AirZOne

Comprehensive Air Quality Services

To: Stephanie De Grandis, *Concerned Residents Coalition* **15 April 2014**

From: Franco DiGiovanni, *Senior Air Quality Modeller* **Pages: 25**

Screening-level review of James Dick Construction Ltd. air quality assessment re: Proposed Hidden Quarry

1. Background

James Dick Construction Limited (JDCL) has proposed to locate a quarry, the proposed Hidden Quarry, in the Township of Guelph-Eramosa, Wellington County. JDCL retained RWDI AIR Inc. (RWDI) to conduct an air quality study to assess the potential air quality impacts from the quarry. RWDI issued a "Final Report" (dated September 6, 2012) describing their assessment.

A copy of the report was obtained by the Concerned Residents Coalition (CRC). I was requested, by CRC, to provide a screening-level review of the RWDI report (provided in section 5 of this report) and to address the Terms of Reference and answer questions provided by CRC (listed and addressed in section 7 of this report).

In addition, in this report, I provide my qualifications as an air quality expert in section 2, section 3 indicates the scope of this review, section 4 provides an overview of the requirements of an air impact assessment, section 6 assesses a previous review of the RWDI report, section 8 provides conclusions and section 9 provides recommendations for further work required before the air quality assessment can be considered complete.

2. Qualifications of Franco DiGiovanni, PhD

I am a Senior Air Quality Modeller for Airzone One Limited (Airzone), an air quality consulting company located in Mississauga, Ontario. My position entails conducting air quality assessments using dispersion modelling for permitting purposes and also for general air assessments. I have been in this position since 1999 and during my time I have worked on a wide range of air regulatory approvals in Ontario and a number of air assessments using dispersion modelling. As part of my experience, I have been involved in reviewing and providing commentary on the Provincial regulatory air permitting system in Ontario.

I have a BSc(HONS) in Geology from Imperial College (London) and a PhD in Physical Geography from the University of Hull (UK) where my thesis was on modelling airborne particle dispersion. I spent four years conducting postdoctoral research at the University of Guelph, and subsequently, as an NSERC Visiting Fellow with Environment Canada. During that time I continued to focus my research on modelling particle dispersion in air. I have published 12 peer-reviewed scientific articles; all have dealt with airborne particles and five specifically dealt with modelling the dispersion of airborne particles. I have taught Air Quality courses at Conestoga and Sheridan Colleges.

I have been retained as an air pollution dispersion modelling expert in more than half-a-dozen litigation (mainly land re-zoning) disputes, which have involved peer-reviews. I have been qualified to give opinion evidence before the Ontario Municipal Board ("OMB") on matters of air quality.

I have assisted the Town of Oakville in developing their Health Protection and Air Quality (HPAQ) Bylaw, specifically aimed at assessing stationary facility emissions of fine particulate matter ("PM2.5"). This involved the setting of air quality threshold standards for Oakville. As part of that work I have also written dispersion modelling and air impact assessment guidance to support their regulatory system.

With regards to aggregate pit operations, I have carried out an air assessment on behalf of a proponent in Ontario. I have also supervised an assessment of dust emissions from a limestone quarrying operation in the

Caribbean as part of an environmental assessment for a waste dump expansion. More recently I have directed the air emission assessment of multiple limestone quarries in the Caribbean in relation to an Environmental Impact Assessment for a garbage incinerator.

I have previously reviewed air assessments for three other aggregate operations in Ontario. I have reviewed two proposed aggregate operations brought before the Ontario Municipal Board (OMB) and one brought before a Joint Review Tribunal (JRT). Both proponents heard before the OMB retained RWDI as their air quality consultant,

I have carried out an assessment for Environmental Compliance Approval ("ECA") purposes for a brick manufacturing facility that has ancillary aggregate-like operations. Additionally, I have managed noise impact assessments for asphalt plants, which also have ancillary aggregate-like operations. Furthermore, I have also conducted dust assessments, or supervised the assessment, for a number of industrial operations that have aggregate-like operation activities on-site. A copy of my Curriculum Vitae is attached.

3. Scope of Work

I will conduct a preliminary, and brief, screening-level review of the RWDI report. The purpose would be to identify major deficiencies (if any) in the air assessment conducted by RWDI.

Specifically I will (1) review the text in the main body of the report and only relevant materials in the appendices (maps, etc.), and, (2) provide a summary report on my findings.

I will not provide a detailed review of supporting materials in the appendices, including detailed calculation tables, dispersion models, scientific papers or materials referred to within the body of the report, or any secondary references cited in the primary references provided. I believe that, eventually, these should be reviewed but are not at this stage.

I provide my findings and report below (section 5).

I have also been provided Terms of Reference by CRC, including questions they have raised. These are addressed in section 7.

4. Requirements of an Air Quality Assessment

4.1 Introduction

One way to determine airborne pollutant levels resulting from emissions from an aggregate facility would be to measure the levels of all substances emitted into the surrounding community. However, actual measurements will not be available for a proposed aggregate project; instead, we have to rely on predicted changes in air quality (using air quality computer models) to assess estimated changes in local air pollution levels.

As the site does not yet exist much of the input data required to conduct the assessment does not yet exist. In those cases estimates for those data must be made on a conservative basis. For example, the level of dustiness of the unpaved roads in the proposed aggregate pit is not yet known and yet is a key input into assessing dust emissions and impacts on the surrounding neighbourhood.

However, there is information available from other existing or past aggregate operations. If those other operations are representative of the proposed site, then data from those other sites may be used as an estimator of (for example) road dustiness for the proposed aggregate pit. The key issue in assessing those data is dealing with the range of data values from those other sites. Unless one has good reason to argue against it, it is prudent to choose the upper limit of the range, the value that will result in the highest emissions or impacts. For example, the United States Environmental Protection Agency (US EPA) has published information on road dustiness levels in aggregate and quarrying operations. Unless one can argue otherwise it is prudent, and necessary, to choose the upper limit. It is the proponent's responsibility to explain why upper limit values are not possible for the proposed site.

