. s.1.8.3 “Landfill Gas Collection & Destruction” – it is provided that “Flaring of the landfill gas typically converts about 98% of the methane to carbon dioxide (i.e., the destruction efficiency) and consumes more than 99.9% the trace organic compounds.” Dependent upon methods used to calculate air emissions related to flaring emissions, quantitative evidence may be required to provide basis to these destruction efficiency claims.
4. s.1.8.3 “Landfill Gas Collection & Destruction” – it is provided that “Landfill gas utilization appliances (i.e., kilns, boilers, reciprocating engines) would have similar destruction efficiencies to the flares noted above.” Dependent upon methods used to calculate air emissions related to flaring emissions, quantitative evidence may be required to provide basis to these claims of efficiency equivalence.
5. s.1.8.3 “Landfill Gas Collection & Destruction” – it is provided that “At operating year 5 of the landfill, landfill utilization may be expected.” Dependent upon utilization methods contemplated, there may be need to assess air emissions impacts of those utilization scenarios,
6. s.3.3 “Traffic Volumes” – a traffic volumes table is provided; please identify whether the volumes listed are maximums or averages expected, and whether caps or limits may be imposed on traffic volumes.

***(D) Revised Draft Air Quality Assessment Work Plan***

1. Under “ENVIRONMENTAL ASSESSMENT CRITERIA’ (p. 5), RWDI indicate that “Effects due to fine particulate exposure” will consider only the operational period assuming that particulate impacts will be negligible following closure and rehabilitation efforts. However, RWDI do not provide any evidence or rationale for excluding this assessment from the Post-Closure Period assessment. These emissions should be directly assessed based on proposed Post-Closure operations. Any sources considered negligible under any scenarios should be accompanied with appropriate rationale and assessments to allow reviewers to confirm negligibility.
2. RWDI indicate a criterion of 25% of the applicable limit as the basis for expanding the corresponding study areas (p. 6). However, this criterion appears to be based solely on contaminant emissions from the subject facility and not a cumulative air quality assessment of each contaminant. RWDI should provide rationale, or clarification, on why this criterion is based on subject source emissions only. Furthermore, RWDI have not provided a basis for the use of 25% as the criterion; rationale, or clarification, is required.
3. RWDI provide a generic list of potential receptors in Section 4 (p. 7). As we have previously indicated, allowance must be made for review by all stakeholders of all information used to select receptors, including Town of Ingersoll, and allowance should be made for input into the decision-making process by all stakeholders to choose distinct receptors. It is not clear if RWDI will include all appropriate stakeholders in the determination of distinct receptors.
4. On p.8, RWDI indicate (Tabulated) that contaminants will be compared to certain indicators or measures but do not mention that certain contaminants (e.g., PM<sub>2.5</sub> or substances with no Ontario benchmarks) will need to be referred to the human health or ecological assessment.
5. In answer to one of our original critiques of the ToR, RWDI has provided a list of potential contaminants (Table 6.1.1.2) that may be emitted as constituents of dust. However, this list appears to only consider potential waste streams to be received by the site and only metals. While RWDI admit that this list may be altered, they should be sure to give consideration to soil constituents (e.g., crystalline silica) and other constituents (e.g., mineralogical or other materials) that may become airborne during the working of fill material, as well as other soil movement operations. RWDI should also provide references and sources for their complete list of particle constituents in the final assessment and not confine themselves just to metals.
6. In Section 5.2.1, RWDI make no reference to volatile organic compounds (e.g., Benzene,) nor Total Suspended Particulate Matter (and constituents thereof) as potential contaminants emitted from haul route traffic. These contaminants, and corresponding criteria, should be added to Table 6.2.1.1. This comment has been previously made on the draft ToR and RWDI appear to have still not considered all contaminants from vehicle exhausts. RWDI should also consider emissions of Diesel Particulate Matter, for evaluation by the Human Health Assessment.
7. Again, as with the draft ToR, RWDI appears to have not fully considered all contaminants from landfill gas and its flaring. Tables 6.2.2.1 and 6.2.2.2 are incomplete lists of contaminants that can potentially be emitted, as described in our 5 May 2014 report (and further in our 3 June 2013 report). RWDI have previously indicated that 6.2.2.2 is complete “based on extensive experience with other landfill assessments”. RWDI should divulge its “extensive experience with other landfill assessments” and explicitly show how this justifies the abbreviated list provided. Alternatively they should expand the list as suggested in our comment 5.1 (ii) (b) submitted 3 June 2013.
8. Section 5.2.2 of the draft ToR, RWDI discusses 23 compounds associated with landfill gas to be assessed based upon the 1992 Ontario “Interim Guide to Estimate and Assess Landfill Air Impacts”. It is noted that

the revised ToR identifies only 22 compounds in Table 6.2.2.1. Further, it is noted that due consideration should be given to LFG Constituents listed in Table 2.4-1 of US EPA AP42.

9. In section 5.3 RWDI indicate “Through our experience with other landfills in Southern Ontario, we have considered an objectionable level for odour to be generally in the range of 3 to 5 OU. These levels are more closely related to public complaints.” They do not, however, provide “our experience” for public review and so their assertion remains uncertain and questionable.
10. In Section 6.3, the Minister’s amendment #12 to the Approved Amended Terms of Reference required that “climate change should be considered in this environmental assessment”. It is not clearly specified in the work plan how these expected changes to the local weather systems are to be accounted for in the environmental assessment.
11. In Section 7.1, RWDI states that “meteorological data will be requested from the Ontario Ministry of the Environment and Climate Change for a local meteorological station approved by the MOECC.” As we have commented before, the response from RWDI does not appear to allow for review of input from all stakeholders. Further it does not discuss the possibility, nor make allowance, that no existing data may be appropriate for the site (i.e., that default MOECC meteorological data is not appropriate for use in this assessment). The dataset typically provided by the MOECC for assessment purposes in the region would include 5 years of data from the London airport for the period from 1996 through 2000. However as this data is already 15 years old, and in the light of increasingly significant climate change, a more recent 5 year meteorological dataset from the nearest local (i.e. < 70km from site) meteorological station should be used to prepare the initial case assessments of air quality and odour related impacts.
12. Further to Section 7.1, and further to comments in our 5 May 2014 report, the review of historical ambient air quality data should be open and transparent to all stakeholders and allow input from other stakeholders. It is not clear if RWDI plans to include third party stakeholders in discussions with the MOECC prior to utilizing the data. Concerns stem from the appropriateness of historical data to be representative of the current and future conditions at the site in question. Furthermore, RWDI does not provide criteria against which it will “review and validate the measurements to ensure the data set would be considered valid for this evaluation.” These criteria and evaluation processes should be made available to all stakeholders. Lastly, for all ambient air quality data, RWDI should provide all appropriate technical information on how samples were collected, processed and analysed, to allow for proper stakeholder input. This would also apply to soil and road samples that will be collected, as outlined in Section 7.3.2.
13. When collecting background data concerning existing ECAs, Section 7.1, we would advise caution on how this data is used and caution RWDI to be careful on their reliance of this data. The process for obtaining an ECA has different requirements than those for completing an environmental assessment. Consequently, ECAs, and any corresponding reports, may not contain all relevant information required to complete an environmental assessment.
14. In Section 7.3.2, the use of mitigation measures to adjust dust emissions rates should be accompanied with appropriate proof of efficacy and effectiveness. We have previously recommended that the general mitigation methods intended for use at the site should be described as part of the ToR so that they can be agreed upon before-hand. This, however, has not been done.
15. When modelling dust, as outlined in Section 7.3.2, RWDI appears to be ignoring non-subject sources, local traffic and landfill gas flaring, all of which can potentially produce particulate emissions. RWDI needs to include these in the dust dispersion modelling or provide rationale for their exclusion. As we have previously commented in our 5 May 2014 report, it is not clear what guidance Walker Environmental’s consultants will be using to decide which non-subject, local pollutant sources to include in the modelling