Moreover, under certain circumstances, an aggregate pit may be proposed under different conditions not well represented in existing datasets. Under such circumstances the upper limit of available data may not even be representative of the maximum dustiness in the proposed aggregate pit roads. Different decisions must be made in those cases.

The adoption of the above approach will help ensure that the actual impacts will not be underestimated; this is the essence of the conservative approach in aggregate air quality assessments.

Married to the conservative approach, the assessment must also be carried out on a worst-case basis. Maximum emissions and worst-case dispersion conditions must be considered under maximal production levels so that maximal impacts can be considered and assessed. For example, crushing machinery in the pit intended to be used to process extracted aggregate will emit dust. The more aggregate processed in a day, the greater the dust emissions from that machinery. It is important that the maximum emissions rates that could happen, or will be allowed to happen, are assessed; these limits could be set by pit management (with appropriate oversight) or may be limited by the machine itself (mechanical specifications). Equally, other factors may cause neighbourhood impacts to reach a maximum; the location of machinery, as close as permissible to property boundaries, must be assessed if it is allowed within the Site Plans. In general, the operational scenario assessed should be that which causes the highest off-site impacts; it is the responsibility of the proponent to test all likely scenarios and find the one(s) that cause the highest off-site impacts. It is also the responsibility of the proponent to demonstrate to the public that it has tested all scenarios and found the worst-case one, which must then be used in the air assessment.

4.2 Sources of Emissions

There are numerous sources of contaminant emissions at an aggregate operation. They include dust sources such as vehicle loading and unloading with extracted material, road dust from on-site traffic, rock crushing and screening operations, wind erosion of stockpiles and also gaseous emissions from on-site combustion equipment (diesel generators, vehicles, gas-fired heaters, etc.).

In regards to the dust emissions, dust particles vary in size and composition. The total amount of dust in the air is known as Total Suspended Particulate ("TSP"). The size fractions of dust particles can vary from very fine particles, less than 2.5 micrometres (μm) in aerodynamic diameter, through to particles greater than 44 μm in diameter. Dust particles smaller than 10 μm in aerodynamic diameter are known as "PM10." The finer dusts (especially those smaller than 2.5 μm in aerodynamic diameter, termed "PM2.5") are known to cause health effects.

In Ontario, TSP is regulated by the Ministry of the Environment ("MOE") as part of Ontario Regulation 419 ("O.Reg.419/05"), which sets out a point-of-impingement ("POI") standard of 120 $\mu g/m^3$ averaged over a 24 hour period. The PM10 and PM2.5 size fractions do not have POI standards under O.Reg.419/05. PM10 has a suggested interim Ambient Air Quality Criterion ("interim AAQC")and PM2.5 has a "Canada Ambient Air Quality Standard" ("CAAQS"). The CAAQS is not protective of human health but rather is merely intended as an airshed management tool.

Dust from aggregate operations also varies by composition. For example, pit road dust may contain the same minerals contained in the overburden soil or the aggregate deposit itself, or both. If the road surface material contains quartz (a common mineral in rocks and soils; a form of crystalline silica), the dust raised may be an inhalation hazard since crystalline silica has known health effects if inhaled.

Once all contaminants that can be emitted have been identified, these become the "contaminants of concern" (CoCs) for an air quality assessment focused on the impacts of a "subject" facility.

In any air assessment, one must consider the locations of sources of emissions at the facility (e.g., rock crushers within an aggregate pit producing dust) and how individual dust source emissions vary over time. As mentioned, it is necessary to consider the maximal emissions that could happen but also the coincidence of dust sources (e.g., all dust sources that may emit at the same time). For example, if material handling, causing dust emissions, may occur at the same time as vehicle movement on roads, also causing dust emissions, then this combined scenario should be assessed. A proponent is always free to show that the coincidence of certain emissions is not possible or not permitted at their facility.

4.3 Modelling Air Concentrations

To assess the levels of a contaminant surrounding a facility, due to emissions from that facility, Ontario (and most other jurisdictions) requires the use of quantitative computer models that predict the dispersion of contaminants from a discharge point to a receptor in the surrounding community (“dispersion models”).

In its simplest form, a dispersion model requires input on (1) the sources of pollution, including the emission rate, and, (2) meteorological data such as wind speed and turbulence. The model then simulates, mathematically, the pollutant’s transport and diffusion through the air. The model output is an air pollutant concentration level for a particular time period at one or more specific receptor locations in the surrounding community.

Dispersion modelling represents a simplification of actual events. For a particular location and time period, dispersion modelling is not as accurate as specific measurement of airborne contaminants. The most common air dispersion models used for regulatory compliance in North America are generally accurate within a factor of 2 when compared to actual measurements (as ranked comparisons), but may be even more inaccurate when model results are compared to measurements at specific locations and times (paired comparisons). However, modelling does allow a prediction of changes in air pollution levels when an aggregate facility is modified, and does allow estimates to be made at many locations (“receptors”) and for long periods of time (e.g., years). It is also the only way to estimate air quality levels from a proposed facility.

Overall, the practice associated with taking a conservative approach, when conducting a modelled air impact assessment, means that an assessment must combine worst-case emissions with worst-case meteorology to ensure that worst-case air quality levels are estimated at all locations in question. This focus on worst-case impacts (rather than average impacts) is the general practice when conducting an air quality impact assessment.

4.4 Estimated Air Quality Levels in the Surrounding Community

As pollutants from the proposed facility (“subject” source) disperse through the air, they will add to pre-existing levels of those same pollutants (so-called “background levels”) emitted from other sources. For example, PM2.5 will be emitted by many of the surrounding “non-subject” facilities, e.g., from public roads, agricultural operations as well as from other industrial facilities, etc., in the area.

However, background levels of air pollutants are not the same at all locations. For example, closer to a non-subject source, background levels will be higher as they will be affected by emissions of CoCs from that non-subject source. A specific example would be consideration of major roadways in the area. These roadways will emit PM2.5 (for example) due to automobile exhaust and road dust. Major roadways will also be emission sources of oxides of nitrogen (“NOx“). Therefore, locations closer to major roadways will experience higher background levels of PM2.5 and NOx, for example.