- (see, for example, International Association of Impact Assessment “Guiding Principles For Air Quality Assessment Components Of Environmental Impact Assessments”).
16. Section 7.3.2, as in other sections of the report, indicates that results from only ten (10) of the closest discrete receptors will be provided. RWDI needs to provide rationale on why results from only ten (10) discrete receptors will be provided, as opposed to the entire list of discrete receptors that will be assessed as discussed in Section 4.
  17. The final paragraph of section 7.3.2 indicates that only 24-hour concentrations of PM<sub>2.5</sub> will be presented; annual PM<sub>2.5</sub> should also be provided.
  18. In our 5 May 2014 report, we requested that any intended computer modelling of dust should be provided with and without fall-out. However, it appears that RWDI will not provide the alternate results as requested. In addition, the choice of deposition parameters should be open to all stakeholders to review as part of the development of the final technical work plan.
  19. Section 7.4 of the ToR indicates 23 landfill gas related compounds of interest. As indicated above, only 22 are presented in Table 6.2.2.1.
  20. Section 7.4.2 provides a discussion on the ambient monitoring of VOCs; however, no discussion is given to specific methods. RWDI’s intended methods to measure background VOCs should be reviewed and agreed to before use in the environmental assessment. Furthermore, RWDI has not clarified how they will define upwind and downwind. Depending on how samples are collected, classification of upwind and downwind may not be straightforward and are subject to the meteorological conditions during sample collection.
  21. In section 7.4.3 RWDI have confined themselves to assessing 23 contaminants emitted from landfill gas without providing an explanation of this restriction.
  22. In section 7.4.3 RWDI propose to estimate “rates from the proposed waste soil derived from the flux measurement programs for other landfill sites” but do not make it clear that those estimations will be transparent to public reviewers (such as the Town of Ingersoll), which it should.
  23. In section 7.5 the data “Odour source emission data have been collected for other landfill sites that would be utilized for this evaluation” should be made fully accessible for third-party review.
  24. In Section 7.5.1, RWDI admit that local agricultural sources may emit odours “related to landfill type odours.” These may add to odours emitted from the landfill and cumulatively cause higher odour levels in the surrounding community. However, Walker Environmental consultants do not intend to take those pre-existing odour sources into account. RWDI have previously indicated that odour will not be evaluated cumulatively and, therefore, do not intend to take those pre-existing odour sources into account; no rationale is provided. We recommend that Walkers consultants either include background odour or provide a detailed rationale as to why it is ignored. It is a general and fundamental element of EA air studies that the cumulative (subject source + background) levels of pollutants in the community be fully assessed.
  25. In Section 7.5.2 landfill gas (containing hydrogen sulphide) is identified as being “*offensive to most people all of the time*”, indicating that it would be considered objectionable at the detectable level, or 1 Odour Unit (OU)/m<sup>3</sup>; however, in Section 5.3 the suggested criteria for an objectionable odour, or “*annoyance threshold*”, is proposed to be set at 3 to 5 OU/m<sup>3</sup>. Suggesting that off-site impacts in a range from 3 to 5 times the prescribed MOECC odour limit of 1 OU/m<sup>3</sup> should be used to assess the potential impacts from the site is inconsistent with the intent of Section 14 of the Environmental Protection Act (R.S.O. 1990, c. E.19). Landfill gas, which is clearly identified as being “*offensive to most people all of the time*” would be one of the key odourous emissions from the facility and therefore likely to cause an adverse effect at any detectable concentration (i.e. 1 OU/m<sup>3</sup> as defined by the MOECC).

26. Further to Section 7.5.2, RWDI do not indicate what frequency threshold will be used as a basis for acceptability of odour exceedances. RWDI have previously indicated “that 0.5% exceedance frequency of 1 OU limit will be considered acceptable”, based on “MOE correspondence”. First, this threshold is not referenced in the draft work plan. Second, the only 0.5% criterion we are aware of is applicable to individual contaminants with 10 minute averaging periods and not whole odour assessments (TECHNICAL BULLETIN: METHODOLOGY FOR MODELLING ASSESSMENTS OF CONTAMINANTS WITH 10-MINUTE AVERAGE STANDARDS AND GUIDELINES for Odour under O. Reg. 419/05, MOECC, September 2016). RWDI should provide rationale for the applicability of this criterion to whole odour assessments.
- It should be noted that the proposed range is not supported by MOECC publications or guidelines. 1 OU/m<sup>3</sup> is the prescribed standard; the Ontario Ministry of the Environment Interim Guide to Estimate and Assess Landfill Air Impacts (Air Resources Branch, 1992), Section C.4 Estimating Odour Impacts, Item (iv) specifies a criteria of less than or equal to 1 OU/m<sup>3</sup> over 10 minute averaging time, with more stringent criteria to be applied in certain circumstances. There is no mention in any MOECC publication that supports the use of a less stringent criteria.
27. In Section 7.5.2 the odour levels suggested as being annoying are cited as 3 to 7 OU, whereas in Section 5.3 the annoying range is cited as being 3 to 5 OU. This is inconsistent and it is not clear which is the intended proposed standard to be used in the assessment.
28. The following statement from Section 7.4.1 requires clarification:
- Using the U.S. EPA’s LandGEM landfill gas emission estimation model is the most direct method to determine first-order emission rates of VOCs from the proposed landfill. It is also recommended by the MOECC; however, it can generate conservative estimates (i.e. overestimate) of VOC emissions. This could result in predicted levels in excess of the MOECC’s air quality standards, even with a proposed landfill gas collection system in place. For this assessment U.S. EPA default values for landfill gas constituents will be used.*
- It is unclear from the statement above whether or not the LandGEM landfill gas emission estimation model is to be used to estimate VOC emissions. It is specified as the recommended method, but the statements following suggests that it could be inaccurate and that U.S. EPA default values for landfill gas constituents will be used [as inputs in the LandGEM model?]. This point should be clarified.
29. When modelling haul route traffic, as outlined in Section 7.6, RWDI appears to be ignoring non-subject sources, landfill gas flaring and ambient background data. RWDI needs to include these in the dispersion modelling or provide rationale for their exclusion. Also, they appear to be ignoring volatile organic compound emissions (e.g., benzene) from vehicles.
30. The Glossary contains potentially misleading and inappropriate definitions (s. 12). RWDI insist that the glossary of terms described in the work plan are based on RWDI’s experience with similar projects. This response however, does not directly address our concerns raised in our comments submitted 3 June 2013.

Please note that a lack of comment on any aspect of the proposed workplans does not obviate future comments or criticisms as more details are provided in the ensuing technical reports.

Sincerely,



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Airzone One Ltd.  
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Reviewed by:



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# Curriculum Vitae

## Education

Ph.D., Earth Sciences (Atmospheric Specialty), University of Waterloo	2010
M.Sc., Atmospheric Sciences, University of Michigan	2005
Bachelor of Science, Honours Environmental Chemistry, University of Waterloo	2003

## Employment

### *Air Quality Scientist*

2011 – present

Airzone One Ltd., Mississauga, ON

*Manage and assist projects involving occupational health and hygiene, indoor air quality, ambient air quality, permitting and modeling, and laboratory analysis of air samples.*

- Provide air quality services for Environmental Assessments, including monitoring programs for Contaminants of Concern, as well as dispersion impact modelling for CoCs.
- Implementation of field laboratories utilizing research grade gas chromatographs for quantitation of Reduced Sulfur Compounds (RSCs) via flux monitoring of area sources.
- Ambient air quality monitoring of particulate matter, volatile organic compounds (VOCs), dioxins & furans and inorganic species (NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, mercury) at industrial, construction and remediation sites.
- Validation and verification of chemistry mechanisms in CALPUFF dispersion model to provide guidance and recommendations for use in the Town of Oakville Health Protection & Air Quality By-Law
- Peer Reviewer for Town of Oakville Health Protection & Air Quality By-Law
- Provide peer review of air quality assessments conducted as part of land use compatibility assessments, environmental assessments, and source testing assessments
- AERMOD, SCREEN3, and O.Reg346 dispersion modelling for Environmental Compliance Approval (ECA) applications undertaken for private sector clients.
- Conduct land use compatibility assessments with regards to odour and air quality according to the Provincial Policy Statement and the Ontario Ministry of the Environment and Climate Change D-Series Guidelines
- Emissions reporting for federal (NPRI) and provincial (TRA) levels
- Preparation of Toxics Reduction Plans under the Ontario Toxics Reduction Act
- Method development for laboratory analysis of ambient air quality samples using thermal desorption/gas chromatography/mass spectrometry.
- Pursue and participate in research & development projects with academic sector clients.