In theory all sources, no matter how far away, will contribute to air quality levels at locations in the Township of Guelph-Eramosa; in practice, however, it is found that only sources within a relatively short distance will cause significant variations in background levels. Beyond that short distance, emissions from all non-subject sources will “merge” together.

This concept of dividing background air levels into “regional” and “local” components is well established and is formalized in various regulatory modelling guides and regulations around the world. For example, the Province of Alberta Air Quality Model Guideline describes methods of dividing the background into these two components, where section 3.9 (“Cumulative Effects Assessment of Nearby Emission Sources”) describes inclusion of local non-subject sources and section 4.2 (“Baseline Concentrations”) describes the addition of regional background. In addition, the United States regulatory air quality dispersion modelling is guided by the "Guideline on Air Quality Models" and is incorporated by reference in the American regulations for the Prevention of Significant Deterioration of Air Quality, Title 40, Code of Federal Regulations (CFR) sections

51.166 and 52.21 in June 1978 [Federal Register, 43 (118), 26 382-26 388]. Part 51 paragraph 8.2.3 describes division of background into local and distant sources.

Emissions from local, anthropogenic ("man-made"), non-subject sources can be divided into mobile (on-public-roads vehicle emissions) and stationary sources. Mobile sources (e.g., on-road vehicles) emit CoCs via tail-pipe emissions and via re-suspension of road dust (causing, for example, emissions of PM2.5).

In assessing background concentrations, biogenic ("natural") emissions should also be considered.

The Province of British Columbia "Guidelines for Air Quality Dispersion Modelling in British Columbia" section 10.1 ("Model Output – the Need to Add Background") provides advice on an order of preference among different techniques to estimate background concentrations of CoCs. The BC modelling guide (page 82) indicates the order of preference as, sequentially:

Top preferred - "a network of long-term ambient monitoring stations near the source under study"

Second most preferred – "long-term ambient monitoring at a different location that is adequately representative"

Third most preferred – "modelled background"

4.5 Use of Air Quality Assessment Modelling Results

In my experience conducting reviews of air quality reports, a health impact expert frequently provides their opinion in the form of a human health risk assessment based upon the community-level exposure to CoCs estimated by the modelling.

I am not a health impact expert. However, below are a few references indicating the dangers of very fine dust emissions from aggregate operations (aka "PM2.5"):

<u>World Health Organization (WHO) Europe. (2004). Health Aspects of Air Pollution (2004). Results from the WHO project 'Systematic Review of Health Aspects of Air Pollution in Europe':</u>

"Many studies have found that fine particles (usually measured as PM2.5) have serious effects on health, such as increases in mortality rates and in emergency hospital admissions for cardiovascular and respiratory reasons. Thus there is good reason to reduce exposure to such particles."

<u>Toronto Public Health (TPH). (2004). Agenda for Action on Air and Health. Prepared by Kim Perrotta, Monica Campbell, Angela Li-Muller, Ronald MacFarlane, Sarah Gingrich. Toronto, Ontario: July 2004, referring to PM2.5 as one of the five air pollutants:</u>

"The premature deaths and hospital admissions estimated for the five air pollutants in the Toronto Air Pollution Burden of Illness study are associated with air levels that are well below both, Ontario's existing ambient air quality criteria (AAQC) and the new Canada-wide Standards (CWS) developed by the Canadian Council of Ministers of the Environment (CCME)."

<u>Filling the Gaps in the Regulation of Fine Particulate Matter, Office of the Environmental Commissioner of Ontario. Serving the Public; Annual Report, 2012-2013 (Section 5.8):</u>

"Particles less than 10 micrometres (μm) in diameter can be inhaled, and particulate matter smaller than 2.5 μm (PM2.5) is able to penetrate deep into the lungs where there is a diminished capacity to remove contaminants. Anthropogenic emissions of PM2.5 are produced primarily by fuel combustion (e.g., gasoline and diesel engines, wood burning, etc.), industrial activities, and disturbance of open sources, such as dust, during construction, resource extraction, etc. Secondary PM2.5 is produced through reactions between gaseous substances known as precursor emissions. Transboundary emissions from the United States are also a significant source of PM2.5 in Ontario. Evidence shows that exposure to particulate matter is a cause of a number of serious and fatal health effects, including chronic bronchitis and asthma, reduced lung function, and

increases in hospitalization and mortality due to cardiorespiratory diseases. Health risk increases with exposure to PM2.5, and there is no known threshold below which adverse health effects are not anticipated."

A Canadian document about PM2.5 standards: "Canada-wide Standards for Particulate Matter and Ozone: Five Year Report: 2000-2005" (CCME November 2006):

"The long-term air quality management goal for PM and ozone is to minimize the risks of these pollutants to human health and the environment. There is clear evidence of the harmful effects of these pollutants throughout the range of concentrations to which Canadians are exposed. This means that any reduction in the ambient levels of these pollutants provides a reduction in population health risk. The CWSs for PM and Ozone were endorsed by CCME in June 2000. They represent a balance between the desire to achieve the best health and environmental protection possible in the relative near-term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated levels of PM and ozone in ambient air."

According to the above references, it seems prudent to pass any resulting conclusions of PM2.5 concentrations on to a health impacts expert, as was my experience in the Nelson Aggregated Case (Re Nelson Aggregates Co. Case No.: 20-030).

In my experience of air quality reports, in addition, an ecological expert could also provide their opinion in the form of an ecological risk assessment for the environmental-level exposures of CoCs estimated by the modelling.

5. Deficiencies with the RWDI Air Quality Assessment

I have reviewed the Air Quality Assessment (AQA) and numerous and serious deficiencies were found. I will describe those deficiencies in the order that they were presented in the RWDI report.

This review is a screening-level review. A more in-depth review may reveal additional problems not mentioned in this report.

<u>AQA Report s.1.4 PROCESS FLOW DIAGRAM</u>

"The typical process flow diagram for the processing plant is shown on Figure 1.4. It should be noted that at any time, the precise flow of material may change between different pieces of processing equipment, but the overall maximum processing rate remains constant."

Different pieces of aggregate processing equipment may emit differing amounts of dust even for the same overall material throughput rate. Thus it should be noted that greater use of different pieces of equipment (as suggested by RWDI) may lead to greater emissions than estimated by RWDI regardless of the overall amount of material processed per day staying constant. Further clarification is required here as the emissions scenario used in their assessment may not be reflective of the maximum emissions in reality.

Furthermore, the number of pieces of processing equipment used affects dust emissions (regardless of the overall amount of material processed per day staying constant), and so the number of pieces of equipment (and type) needs to be fixed, or, a worst-case scenario needs to be presented if there are variations possible. In addition, the worst-case scenario should be justified by comparison against the other possible scenarios.

Conclusion – This statement would seem to provide a caveat to their assessment; this may mean that their assessment may not be reflective of the actual worst-case emissions whereas it should be reflective of the worst case emissions.

<u>AQA Report s.1.5 OPERATING SCHEDULE</u>

"_ Site preparation and rehabilitation activities occur from 7:00 am to 7:00 pm.

_ Drilling, blasting, excavation and processing operations occur from 7:00 am to 7:00 pm; and,

_ Shipping operations will occur from 6:00 am to 6:00 pm."

It should be ensured that the modelling accounted for site processing during 7 am – 7 pm whereas shipping activities were off-set to the period 6 am – 6 pm. This requires further review of the modelling.

"_ The site will operate generally from April 1 to December 24."

If the modelling assessment excluded the period between December 25 and April 1, then this exclusion needs to be explicitly cited on the site operational plans. Further explanation and review is required.

This is because modelling estimations excluding that calendar period may exclude meteorology specific to that period; meteorology specific to that (Winter) period may cause poorer air dispersion and thus higher impacts compared to the period actually used. This requires further review of the modelling.

Conclusions - further review on the operating schedule is required to verify RWDI's claims.

<u>AQA Report s.3.1.1.1 Crystalline Silica</u>

"The quarry will process dolostone. Dolotsone dust consists of a mixture of calcium and magnesium carbonates, which do not have any specification limitations under the O. Reg. 419/05."

Calcium carbonate has an air quality limit (Jurisdictional Screening Level (JSL) 24 hour value of 24 μg/m^3), which should be assessed by RWDI; they did not assess for calcium carbonate against this limit.

Even under guidance supporting O.Reg. 419/05, all contaminants must be assessed even if there is no standard or guideline listed as they may nonetheless cause an adverse effect. Under such circumstances, a health/ecological assessment is required to assess the effects of the maximal off-site exposure levels from such substances.

"Dolostone dust may include small amounts of other non-metallic materials introduced from other aggregates contained as anomalies in the rock."

RWDI should explain these non-metallic materials that are "*introduced*" from other aggregates. What is the geological process by which this occurs? Why are these considered "*anomalies*"? – it is normal to have a mixture of minerals in rocks – again explanations are required. Until suitable explanations are provided this analysis remains lacking and uncertain.

Of further note, it is also irrelevant if the amounts are "*small*"; even small amounts must be accounted for as part of the assessment to ascertain their impact. RWDI did not account for these other "*non-metallic materials*" but should have. Thus the overall assessment is missing this component.

"Of these materials, crystalline silica is of most interest with respect to air quality."

It is impossible to decide which material is of most interest until we have information on all other constituents. The full analysis is required but has not been provided. Until it is provided the analysis remains incomplete and uncertain.

"Based upon the chemical analysis of the quarry, the average concentration of crystalline silica is well below the 10% threshold."

This "*chemical analysis*" should be provided (which it was not) so that its credibility can be reviewed. Without being provided the claim by RWDI remains uncertain and unverifiable.

"To ensure this aspect of air quality standard is met, the silica content will be monitored as part of the normal chemical analysis of particulate matter at the site."

The complete protocol for this analysis is required; without that, this analysis is uncertain and unverifiable.

Will the aggregate be analysed before extraction to ensure work is stopped before the community is exposed to unacceptable levels in a proactive fashion? Or, will air monitoring samples be analysed retroactively, potentially discovering unacceptable exposures after the community has already been exposed?

AQA Report s.3.1.1.2 Trace Metals

"With regard to trace metals and other possible contaminants contained within dust generated at a dolostone quarry operation, the MOE's guidance in its "Procedure for Preparing an Emission Summary and Dispersion Modelling Report, Version 3" was followed. Table 7-3 of the procedure document identifies non-metallic mineral mining and quarrying operations as sectors where metals in the fugitive particulate matter are generally not anticipated. Based on this guidance, trace metals were not assessed explicitly."

However, this does not obviate proponents from assessing for other substances within the aggregate (and thus dust generated). RWDI have not assessed for all other components within the aggregate.

Conclusion on aggregate composition – valid and complete site-specific data is required in order to predict the composition of the dust that will be generate from the pit; this has not been provided. This renders RWDI's assessment uncertain and thus unreliable.

AQA Report s.3.1.1.3 Combustion By-Products

"With respect to emissions of combustion by-products from on-site mobile equipment and the drag-line, the principal contaminants of interest are typically nitrogen oxides (NOx), $PM_{2.5}$, PM_{10}, and TSP and these are used as surrogates for all products of combustion."

In RWDI's assessment for another aggregate pit, the Henning Pit in North Dumfries (air quality assessment report submitted November 2013), they also analysed for benzo-a-pyrene (BaP) emissions from diesel combustion sources. To quote from RWDI's report on Henning Pit:

"The MTO's Guide identifies the following as the contaminants of greatest relevance to transportation air quality:

- *Carbon monoxide (CO)*
- *Nitrogen dioxide (NO_2)*
- *Particulate matter (airborne particles) smaller than 10 microns (PM_{10})*
- *Particulate matter smaller than 2.5 microns ($PM_{2.5}$)*
- *Key hydrocarbons compounds (benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein)*

In addition to these, the so-called polycyclic aromatic hydrocarbons (PAH) were also considered, of which the key representative is benzo(a)pyrene (BaP)."