### *Research & Development Consultant*

2010

Lucas Neil Consulting, Kitchener, ON

*Consulted within industry and academic sectors to provide advice and support on a variety of research and development projects. Details cannot be given due to confidentiality agreements.*

### *Ph.D. Candidate*

September 2005 – April 2010

Advisor: Dr. J.J. Sloan

Department of Earth & Environmental Sciences, University of Waterloo, Waterloo, ON

*Explored the development of a low pressure aerosol flow tube (LP-AFT), coupled to a Chemical Ionization Mass Spectrometer (CIMS), for the study of hydroxyl radical uptake on organic aerosols. The LP-AFT-CIMS system was successfully assembled and implemented for the study of uptake kinetics.*

- Utilized ANSYS CFX computational fluid dynamics program for testing and designing experimental flow tube.
- Developed and investigated surface science theory for the explanation of experimental results concerning uptake of hydroxyl radicals on aerosol surfaces.
- Operated and maintained a Chemical Ionization Mass Spectrometer and Fourier Transform Infrared Spectrometer

- Generated research proposals for submission to funding institutions.
- Supervised and instructed undergraduate co-op and fourth year research students.

### ***Master's Student***

2003 – 2005

Advisor: Dr. Mary Anne Carroll

Dept. of Atmospheric, Oceanic and Space Sciences, University of Mich., Ann Arbor, Mich.

*Supported research that investigated the interactions between the atmosphere and forest ecosystems. Collected meteorological and air quality data above a northern hardwood forest. Data was analyzed to determine correlations between meteorology and air quality.*

- Managed and operated meteorological and air quality instruments.
- Maintained, calibrated and improved function of ozone channel on University of Michigan Multichannel Chemiluminescence Instrument (UMMCI).
- Oversaw the operation of Fast Isoprene Sensor.
- Archived all meteorological, ozone, carbon monoxide, and isoprene data.
- Wrote code using IGOR Pro for the calculation and analysis of ozone fluxes.

### ***Research Assistant***

*co-op term 2001*

Dr. J.J. Sloan

*co-op term 2002*

Department of Chemistry, Professor, University of Waterloo, Waterloo, ON

*Designed and constructed field portable fine particle aerosol collector, which was employed during Pacific 2001 field study in Vancouver. Designed and assembled field portable Fourier Transform Raman Spectrometer system for detection and analysis of aerosol and geologic composition.*

- Tested and experimented with design of aerosol sampler to optimize collection efficiency
- Programmed computer model using MATLAB to simulate portable Fourier Transform Raman Spectrometer
- Utilized MATLAB model to determine possible sources of error and to overcome stray light issues found in initial design of spectrometer
- Conducted multiple experiments on the metrology and mechanics of the moving mirror of spectrometer to minimize vibrations during field operation
- Drafted two articles for Dr. Sloan chronicling design and manufacture of instruments

## **Selected technical, governmental and consulting reports:**

- Airzone One Ltd. 2016. Notes on the Review of Processing Methods for the Durham/York Energy Centre May 2016 Source Test. Prepared for the Regional Municipality of Durham, Ontario.
- Airzone One Ltd. 2015. XXXXXX SO2 Process Exhaust Stream Sampling. Prepared for XXXXXX.
- Airzone One Ltd. 2015. Technical note on on-property dispersion of by-products of spontaneous combustion of coal at XXX Terminal, XXXXX. Prepared for XXXXXX.
- Airzone One Ltd. 2015. Air Quality Report For EIA of The XXXXXX Berthing Facility. Prepared for XXXXXX, Jamaica.
- DiGiovanni, F. 2015. Review of air quality component of EIA for Kosovo Power Plant. World Bank, Washington DC.
- Airzone One Ltd. 2015. An Air Quality Study of the Land Use Compatibility of the Proposed Development of XXXXXX. Assessed using MOECC D-6 guidelines. Prepared for XXXXXX, Ontario.
- Airzone One Ltd. 2013. Air Emissions Assessment for an Environmental Impact Assessment for a garbage incinerator in the Caribbean. Prepared for XXXXXX, Ontario.
- Airzone One Ltd. 2011 – present. Various reports to support dust monitoring for major TTC construction project in the GTA.

Airzone One Ltd. 2011 – present. Various Emission Summary and Dispersion Modelling reports to support applications for Environmental Compliance Approvals for a variety of industry sectors and clients.

Airzone One Ltd. 2010. Contributing Author to Development of Air Emission reporting and Permitting Municipal Bylaw 2010-035. Prepared for Town of Oakville, Ontario.

## Presentations

L. Neil, P. Fellin, and F. DiGiovanni. “A Low Cost Passive Sampling & Analysis Solution for Air Quality Sampling”, A&WMA Ontario Section 2016 Air and Acoustic Monitoring Course & Conference, 2016.

M.A. Carroll, I.B. Ocko, F. McNeal, J. Weremijewicz, A.J. Hogg Jr., N. Opoku, S.B. Bertman, L. Neil, E. Fortner, T. Thornberry, M.S. Town, G. Yip, L. Yageman, “An Assessment of Forest Pollutant Exposure Using Back Trajectories, Anthropogenic Emissions, and Ambient Ozone and Carbon Monoxide Measurements”, American Geophysical Union 2008.

Hogg, Alan, Johan Uddling, Lucas Neil, Mary Anne Carroll, David Ellsworth, Shelley Pressley, Brian Lamb, Christoph Vogel, and Peter Curtis, “Multi-year Measurements of Stomatal and Non-stomatal Fluxes of Ozone to a Northern Mixed Hardwood Forest”, American Geophysical Union, Fall Meeting, San Francisco, CA, 2007.

R. Remorov, L. Neil, A.-Y. Zasetsky and J.J. Sloan, “Measurements of the reactions of organic gases and OH radicals with aerosols”, Joint IGAC/CACGP/WMO Symp. Atmospheric Chemistry and the Interfaces, Sept. 2006.

L.J. Neil, R.G. Remorov, and J.J. Sloan, “Kinetics of OH Radical Uptake on Micron-Sized Liquid Aerosols”, 40<sup>th</sup> CMOS Congress, 2006.

A. Khalizov, M. Earle, R. Remorov, L. Neil, A. Zasetsky, J.J. Sloan, “Spectroscopic measurements of processes at the surfaces of atmospheric aerosols”, The 231<sup>st</sup> American Chemical Society National Meeting, 2006.

A.J. Hogg, M.A. Carroll, L.J. Neil, S. Pressley, J. Uddling, B. Lamb, D. Ellsworth, and C. Vogel, “Eddy Covariance Fluxes of O<sub>3</sub> to a Northern Mixed Hardwood Forest Ecosystem: Stomatal and Non-Stomatal Deposition”, 1<sup>st</sup> Integrated Land Ecosystem – Atmosphere Processes Study (iLEAPS) Science Conference, 2006.

L.J. Neil, R.G. Remorov, W.J.W. Johnson, M.W. Bardwell, and J.J. Sloan, “Uptake of OH Radicals by a Surfactant Surface”, Symposium on Chemical Physics, 2005.

L.J. Neil, AJ Hogg, SN Pressley, B Lamb, HP Schmid, D Ellsworth, and MA Carroll, “Determining the Influence of Ozone on Isoprene Fluxes”, 2005 Biosphere Atmosphere Research and Training 2005.

L.J. Neil, AJ Hogg, SN Pressley, B Lamb and MA Carroll, “Influence of Ozone on Isoprene Fluxes at the PROPHET Tower”, 2004 Biosphere Atmosphere Research and Training 2004.

Naila Siddique, Lucas J. Neil, Daniel R. Flaming and James J. Sloan, “Characterization of Particulate Matter by Raman Spectroscopy”, Symposium on Chemical Physics, 2002.

## Teaching Experience

- 2010-11** Contract Academic Staff (Department of Chemistry, Wilfred Laurier University)  
Courses: Introduction to Physical Chemistry, Environmental Chemistry, Spectroscopic Methods in Organic Structure Elucidation
- 2005-09** Teaching Assistant (Department of Earth & Environmental Sciences, University of Waterloo)
- 2008** Guest Lecturer, CH480d: Special Topics in Environmental Catalysis, Department of Chemistry, Wilfrid Laurier University

## **FRANCO DIGIOVANNI, PhD**

Senior Air Quality Modeller, Partner and Manager of Air Quality Modelling Section,  
Airzone One Limited (since 1999 under predecessor names)

Email: fdi-giovanni@airzoneone.com

### **Services Provided:**

- Air quality modelling, emissions determinations and inventories, air regulatory compliance
- Land Use Compatibility Assessments in regards air quality
- Specialized dispersal modelling work relevant to dust, agriculture and forestry (pesticide spray optimization, seed production field management, crop pathogen protection)
- Air Quality measurements
- Occupational Hygiene – worker exposure measurements
- Indoor air Quality – mould/fungal measurements and interpretation

### **Education:**

**2012** Qualified Ontario Toxic Substance Reduction Planner (Ministry of the Environment)

**1985-1989** PhD in Physical Geography (University of Hull, England) on "Mathematical Modelling of Pollen Deposition in Closed Canopy Woods".

- Developed a K-theory dispersal model for dispersal of tree pollen through heterogeneous woodlands from multiple sources and solved numerically. Estimated pollen spectrum the forest floor, and used as an analogy for the pollen spectrum in a woodland hollow to aid in interpretation of spatially-precise palaeoecological studies. Verified using climatological input data and pollen deposition patterns in woodlands.

**1982-1985 BSc (HONS)** in Geology at Imperial College (Lond.), England, UK.

### **Employment history:**

**1999-present: Senior Air Quality Consultant** – Airzone and predecessor companies.

- Provides air quality and bioaerosol consulting services.
- Provides air pollutant modelling, permitting (Certificate of Approval/ECA) and emissions reporting (NPRI, Ontario Reg. 127 etc.) – supervises group of 7 persons providing this service.
- Provides indoor air mould and spore collection, analysis and interpretation services.
- Provides air quality and occupational exposure measurement services including airborne TSP, PCBs/PAH, VOCs and inhalable particulate matter in industrial and commercial premises.

**September 1994 – June 1999** Scientific consultant

Air Quality Consulting - DiGiovanni Scientific Consulting and Products

- Providing consultation to government and industry on outdoor bioaerosols
- Development of forecast model used for the "Pollen Report" on The Weather Network
- Numerous contracts for Environment Canada on dry deposition of airborne acid rain species
- IR cloud sensor development for instrument manufacturers

**August 1993 - August 1994** Contract Scientist with Climate Processes and Earth Observations Research Div.,  
Climate Research Branch, Atmospheric Environment Service, Environ. Canada.

**1991- August 1993** NSERC Visiting Fellow to Canadian Government Laboratory (Canadian Climate Center), Atmospheric Environment Service, Environ. Canada.

**1989-1991 Postdoctoral Fellow** Dept. of Environmental Biology, U. Guelph, Guelph, ON, Canada.

- Modelling of dispersal of airborne conifer pollen to establish isolation zones for pedigree seed production for Ontario's forestry sector. Developed a Lagrangian model for particulate (pollen) dispersal, conducted field tests of model (measuring pollen dispersal from point- and area-source releases and meteorological data), and added user-friendly front-end for seed orchard managers to use as a management tool.

### **Peer-reviewed scientific publications:**

- DiGiovanni, F. and Kevan, P.G. 2008. Comment on "Session V: Estimating Likelihood and Exposure", by Zaida Lentini, Environ. Biosafety Res.5 (2006) 193–195." Environ. Biosafety Res. 7 105-108.
- DiGiovanni, F. and Fellin, P. (2002). Transboundary Air Pollution. In: Environmental Monitoring, edited by Hilary I. Inyang and John L. Daniels,. In Encyclopaedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford ,UK, [<http://www.eolss.net>]
- Brook J., Zhang L., DiGiovanni, F. and Padro J. (1999) Description and evaluation of a model of deposition velocities for routine estimates of air pollutant dry deposition over North America. Part I. Model development. Atmospheric Environment 33, 5037-5052.
- DiGiovanni, F. 1998. A review of the sampling efficiency of rotating-arm impactors used in aerobiological studies. Grana 37: 164-171.
- Brook, J.R., DiGiovanni, F., Cakmak, S., Meyers, T.P. 1997. Estimation of dry deposition velocity using inferential models and site-specific meteorology: Uncertainty due to siting of meteorological towers. Atmos. Environ. 31(23): 3911-3919.
- DiGiovanni, F., Kevan, P.G. and Arnold, J. 1996. Lower planetary boundary layer profiles of atmospheric conifer pollen above a seed orchard in northern Ontario, Canada. Forest Ecology and Manage. 83(1-2):87-97.
- DiGiovanni, F., Kevan, P.G. and Caron, G. 1996. Prediction of the timing of maximum pollen release from jack pine (*Pinus banksiana* Lamb.) in northern Ontario, Canada. Forestry Chronicle 72(2):166-169.
- DiGiovanni, F., Kevan, P.G. and Nasr, M.E. 1995. Settling velocities of some pollen and spores and their variability. Grana 34:39-44.
- Banks, L. and DiGiovanni, F. 1994. A wind tunnel comparison of the rotorod and samplair pollen samplers. Aerobiologia 10(2-3): 141-145.
- DiGiovanni, F. and Kevan, P.G. 1991. Factors affecting pollen dynamics and its importance to pollen contamination: A review. Can. J. For. Res. 21: 1155-1170.
- DiGiovanni, F. and Beckett, P.M. 1990. On the mathematical modelling of pollen dispersal and deposition. J. Appl. Meteorol. 29: 1352-1357.
- DiGiovanni, F, Beckett, P.M. and Flenley, J.R. 1989. Modelling of dispersion and deposition of tree pollen within a forest canopy. Grana 28: 129-139.

### **Selected technical, governmental and consulting reports:**

- DiGiovanni, F. and Coutinho, M. 2016/7. Guiding Principles for Air Quality Assessment Components of Environmental Impact Assessments. In prep for International Association of Impact Assessment, ND USA.
- Neil, L. and DiGiovanni, F. 2015. Technical note on on-property dispersion of by-products of spontaneous combustion of coal at XXX Terminal, XXXXX. Prepared for XXXXXX.
- DiGiovanni, F. 2015. Review of air quality component of EIA for Kosovo Power Plant. World Bank, Washington DC.
- Shantz, N. and DiGiovanni, F. 2015. D-series Guidelines. Ontario Planning Journal 30(3): 26-29.
- Airzone One Ltd. 2015 (part-author). Air Quality Assessment for EIA for Cruise Berthing Terminal, Grand Caymen Islands, WI. Prepared for TEMN on behalf of Government of CI.
- DiGiovanni, F. 2014. Review of air quality assessment for land use compatibility assessment of proposed waste transfer station, City of Toronto. For XXXX client.