It is more reasonable to have followed the general procedure that RWDI did in their Henning Pit analysis (although some of the details of their procedure were questionable). Thus, BaP should have been included in their analysis for the present JDCL assessment. In their Henning Pit assessment, RWDI demonstrated that BaP has the highest potential to exceed the air quality standard; thus it would potentially be the contaminant of greatest concern.

Conclusion – missing combustion by-products assessments.

AQA Report s.3.2.1.1 Emissions from Overburden Stripping & Rehabilitation

"Removal and hauling of overburden is expected to occur only at times when extraction, production and shipping of aggregate are relatively low. The total on-site level of activity is expected to be lower than that during peak extraction, production and shipping. As such, peak extraction, production and shipping, with no coincident overburden removal represents the worst-case operating scenario to be assessed as required under Section 10 of O. Reg. 419/05. Removal of overburden does not represent the worst-case operating scenario and therefore was not assessed."

RWDI claims that overburden stripping and rehabilitation only occurs when aggregate processing amounts are at less than maximal activity levels and thus does not require assessment; if so, this should be reflected in the site plans. However, there is no discussion of whether overburden processing occurs in the same locations as processing for aggregate material, nor if it has the same composition. These two aspects can profoundly affect dust dispersion and community-level exposures. Therefore, overall, a separate assessment is required unless adequate explanation is provided. Until proper explanation is provided, this analysis remains uncertain and unverifiable.

Conclusion – assessment on stripping and rehabilitation missing.

"In addition, stripping of overburden normally involves material that has inherently high moisture content. A review of literature on continuous soil measurements, included in Appendix C, indicates that the 95th percentile low soil moisture level was 20% by volume (approximately 13% by mass). These values are from a study done in Illinois; however RWDI believes that the measurements provide a suitable surrogate for soils in south-western Ontario. Given the moist, organic, loam nature of the material, a review of the emission factors provided in U.S. EPA AP-42 Chapter 13.2.4: Aggregate Handling and Storage Piles for these activities suggest that with elevated moisture content (in this case greater than 13%), the potential emissions of particulate matter are insignificant compared to site-wide emissions during peak extraction, production and shipping."

RWDI claims (from the above quote "*RWDI believes that the measurements provide a suitable surrogate for soils in south-western Ontario"*) that soil moisture data from Illinois is representative of conditions in southern Ontario – this claim requires verification and, until verified, remains uncertain.

Conclusion – RWDI's claim on soil moisture levels is not sufficiently supported.

AQA Report s.3.2.1.4 Aggregate Storage Piles

"Wind erosion from exposed pit faces and stockpile areas is relatively infrequent, occurring only when the wind is high and conditions are dry. Wind erosion begins to occur when the wind gusts exceed 15 to 20 km/h and becomes significant when the gusts exceed about 30 km/h. As discussed in Section 6.1.1, winds above 30 km/h occur less than 2% of the time during the summer. If surfaces are wet due to rainfall or other precipitation, then wind erosion will not occur. Overall, wind erosion is expected to occur less than 2% of time."

The claims of insignificance by RWDI need to be numerically verified. RWDI must provide specific numeric calculations to support their claim. Until this is done, their claim remains uncertain and unverifiable.

Conclusion – RWDI's claim on wind erosion frequency is not sufficiently supported.

AQA Report s.3.3.2.1 Fugitive Dust Emissions from Paved and Unpaved Internal Haul Roads

"JDCL will develop a Best Management Practice Plan, which will serve as a guideline for dust management practices at the facility. With the implementation of this plan, the facility is exempt from assessing particulate emissions from paved roadways, unpaved roadways, and aggregate storage piles located on-site, as per guidance in Section 7.4.1 of MOE Guideline A10."

RWDI claims that it does not need to assess particulate emissions from roads, despite the fact that roads tend to be one of the major sources of dust emissions at an aggregate extraction operation. They claim that assessment is not required as part of their so-called “compliance assessment.” However, it would seem that RWDI misunderstand that section of the MOE guideline s.7.4.1, which only refers to no requirement to assess metals in dust; other components still need to be assessed.

Conclusion – road particulate assessments missing from compliance assessment.

Other sources not directly assessed, not mentioned by RWDI and other issues

Clarification is required on whether there will be any blasting of aggregate for above-water-table operations.

Conclusion – clarification required on above-water-table blasting.

Referring to Figure 5.2B – mapping of source locations: it should be noted that any deviations from the source locations shown in this map will results in different modelling results and therefore different values for community-level exposures. Therefore, these locations (equipment, roads, etc.) must be fixed for the duration of the pit activity; the exact locations must be fixed by a land survey based upon the UTM geographical coordinates specified in the model runs. Assurance that this will be done may be achieved, for example, by specification of source locations on the Site Plans, with UTM coordinates specified.

Conclusion – clarification in the Site Plans required on source locations.

AQA Report s.4.1.2 SCENARIO 2 – CUMULATIVE EFFECTS MODELLING – CONVEYORS FROM FACE

“This scenario included fugitive dust and tail pipe emissions from mobile equipment at the site, and considers the use of conveyors for transporting raw material from the working face to the primary crusher.

As a conservative simplification, emissions from the transfer of the material onto the conveyor were represented by the same haul truck loading emission estimate of the third scenario, while emissions from the conveyor drop into the primary crusher are represented by the emission estimate from the third scenario for trucks dumping into the grizzly feeder at the primary crusher.”

The US EPA provides specific emission factors for the conveyor drop operations that RWDI estimated here; however RWDI did not use these more specific methods but rather substituted equations meant for truck loading.

RWDI claims that these are “*conservative*” but provides no evidence to verify this claim. RWDI are required to provide this evidence to back-up their claim. Without such evidence, their claim remains uncertain and unverified.

Conclusion – RWDI’s claim that truck loading estimates are applicable to conveyor transfers is not sufficiently supported.

AQA Report s.4.2.1 HAUL TRUCK LOADING AND DUMPING OPERATIONS

“PM emissions from loading of haul trucks and dumping at the grizzly were estimated using emission factors from the U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42) Chapter 13.2.4: Aggregate Handling and Storage Piles. A moisture value of 5% was used to reflect the high moisture content of material taken directly from the working face. This is consistent with RWDI’s experience at sand and gravel operations in Southern Ontario.”