DiGiovanni, F. 2014. Witness Statement re review of air quality impacts of proposed Henning Pit, North Dumfries. Prepared for CRAND, submitted to OMB.

Airzone One Ltd. 2013. Air Emissions Assessment for an Environmental Impact Assessment for a garbage incinerator in the Caribbean. Prepared for XXXXXX, Ontario.

Airzone One Ltd. 2013. An Air Emissions Assessment of the Land Use Compatibility of the Proposed XXXXXX Project. Assessed using MOE D-6 guidelines. Prepared for XXXXXX, Ontario.

Airzone One Ltd. 2012. Review of Draft Terms of Reference (Air) for an Environmental Impact Assessment for a proposed garbage dump in S. Ontario. Prepared for XXXXXX, Ontario.

Airzone One Ltd. 2011-present. Various reports to support dust monitoring for major TTC construction project in the GTA.

Airzone One Ltd. 2012-??. Reviews for World Bank on proposed lignite-fuelled electricity generating plant in Eastern Europe (continuing).

Airzone One Ltd. 2012. 15 toxic substance reduction plans developed and reviewed.

Airzone One Ltd. 2012. Background concentration determination for impact assessment of proposed XXXXX Bypass Transportation project. Prepared for XXXXXX, Ontario.

Airzone One Ltd. 2012. An Air Emissions Assessment of the Land Use Compatibility of the Proposed XXXXXX Subdivision. Assessed using MOE D-6 guidelines. Prepared for XXXXXX, Ontario.

Airzone One Ltd. 2010-11. Guidance Documents to Support Air Emission reporting and Permitting Requirements under Bylaw 2010-035. Prepared for Town of Oakville, Ontario.

DiGiovanni, F. 2010-11. Witness Statements (and testimonial appearance) in regards to a Joint Board hearing in regards to the proposed extension of an aggregate pit next to Mount Nemo, Burlington, Ontario. Expert witness on behalf of the City of Burlington opposing the proposed extension.

Airzone One Ltd. 2010. Contributing Author to Development of Air Emission reporting and Permitting Municipal Bylaw 2010-035. Prepared for Town of Oakville, Ontario.

DiGiovanni, F. and Davis, C. 2010. Review of the Draft Air Quality Assessment for the Oakville Generating Station: Environmental Review Report (ERR). Appendix A of Comment/Feedback Document submitted to TransCanada by Fogler, Rubinoff LLP on behalf of the Town of Oakville.

Airzone One Ltd. 2010. Part-author, editor and Project Manager for EIA for Mangrove Pond Landfill Expansion, Barbados. Prepared for RJ Burnside and Associates Limited, Ontario.

DiGiovanni, F. 2009. Witness Statements (and testimonial appearance) in regards to an OMB hearing in regards to the proposed establishment of an aggregate pit in Puslinch, Ontario. Expert witness on behalf of the Cranberry Area Residents and Ratepayers Association opposing the proposed pit.

Airzone One Ltd. 2008. Mould Clearance Sampling Report. Prepared for Sisters of St. Joseph, Ontario.

Airzone One Ltd. 2006. The Equatorial African Deposition Network (EADN): Program Manual for Monitoring Atmospheric Deposition of Nutrients and Other Contaminants in the Equatorial Region of Africa. Prepared for World Bank, Africa.

Airzone One Ltd. 2005. Exposure Assessment Of Canadians To Substances Associated With Exhaust, Evaporative And Refuelling Emissions Of Vehicles Fuelled With Conventional And Ethanol Blended Gasoline. Report to Health Canada.

Glover, R., DiGiovanni, F. and Trevors, J.T. 2003. Field Sampling of the Canada Blue Tanning Co. Premises for the Presence and Levels of Spores of *Bacillus anthracis* (Anthrax). Prepared for DL Services, Brighton, Ont.

DiGiovanni, F. 2003. Air Emission Summary and Dispersion Modeling Report for Impacts of Proposed New Laboratories at the XXXXX on Air Quality Measurements at the XXXX. AirZOne Report J3018.

DiGiovanni, F. 2002. Impacts of Proposed Developments in XXXXXX on the Programs of the XXXXXX. AirZOne Report J2001-47.

DiGiovanni, F. 2001. Air quality impacts of proposed XXX XXXX condominium on the residents of XXXX XXXX. AirZOne Report J2001-16.

DiGiovanni, F. 2001. Physical modelling of conifer pollen dispersal: Task 1 – Model verification. AirZOne Report 0-4167-36.

DiGiovanni, F. 2000. Report on STAC Audit for XXXXXXXX pulp and paper mill, XXXXX. Conor Pacific Report 0-4171-08.

DiGiovanni, F. 2000. Air quality assessment of the proposed aggregate extraction from a pit near XXXX, XXXXX. Conor Pacific Report 0-4171-01.

- Conor Pacific, 1999. Report on study to assess NARDM sensitivity to the use of field-measured LAI versus NARDM's default values for LAI. Conor Pacific Project 9-4167-40.
- DiGiovanni, F. 1999. Report on site vegetation surveys, and assessment of land use category data collection technique. DiGiovanni Scientific Report, May, 1999.
- DiGiovanni, F. 1998. Report on: Development of measurement protocols to collect site-specific input parameters for estimates of  $v_d$  at CAPMoN sites using the NARDM and MLM models. Contract report to Environment Canada.
- DiGiovanni, F. 1997. Assessment of options for, and derivation of, input parameters for the Detailed Dry Deposition Model. Contract report to Environment Canada.
- Hertzman, O. and DiGiovanni, F. 1996. A field test of the CLOUD algorithm to estimate cloud cover using IR data. Contract report to clients in Ontario.
- DiGiovanni, F. 1996. Uncertainty in aerodynamic resistance and deposition velocity estimates of pollutant deposition in a heterogeneous landscape. Contract report to Environment Canada.
- DiGiovanni, F. 1995. Report on consultation to develop a predictive model for airborne concentrations of ragweed pollen. Contract report to Research Laboratories, Ontario.
- DiGiovanni, F. 1995. A study of different methods to determine how the All-sky scanning radiometer may be used to estimate cloud type and cloud height. Contract report to clients in Ontario.
- DiGiovanni, F. 1995. Leaf wetness data analysis and collection of input parameters required to run inferential models of pollutant deposition at the CARE site. Contract report to Environment Canada.
- DiGiovanni, F. 1994. Uncertainty in aerodynamic resistance estimates of pollutant deposition in a heterogeneous landscape. Contract report to Environment Canada.
- DiGiovanni, F. and Kevan, P.G. 1994. Pollen dispersal (POLDISP) project final report. Final consultants' report, Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario, Canada.
- DiGiovanni, F. 1994. User manual for pollen dispersal model: POLDISP Ver 1.0. Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario, Canada.
- DiGiovanni, F. and Joyce, D. (eds.) 1992. Proceedings of a workshop on "Challenges in Pollen Dispersal and Pollen Contamination". Canadian Climate Centre, Environment Canada, Egbert, Ontario. CCA-92-008. 71pp.
- Kevan, P.G., Lupson, J.D. and DiGiovanni, F. 1992. Pollination technology for hybrid seed production in canola. Report 10: Wind pollination in hybrid canola. Final Report, King-Agro Inc., Listowel, Ontario.
- DiGiovanni, F. and Ho R.H. 1991. Pollen Monitoring in a Seed Orchard. Can. Tree Imp. Assc. Nwsbt. 15:6-9.
- DiGiovanni, F. 1991. Island Lake Tree Improvement Area - Pollen dispersal studies 1990. Research Report to Ontario Ministry of Natural Resources - N. Region.
- Kevan, P.G. and DiGiovanni, F. 1990 Review of Pollen Contamination and Pollen Dispersal. Ontario Tree Improvement Board Research Report, Guelph, Ontario, Canada.

### **Conference Presentations:**

- DiGiovanni, F., Matusik, M., Pengelly, D., Davis, C., Toth, C. And Lee, J. 2013. A Canadian Municipal Regulatory Permitting System for PM<sub>2.5</sub> Emissions and Health Impacts Utilizing the CALPUFF Dispersion Model. Presentation to Air & Waste Management Association's Specialty Conference [Guideline on Air Quality Models: The Path Forward](#), Raleigh NC, March 19-21, 2013.
- DiGiovanni, F. 2009. Cumulative Air Exposures – The Reality. Invited presentation to Air and Waste Management Association, Jan 2009 Air Pollution Modelling Conference, Toronto, Ontario.
- DiGiovanni, F. 2008. Uncertainties in Road Dust Emissions. Invited presentation to Air and Waste Management Association, Feb 2008 Nuisance Conference, Toronto, Ontario.
- DiGiovanni, F. 2006. Physical Modelling for Assessing Out-crossing of wind –pollinated crops. Invited presentation to “9th INTERNATIONAL SYMPOSIUM ON BIOSAFETY OF GENETICALLY MODIFIED ORGANISMS,” Jeju Island, S. Korea, September 2006.
- DiGiovanni, F. 2005. The Scientific Basis for Fugitive Dust Emissions and Control. Invited presentation to Air and Waste Management Association, May 2005 Nuisance Conference, Toronto, Ontario.
- DiGiovanni, F. 2004. Mechanistic Modelling Approaches to Pollen-mediated Gene Flow and Confinement. Invited Presentation to “Workshop on the Confinement of Genetically Engineered Crops during Field Testing,” September 13-15, 2004, USDA APHIS Headquarters. ([www.aphis.usda.gov/brs/confine\\_present.html](http://www.aphis.usda.gov/brs/confine_present.html))

- DiGiovanni, F. and Taylor, P.A. 2003. The Application of Airborne Pollen Dispersal Modeling to Regulatory Risk Assessment for Genetically Engineered Plants. 2003 CMOS Conference, Ottawa, Canada.
- DiGiovanni, F. and Larsen, J. 2002. Airborne Pollen Dispersal Modeling: An Effective Tool For Regulating Gene-flow. 7th International Symposium on the Biosafety of Genetically Modified Organisms, October 10-16, 2002. Beijing, China.
- DiGiovanni, F., Lo, A. and Kevan, P.G. 1998. Commercial tree seed production: The influence of pollen dispersal and deposition patterns. 6th Intern. Congress on Aerobiology, 31 Aug. - 5 Sep. 1998, Perugia, Italy.
- DiGiovanni, F. and Frenz, D.A. 1997. A critical review of the sampling efficiency of rotating-arm impactors used in aerobiological studies. Symp. of the Pan-American Aerobiological Association, June 18-20, 1997, Cambridge, Mass., USA.
- DiGiovanni, F. and Kevan, P.G. 1993. Pollen dispersal and pollen contamination in conifer seed orchards. 13th International Congress of Biometeorology, Sep. 12th - 18th, 1993, Calgary, Alberta.
- DiGiovanni, F. 1991. Atmospheric Dispersal of Pollen in Seed Orchards. Canadian Tree Improvement Association Meeting, poster presentation. August 19th - 22nd, 1991, Ottawa.
- DiGiovanni, F. 1991. Pollen Contamination at the Island Lake Tree Improvement Area (ILTIA). Oral presentation at 20th Conference on Aerobiology & Biometeorology. September 9th - 13th, 1991, Salt Lake City, Utah.
- DiGiovanni, F. 1990. Pollen contamination studies at Chapleau, N. Ont. USDA Pollen Mgt. Wrkshp. (Macon, Georgia), July 17th-19th, S. For. Tree Imp. Cmtee.
- DiGiovanni, F. 1988. Physical dispersion models and Quaternary pollen-vegetation relationships. 7th Intern. Palyn. Conf., Brisbane, Aus.
- DiGiovanni, F. 1987. Modern pollen-rain and Quaternary pollen analysis. Inst. of Brit. Geog., S'hampton, U.K.

### **Workshops, Conferences and Meetings organized:**

- Co-Chaired (with D. Joyce, Ontario Ministry of Natural Resources) scientific workshop on "Challenges in Pollen Dispersal and Pollen Contamination" (Feb 5th 1992) at Centre for Atmospheric Research Experiments (Egbert) (Proc. publ. in April 1992).
- Chaired workshop on atmospheric pollen dispersal and other pollination aspects (August 16th 1991) at University of Guelph, Guelph, Ontario.
- DiGiovanni, F. (Organizer) 1991. Island Lake Tree Improvement Area - Pollen dispersal study 1990. Jan. 28th, U.Guelph, Ontario.

### **Teaching and training:**

- 1986-89** Teaching Assistant in department of Geography: undergraduate statistics, basic computing, computer cartography, sediment analysis.
- 1990/1991** 7 summer students and technician - training and supervising  
Tutored bi-national graduate level course (in pollination biology at UNAM, Mexico City).
- 1992/1993** 2 MSc student (on Committee; assumed position of Graduate Faculty at U.Guelph)  
6 summer students - training and supervising  
teaching assistant - 400-level course in Math department (U. Guelph) -
- 1994** 1 MSc student (completion of Committee duties).  
Thesis: Roussy, A.-M. 1994. Alleles, cones and pollen: A discreet look into Jack Pine (*Pinus banksiana* Lamb.). M.Sc. Dissertation, University of Guelph. 64pp.
- 1998** Teaching - Air Quality (Environmental Engineering Technology Program - Conestoga College)
- 2004 - 2007** Teaching - Air Quality Control course - Sheridan College
- 2001-present** Training and mentoring for staff of 7 in air quality modelling, air emissions permitting and emissions reporting.

## EXPERIENCE SUMMARY

Mr. Michel Lefebvre joined Tetra Tech's Waste Management practice within the Edmonton, Alberta office in 2016. He has more than 20 years of experience in civil engineering (solid waste, environmental and geotechnical). Mr. Lefebvre's experience includes extensive engineering design and project management experience in both solid waste and environmental engineering which includes the preparation of integrated design and operations plans, permitting, detailed design, construction project management, and landfill gas utilization. Landfill gas related experience includes design includes the design and construction of LFG collection systems, (including integration of horizontal trenches into fill plan development, and dual phase vertical extraction wells), utilization facility control integration, and landfill gas utilization project technical support.

## RELEVANTS EXPERIENCE

### LANDFILL DESIGN

- Design and construction of a piggyback lined lateral expansion at the Nanaimo Regional Landfill. This lateral expansion project incorporated a geogrid reinforced geocomposite liner system, extending 60+ metres upslope on a 4H:1V incline of an unlined cell, four metre high perimeter berm, and below liner gas collection trench to address short-term static stability.
- Design and construction of a six metre high bermed lateral expansion cell at the Nanaimo Regional Landfill. This lateral expansion incorporated an aggressive textured geocomposite liner to improve both static and seismic slope stability of an existing lined cell constructed with a smooth HDPE base liner.
- Design and construction of the City of Saskatoon Cell H lateral expansion. This project included the detailed design, approvals and construction of a geocomposite lined lateral expansion to connect an existing lined cell to the existing unlined landfill area. This project also included the design and construction a leachate force main to connect the existing landfill leachate management infrastructure to City sanitary sewer system.
- Design and construction of the phase 1 progressive closure at the Sechelt Landfill (Sechelt, BC). This closure incorporated the use of an aggressive textured LDPE liner (AGRU Super Gripnet) with a high transmissivity geocomposite lateral drainage layer (Draintube) to address 3H:1V or steeper slope grades, high annual precipitation and seismic stability concerns. The project also included the undertaking of a riparian assessment, first nation consultation, design and permitting for the landfill's storm water management system designed to accommodate storm events in excess of the 1:100 year return period.
- Design and construction of the City of Red Deer Waste Management Facility leachate management infrastructure. This project included the review of viable long-term leachate management options, permitting, design and construction of a leachate pumping station, force main, and connection to the City of Red Deer sanitary sewer system via directional drilling.
- Design and technical support associated with permitting and approvals for the Breton, AB, Class II non-hazardous Oilfield waste landfill facility. Services included the development of a design submissions, document review, and technical support associated with the successful application for development of a Class II facility.