RWDI needs to explicitly prove that 5% is a reasonably conservative value to use. In this case, a conservative value would be the lowest moisture value (driest) that it could reasonably be. In this we cannot depend on “*RWDI’s experience at sand and gravel operations in Southern Ontario*” so we cannot verify if those other "*experience*"(s) are representative of the situation at the proposed Hidden Quarry. Rather than assume "trust" in RWDI's "*experience*," RWDI must, instead, provide explicit evidence of their claims. Without such explicit evidence, these claims remain uncertain and unverifiable.

Conclusion – RWDI's claim that moisture values used are minimal is not sufficiently supported.

AQA Report s.4.2.3 SHIPPING OPERATIONS

"PM emissions from loading of shipping trucks were estimated using emission factors from AP-42 Chapter 13.2.4: Aggregate Handling and Storage Piles. The moisture values for the material handled were based on the mean values provided in Chapter 13.2.4 for limestone products."

Why were mean values used when conservative (upper) limits are normally required? Such an assumption could lead to underestimates of community-level impacts as lower limit (worst-case) moisture values should be used unless RWDI can provide contrary evidence. RWDI must explain this non-conservative assumption.

Conclusion – RWDI's use of a non-conservative moisture value is not sufficiently supported.

"The amount of aggregate material handled at each location was assumed to be equivalent to the production rate of the material stockpiled at that location. A supplemental control efficiency of 90% was applied to reflect the washed nature of the aggregate."

We require quantitative evidence of RWDI's "*supplemental control efficiency of 90%*" claim – until provided this assumption remains uncertain and unverified.

Conclusion – RWDI's claim of a supplemental control efficiency is not sufficiently supported.

AQA Report s.4.2.4 FUGITIVE DUST EMISSIONS FROM PAVED INTERNAL HAUL ROADS

"The paved section was estimated to have average silt loading of 1.2 g/m², which is lower than the mean value for quarry sites provided on Table 13.2.1-3 of AP-42. Past experience indicates that this is achievable on industrial paved roads using intensive flushing / sweeping programs."

The silt loading represents the level of dustiness on the roads. This value assumed by RWDI of 1.2 g/m^2 represents very low levels of road dustiness compared to the range of values represented in the stated table (range 2.4 – 14 g/m^2) and is therefore not conservative. RWDI claims that this low dustiness level may be achievable based on "*past experience*;" however, the requirement is to provide quantitative evidence that "*past experience*" applies here; RWDI must provide calculations that prove that these levels of road dustiness can be achieved, with certainty, at the proposed Hidden Quarry. Without such evidence, their claim remains uncertain and unverifiable.

Conclusion – RWDI's claim that the paved road silt loading level used is appropriately conservative is not sufficiently supported.

AQA Report s.4.2.5 FUGITIVE DUST EMISSIONS FROM UNPAVED INTERNAL HAUL ROADS

"The silt loading values were based on values provided in AP-42, and is supported by studies done by RWDI at various sites across Ontario. The unpaved haul routes were estimated to have an average silt loading of approximately 8.3%."

Again, RWDI uses an average value rather than a conservative, worst-case value without providing justification. The AP-42 values quoted range from 2.4 – 16%. RWDI cites "*supported by studies done by RWDI at various sites*" but does not provide that evidence nor explains, on a quantitative basis, why those would apply to the proposed Hidden Quarry site. Without such evidence, their claim remains uncertain and unverifiable.

Conclusion – RWDI's claim that the unpaved road silt level is appropriate is not sufficiently supported.

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"In addition, watering of the unpaved haul routes, combined with a posted and monitored speed limit of 25 km/h, was estimated to provide 95% control of emissions compared to a dry haul route with no speed limit, based on information provided in AP-42 and in literature supporting AP-42. These values reflect the implementation of the Best Management Practices Plan."

RWDI claim a very high control efficiency of 95%. This claim requires very detailed justification and verification as dust emissions from unpaved roads tend to be the major sources of dust at aggregate extraction operations. Without this detailed and explicit quantification, RWDI's claim remains quite uncertain and unverifiable.

Conclusion – RWDI's claim on watering road dust efficiency is not sufficiently supported.

AQA Report s.4.2.6 – 4.2.8

not reviewed.

AQA Report s.4.3.1 – 4.3.5

Not fully reviewed. Typographical error found in an equation (in s. 4.3.5.1), which may lead to confusion. Details of inputs should be reviewed at some point in the future.

AQA Report s. 4.3.6-4.3.8

not reviewed.

AQA Report s.4.4 ASSESSMENT OF DATA QUALITY FOR EACH EMISSION RATE

not reviewed.

AQA Report s. 6 Dispersion Modelling

"Sources were modelled as a series of volume sources with parameters based on information obtained from the Site Plan and typical dimensions of processing equipment and vehicles used at other facilities of this nature. The modelled source parameters are consistent with guidance from the NSSGA[2]. Internal haul roads were modelled as adjacent volume sources, also in accordance with guidance from the National Sand Stone and Gravel Association and the U.S. EPA."

The volume source specifications used by RWDI require a third-party check. This should be completed as part of a more detailed review.

Conclusion – further review is required to verify RWDI's claims on the characterisation of source parameters.

<u>AQA Report s.6.1.1 METEOROLOGICAL CONDITIONS</u>

"Under O. Reg. 419/05 the MOE provides a series of pre-processed meteorological data sets for use in dispersion modelling assessments in Ontario. These data sets use surface observations and upper air data from airports that represent major geographical areas of Ontario. While these data sets are the MOE's preferred option for conducting dispersion modelling assessments, they do not necessarily reflect localized conditions, and therefore a discussion of the dispersion modelling data sets and a discussion of more localized meteorological conditions is provided here. For this assessment, the meteorological data from London shows good agreement with the local data, as discussed below."

To use alternative data to MOE's preferred dataset, one must submit a special application and explanation to the MOE to argue why the alternative data is equal to or better than the MOE's preferred dataset. Because this assessment is to be reviewed by open public discourse, RWDI must make full and complete arguments to the public.

In this case, RWDI seem to be arguing that the datasets are in agreement. However, given that the London dataset is preferred by the MOE it is therefore not logical that RWDI would bother to deviate from the preferred London dataset – a full and complete explanation is required.

Conclusion – RWDI's claim that these alternative meteorological datasets are more appropriate is not sufficiently supported.

"Data from the Guelph Turfgrass Institute is not complete for the period of record, so data from the Region of Waterloo International Airport were used to determine the potential for wind erosion, and to characterize the wind climate for the area. Data from the Guelph Turfgrass Institute is useful however, in that it shows a general tendency towards lower average wind speeds than observed at the Region of Waterloo International Airport, which in turn shows lower average wind speeds than observed at the London International Airport. This suggests that using the Region of Waterloo International Airport data to discuss the potential for wind erosion is conservative, and that using the data from London International Airport for the modelling assessment is also appropriate."

RWDI would seem to suggest that using data with lower wind speeds provides conservatively high estimates of potential wind erosion. A full and quantitative explanation is required of this assumption. For example, for material handling (drop) operations, the equation used by RWDI indicates (Appendix B5 of their report) that the lower the wind speed, the <u>lower</u> the emissions; this is contrary to RWDI's assumption above. Until this is fully explained by RWDI, this assumption remains uncertain and unverifiable.

Conclusion – RWDI's claim that using datasets with lower wind speeds provides conservative ("high-end") estimates of wind erosion is not sufficiently supported.

<u>AQA Report s. 6.1.2 AREA OF MODELLING COVERAGE</u>

"In addition, 18 discrete receptor locations were included in the assessment. These receptors represent residences near the quarry."

As part of a more detailed review, there should be a third-party check that all appropriate human receptors have been included in the assessment, including future potential, as-of-right, land uses.

Conclusion – further review is required to verify RWDI's claims that they included all appropriate receptors.

<u>AQA Report s. 6.1.4 TERRAIN DATA</u>

"Base elevations for sources are based on information contained on the Site Plan and are assumed to be at the elevation of the first lift."

Cross reference to the Site Plan is required to verify the credibility of this assumption; further explanation may be required.

Conclusion – further review is required to verify RWDI's claims on terrain data used.

<u>AQA Report s. 6.1.5 AVERAGING PERIODS USED</u>

"PM10 and PM2.5 do not currently have standards in O. Reg. 419/05, but they do have air quality criteria that, like TSP, are based on an averaging time of 24 hours."

Annual averaging is required for certain contaminants and requires their specific calculation using the AERMOD model. For example, PM2.5 has an annual standard listed by the Canadian Council for Ministers of Environment. The MOE in Ontario lists an annual standard for benzene, one of the emissions from diesel exhaust. It is not clear that annual averaging will not be relevant at this aggregate pit.

Conclusion – annualized assessments for certain contaminants are missing.

<u>AQA Report s. 6.4 AMBIENT CONCENTRATIONS</u>

"The compliance assessment predicted the impact of the quarry emission sources at and beyond the property boundary of the facility. The comprehensive cumulative effects assessment went a step further and considered how predicted impacts from the quarry sources would combine with ambient air pollutant levels to produce an overall impact at sensitive off-site receptors."

In order to allow an assessment of ecological impacts RWDI should assess cumulative air concentration levels at <u>all</u> locations at and beyond the property boundary of the facility not just at so-called "sensitive" receptors. RWDI would seem to have only chosen nearby residences but have ignored other areas where ecological effects may occur. They have not provided cumulative air results in these other areas and so ecological impact experts will not have appropriate information available to them to make an ecological impacts assessment.

Conclusion – assessments missing of ecological exposures to air quality contaminants.

"Pollutant concentrations in ambient air can be attributed to two distinct elements:

1. Non-Background (locally significant emissions sources): Emissions from large industrial sources, mobile sources, and other miscellaneous sources that result in acute spatial variation of in-air pollutant concentrations on a local scale (e.g., large combustion sources, industrial process emissions, major highways).

2. Miscellaneous other sources, including smaller industries; agricultural activities, residential and commercial sources; traffic on the local road network; rail traffic; and long-range transport of pollutants from other regions. These sources can be approximated by spatially uniform in-air pollutant concentrations on a local scale.

With respect to non-background sources, there are no such sources within 5 kilometres of the quarry."

However RWDI do not define, on a quantitative basis, what they mean by "*non-background*" sources. They indicate that there are no such sources that cause "*acute*" spatial variations in background concentrations in the vicinity. For example, they would seem not to consider highway traffic emissions from Highway 7 as causing "*acute spatial variation*" and yet do not present evidence on this. This lack of quantitative specification causes their classification to be vague, and therefore uncertain and unverifiable.

Conclusion – RWDI's claim that there are no "non-background" sources within 5 km is not sufficiently supported.

"Therefore, estimating the overall impact at sensitive off-site receptors required an estimate of background pollutant levels, which was based on historical monitoring data from a representative monitoring site. Although the monitoring site in Guelph is located in a more urbanized environment, with some non-background sources located within several kilometers of the monitor, this provides a more conservative estimate of ambient air pollutant levels. Given the proximity of the station to the quarry, and the conservativeness of the data, it is a suitable site for this assessment."

RWDI assumes that airborne concentration data from an urban area provides higher air quality levels than in the Rockwood setting (and it is thus conservative). However, local (Rockwood) sources close to particular receptors may be subject to elevated levels at those locations. Given that JDCL have planned/contemplated this pit for almost 30 years, it would have been advisable that local monitoring had been initiated to provide site-specific data on local, existing air quality.

Conclusion – RWDI's claim that the Guelph data is conservative compared to all areas in Rockwood is not sufficiently supported.

"Background $PM_{2.5}$ levels were based on a 5-year average of the annual 90_{th} percentile hourly concentration measured at the MOE monitoring station in Guelph (14.8 μg/m³)."