### EDUCATION

M.Sc. University of Alberta, Geotechnical Engineering, 1997

B.Sc. University of Alberta, Civil Engineering, 1995

B.A. University of Alberta, Anthropology, Sociology, 1991

### AREA OF EXPERTISE

Landfill Design and Closure  
 Landfill Operations  
 Landfill Gas Collection System Design & Utilization  
 Project Management  
 Regulatory Applications

### REGISTRATIONS/ AFFILIATIONS

Association of Professional Engineers and Geoscientists of Alberta (APEGGA)

Association of Professional Engineers and Geoscientists of British Columbia (APEGBC)

Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS)

Solid Waste Association of North America (SWANA)  
 Northern Lights Chapter  
 Recycling Council of Alberta (RCA)

### TRAINING/CERTIFICATIONS

Standard First Aid with CPR  
 ACSA – CSTS Training  
 OSSA Regional Orientation

### OFFICE

Edmonton, AB

### YEARS OF EXPERIENCE

20

### YEARS WITHIN FIRM

<1

## LANDFILL DESIGN AND OPERATIONS PLANS

- Development of an integrated Landfill Design and Operations Plan for the Nanaimo Regional Landfill. This integrated plan addressed the staged long-term development for the site, taking into account leachate management, storm water management, and landfill gas management. The plan addressed concerns associated with aging environmental infrastructure, hydrogeological impacts related to the unlined portion of the site, and ongoing support for an existing landfill gas utilization project.
- Development of an updated design and operations plan for the Foothills Boulevard Regional Landfill. This plan was developed to integrate long-term leachate management, storm water management and landfill gas collection into the fill plan strategy. The plan also addressed the ongoing development of the site as a regional landfill facility for the Regional District of Fraser-Fort George by optimizing future opportunities to laterally expand the facility.
- Development of a landfill design and operations plan for the Syncrude Mildred Lake Industrial Landfill. This plan was developed to optimize site life of the existing landfill waste footprint, while addressing Syncrude's plant operational policies and procedures. The plan was developed both as a guidance document for Syncrude management, while acting as an operations manual for the landfill operations contractor.
- Development of a Design and Operations Plan for the City of Saskatoon Landfill facility. This plan was developed to act as a guidance document for both landfill management and operations staff, while providing an estimated additional 50 years of airspace at the existing facility. The Design and Operations plan addressed concerns with respect to ongoing cell development, progressive closure, leachate and storm water management, and opportunities to support a future landfill utilization facility by incorporating both vertical and horizontal landfill gas extraction systems into the active operating areas and progressive closure stages.

## LANDFILL GAS DESIGN / MANAGEMENT

- Design and construction of the Greater Vernon Recycling and Disposal Facility Landfill Gas Collection System. This project included the detailed design, approvals, and construction of the landfill gas collection system based upon the Regional District's control system standards and specifications. In addition to the landfill gas system, an updated fill plan was developed to facilitate well field expansion and optimize capture of fugitive emissions. The design incorporated the use of buriable/sacrificial vertical extraction wells with remote manifold controls to further optimize collection opportunities.
- Review of landfill gas utilization options for the Hartland Landfill (Victoria, BC). This review included an assessment of the existing landfill gas based electrical generation facility, review of access to markets and commodity pricing, evaluation of technology maturity in the context of the Canadian market and recommendations for detailed evaluation and analysis.
- Design and construction of phases 1 through 3 of the landfill gas well field expansion at the Foothills Boulevard Regional Landfill site in Prince George, BC. These well field expansions incorporated both vertical extraction wells in closed regions of the site and horizontal trenches in the active landfill area. The design included the staged construction of a ring header and associated condensate management systems.
- Design and construction of the Nanaimo Regional Landfill LFG collection system, well field expansions and Control Plant upgrade to facilitate the development of a utilization facility. This multi-staged project was developed to both optimize gas capture opportunities and facilitate the beneficial utilization of LFG as feedstock for an electrical generation facility. Innovative aspects of this project included the use of sacrificial buriable vertical extraction wells (lifespan > 5 years beneath 10+ metres of waste), zoned manifold stations to facilitate the control of 10+ vertical wells and horizontal trenches per manifold, dual phase extraction wells, and the integration of a 1,200 cubic meter low pressure gas storage facility between the LFG Control Plant and utilization facility.
- Foothills Boulevard Landfill Gas Feasibility Study. This study reviewed the feasibility of several utilization options being considered for implementation by the Regional District of Fraser-Fort George at their regional waste management facility. These options included direct use, electrical generation and the development of a greenhouse facility. Technology, access to markets, and an economical evaluation was undertaken for each option.
- Foothills Boulevard Landfill Gas wellfield expansion (phases 1, 2 and 3). Including detailed design, project management, construction CQA, and commissioning. Integration of wellfield into the landfill design and operations plan.
- City of Red Deer '72 Landfill Facility Landfill Gas Management Plan. This plan was generated to address the construction of a residential sub-division development within the 300 metre stipulated setback from the limit of waste of a closed landfill facility. This plan included a landfill gas migration risk assessment, development of a site-specific monitoring plan, and contingency response plan.

## EXPERIENCE SUMMARY

Douglas McLaren is an environmental engineer specializing in Air Quality, regulatory compliance and reporting. Douglas has extensive experience with a wide range of Air Quality related issues including emission inventory development, dispersion modeling assessments, and environmental management planning for Environmental Assessments (EA's). He has prepared and overseen a number of Certificate of Approval (Air) applications, numerous NPRI, GHG and O.Reg. 127/01 annual reports for a variety of clients as well as working on a number of EA's.

Douglas is also experienced in the development, implementation, maintenance, auditing and improvement of ISO 14001 environmental management systems. He is ISO 14000 lead auditor certified and has been involved in a variety of management system and compliance auditing programs.

## PROFESSIONAL RECORD

2011/Present	Tetra Tech WEI Inc., Senior Air Quality Engineer
2002/2011	AECOM, (Hamilton, Ontario), Environmental Engineer
2000/2002	Stelco Inc., Hilton Works, (Hamilton, Ontario), Air Quality Specialist
1999/2000	Kerry Foods Inc., Specialty Divisions, (Woodstock, Ontario), Production Supervisor
1997/1998	Falconbridge Inc., Research & Development Facility (Sudbury, Ontario), (Co-op)

## DISPERSION MODELLING AND FACILITY PERMITTING:

Completed advanced air dispersion modelling assessments using the US EPA AERMOD model and prepared up to date Emission Summary and Dispersion Modelling (ESDM) Reports for the following projects:

- **Kaminak Gold Corp.**, Coffee Gold Mine Permitting, Yukon
- **Enmax Power Corp.**, Substation Salt Dust Impact Assessment, Alberta
- **Cargil Ltd.**, High River Meat Plant Permit Update, Alberta
- **Sherwin Williams Canada Inc.** - Fort Erie, Brantford and Grimsby Paint Manufacturing Plants' Air Permit Renewals, Ontario
- **Molson Coors Inc.** Molson Brewery Permit Updates, British Columbia
- **Kyoto Fuels Inc.** Biodiesel Manufacturing Facility Permit, Alberta
- **North American Palladium Ltd.** - Lac Des Iles Mine, Permit Updates, Ontario
- **Tenaris - Algoma Tubes**, Seamless Tube Mill Permit Updates, Ontario
- **Johnson Controls Inc.**, Tillsonburg, Shelburne and Whitby Automotive Parts Manufacturing Plant Permits, Ontario
- **Electro-Motive Canada Co.**, Locomotive Manufacturing Facility Permit, Ontario
- **Ecolab**, Cleaning Products Manufacturing Facility Permit, Ontario
- **US Steel Canada Inc.**, Lake Erie Works Integrated Steel Mill Permit Updates, Ontario
- **Dyno-Nobel**, Explosives Manufacturing Facility Permit, Ontario
- **AGC Automotive Inc.**, Automotive Parts Manufacturing Plant Permit, Ontario

### Education:

Technical University of  
Nova Scotia, B.Eng.  
Chemical Engineering, 1999

Saint Mary's University,  
Diploma - Engineering,  
1996

### Registrations:

Toxic Substance Reduction  
Planner (ON MOE)  
License No. TSRP0191

Professional Engineers of  
Ontario (PEO)

ISO 14001 Registered Lead  
Auditor

### Office:

Mississauga, Ontario

### Years of Experience:

15+

### Areas of Expertise:

Air Quality Engineering

Air Emission Estimation &  
Quantification

Air Emission Inventory  
Development  
(Air Toxics & GHG's)

Emissions Tracking System  
Development (MS Excel  
Based)

Air Dispersion Modelling

Air Quality Permitting

Regulatory Reporting  
(NPRI, GHG, etc.)

Regulatory Compliance  
Assessments

ISO 14001 EMS  
Development, Maintenance  
& Conformance Auditing

EA Environmental  
Protection Planning

- **Junbuntzlauer Canada Inc.**, Citric Acid Plant Permit, Ontario
- **PPG Canada**, Kitchener Glass Plant Permit Update, Ontario
- **Region of Niagara**, Pumping Station Permit Updates, Ontario
- **Killarney Water Treatment and Pumping Station**, Stack Height Design, Ontario
- **Dana, Long Mfg.**, Automotive Parts Mfg Plant Permit, Ontario
- **Falconbridge Ltd.**, Kidd Mine Paste Backfill Plant Permit, Ontario
- **Harmony Creek Wastewater Treatment Plant** Permit Update, Ontario
- **Region of Durham**, Duffin Creek Wastewater Treatment Plant Permit Update, Ontario
- **Stelco Inc.**, Stelwire Permit, Ontario
- **Stelco Inc.**, Hilton Works Integrated Steel Mill Permit, Ontario

### AIR QUALITY & STACK MONITORING PROGRAMS

Coordinated the planning and execution of ambient air quality monitoring campaigns including the following:

- **Government of Manitoba**, Sherridon Orphan Mine Site Reclamation Project, Lime Dust Monitoring Campaign, Manitoba
- **Castle Rock Enterprises**, Quarry Operations Ambient Dust Monitoring Campaign, Yukon
- **Calgary Exhibition and Stampede**, Fugitive Dust Monitoring Campaign, Alberta
- **Stelco Inc.**, Hilton Works Stack Testing and Emission Factor Development Campaigns, Ontario

### TOXIC SUBSTANCE REDUCTION PLANNING:

Worked with facility staff to develop and certify the Phase I & II Toxic Substances Reduction Plans required for the following facilities:

- **JD Irving Inc.** Toronto Tissue Mill, Ontario
- **Sherwin Williams Canada Inc.**, Ontario
  - Brantford Paint Mfg. Plant
  - Fort Erie Paint Mfg. Plant
  - Grimsby Powder Coating Mfg. Plant
- **North American Palladium Ltd.** - Lac des Iles Mine, Ontario

### ISO 14001, GHG VERIFICATION & COMPLIANCE AUDITING

Conducted, or participated as an Auditor for the following Auditing Projects:

- **Omya Inc.**, Environmental Compliance Audit, Perth Quarry, Ontario
- **Neucel Inc.**, Port Alice Specialty Cellulose Plant GHG Verification Audit, British Columbia
- **GE Oil and Gas**, Weyburn Maintenance Facility, Environmental, H&S Audit, Saskatchewan
- **Anheuser-Busch – InBev Inc.**, Environmental Compliance Auditing Program
  - Oland's Brewery, Halifax, Nova Scotia
  - Columbia Brewery, Creston, British Columbia
- **Suez Energy Inc.**, Environmental Compliance Auditing Program
  - Gas Fired Power Generating Facility, Grande Prairie, Alberta
  - Wind Power Generating Facilities, Caribou, New Brunswick and West Cape / Norway, Prince Edward Island
- **Rolls Royce Marine Inc.**, Saint John's Marine Service Centre Environmental Compliance Audit, Newfoundland
- **Chrysler Canada Inc.**, Brampton Assembly Plant EMS Audit, Ontario
- **Tyco Thermal Products**, Environmental Compliance / Health & Safety Audit, Ontario
- **Tembec Inc.**, Environmental Compliance / Health & Safety & EMS Audit, Ontario

- **Dyno-Nobel Inc.**, Environmental Compliance Audit, Ontario
- **Reiter Automotive Inc.**, Annual EMS Audits, Ontario
- **Stelco Inc.**, Hilton Works ISO 14001 Development Implementation and Auditing, Ontario

#### REGULATORY REPORTING:

Prepared and submitted annual reports to regulatory agencies including National Pollution Release Inventory (NPRI), Ontario Regulation 127 (O.Reg.127), National Emission Reduction Master Plan (NERM), Environment Canada GHG (EC GHG), Ontario Regulation 452 GHG (O.Reg.452), for the following clients:

- **Ontario Power Generation**, Fossil Division Reporting (NPRI & O.Reg.127), Ontario
- **U.S. Steel Canada Inc.**, Lake Erie Steel Works Reporting (NPRI & O.Reg.127), Ontario
- **Fielding Chemical Technologies**, (NPRI, O.Reg.127, NERM), Ontario
- **North American Palladium Ltd.** – Lac Des Iles Mine. (NPRI, O.Reg.127)
- **Sangold Inc.** – Bisset Mine facility, (NPRI), Manitoba
- **Tenaris - Algoma Tubes**, (NPRI & O.Reg.127), Ontario
- **Johnson Controls Inc.** – Tillsonburg Seating Plant, (NPRI & O.Reg.127), Ontario
- **Electro-Motive Canada Co.**, (NPRI & O.Reg.127), Ontario
- **Ecolab**, (NPRI & O.Reg.127), Ontario
- **MultiServ** (NPRI & O.Reg.127) Hamilton, Nanticoke & Whitby, Ontario & Montreal Quebec
- **ETI Canada Inc.**, (NPRI & O.Reg.127), Ontario

#### ENVIRONMENTAL ASSESSMENTS (EA's)

- **Confidential Client, Port Hope Industrial Site Remediation.** Prepared Environmental Protection Plan (EPP) to mitigate the air quality and noise impacts from construction, demolition and related activities including transportation and handling of contaminated materials.
- **Hamilton Port Authority, Randal Reef EA & Remediation.** Prepared EPP to mitigate the air quality and noise impacts from construction related activities including transportation and storage of materials (primarily aggregate and sand), sheet pile installation, mechanical and hydraulic dredging, and the demolition and repair of existing infrastructure.
- **Sydney Tar Ponds Agency, Sydney Tar Ponds EA & Remediation.** Updated EPP to address updated air quality standards and other issues relating to air quality monitoring and reporting.
- **Saskatchewan Ministry of the Environment, Gunnar Mine Site Closure.** Completed initial data review and prepare an Air Quality Gap Analysis to determine if any additional information, testing and monitoring is required to complete the assessment and EPP.