Notwithstanding the previous comment, in regards to the use of the Guelph air quality dataset, why was the average and not the maximum 5-year 90^{th} percentile used? Significant between-year variations may lead to underestimates of base-line, background concentrations if only the average is used. Elaboration is required of year-to-year differences in the 90^{th} percentile value (if this dataset were to be justified as appropriate). Also, does the quality of the dataset used justify use of the 90^{th} percentile (as opposed to the maximum)?

Notwithstanding the previous criticism there should be a third-party check of the analysis of background data from the Guelph station used by RWDI.

Conclusions – further justification is required from RWDI, and, a detailed review of the data they used is required (if this dataset is justified, as per previous point of criticism).

"Background TSP was derived from the $PM_{2.5}$ data for Guelph, based on an estimated $PM_{2.5}$/ TSP ratio of 0.30. This value came from a published study of 500 monitoring sites in the US.[3] The resulting 90^{th} percentile background concentration is 49 μg/m³.

Background PM_{10} was also derived from the $PM_{2.5}$ data for the Guelph, based on an estimated $PM_{2.5}$/ PM_{10} ratio of 0.54 from the study noted above. The resulting 90_{th} percentile background concentration is 27 μg/m³."

RWDI used scaling factors to derive (by calculation) estimated background levels of PM10 and TSP (based upon measurements of the PM2.5 dust size fraction) as measurements of these larger size fractions were not conducted at the chosen site. RWDI obtained these scaling factors from a study by Lall et al. (Atmos.Environ. 2004), which represented measurements from Metropolitan locations in the US. However, there is a similar Canadian version of this study, which provides different scaling factors (Brook et al. J. Air & Waste Manage. Assoc., 1997) and includes data from rural southern Ontario. The values derived in the Canadian study indicates:

"On average across all sites, PM2.5 accounted for 49% of the PM10, and PM10 accounted for 44% of the TSP."

Therefore, the US version of ratios leads to an underestimate of background PM10 and TSP by 8% and 29%, respectively, when compared to the Canadian-based study. This suggests another source of underestimation of community-level exposures to air emissions in this study.

Conclusion – RWDI have used a less appropriate estimation method for PM10 and TSP background levels that leads to their underestimation, and thus underestimation of community-level impacts.

Values derived for ozone and NO2 should be checked at some point in the future.

AQA Report s. 6.5 CONVERSION OF NOX TO NITROGEN DIOXIDE

The Ozone Limiting Method for NO to NO2 conversion – not reviewed.

AQA Report s. 7 Emission Summary Table and Conclusions

Given numerous and significant problems with analysis methods, as described above, there is little use at this point reviewing RWDI's results. This section of their report was not reviewed in any great detail.

"7.2.2 SCENARIO 2 – CUMULATIVE EFFECTS MODELLING – CONVEYORS FROM FACE

The results of the dispersion modelling analysis indicate that with the inclusion of background air quality data, predicted concentrations of NO_2 and $PM_{2.5}$ are below the relevant criteria at all receptors. Predicted concentrations of TSP and PM_{10} exceed the relevant criteria at several locations, but the predicted frequency of excursions above the relevant criteria remains low, at 1.5% of the time at the most impacted receptor, and below 1% at all other locations.

7.2.3 SCENARIO 3 – CUMULATIVE EFFECTS MODELLING – HAUL TRUCKS

The results of the dispersion modelling analysis indicate that without the inclusion of background air quality data, predicted concentrations of NO_2 and $PM_{2.5}$ are below the relevant criteria at all receptors. Predicted concentrations of TSP and PM_{10} exceed the relevant criteria at several locations, but the predicted frequency of excursions above the relevant criteria is higher than for Scenario 1, but remains low, at less than 2.7% of the time at the most impacted receptor and below 1.2% at all other locations."

RWDI have admitted to exceedances to the relevant criteria. This is despite what has been noted above about non-conservative assumptions and missing information that may result in even higher off-site exposure estimates than what was shown by RWDI. This is significant given the number of non-conservative assumptions and missing analyses as described above, which could lead to even more exceedances potentially.

In addition, under s.7.2.3., RWDI speak to results *"without the inclusion of background air quality data"* and yet this is meant to be a cumulative effects assessment. Thus their analysis would seem to be incorrect.

Conclusion – given the issues noted above, the actual number of exceedances may be significantly higher than claimed by RWDI.

"7.3 CONCLUSIONS

This assessment includes several significant conservative modelling assumptions, which are important when considering the dispersion model predictions. These include:

- *The maximum operating scenario is applied to every day during the operating season for the 5-year simulation period, resulting in a coincidence of maximum operations and worst-case weather conditions which, in reality, will be a rare occurrence; and,*
- *Assumption of dry weather every day of the 5-year simulation period."*

It should be noted that these assumptions are standard, and required, and ensures that (on a 24-hour basis) maximal emissions are forced to coincide with worst-case meteorological conditions, as can happen. To do otherwise is not an acceptable practise. Despite that, RWDI assume the exceedances shown are acceptable.

Conclusion – RWDI are misidentifying a required practise as a source of additional conservatism when it is not.

"Noting these conservatisms, RWDI believes that the predicted frequency of excursions from the dispersion modelling analysis is within acceptable levels,"

It should be noted that, in compliance assessments, no such level of exceedances are acceptable. The basis of RWDI's belief should be explained clearly.

Conclusion –RWDI's claims that (i) exceedances are acceptable, and, (ii) that the level of exceedances they predict are acceptable, are not sufficiently supported.

6. RJ Burnside Review of the RWDI Air Quality Assessment

RJ Burnside (RJB) were retained by the Township of Guelph/Eramosa to review the subject air quality assessment by RWDI. Despite the detail that required review, RJB only had the following comment:

"The Emission Summary and Dispersion Modelling (ESDM) as prepared by RWDI was reviewed. Although the documentation took some time to interpret, there was nothing in the ESDM to indicate that the site could not request and receive an Environmental Compliance Approval ("ECA")."

I do not understand what is meant by "*although the documentation took some time to interpret*." RJB's focus on an MOE ECA application would seem to ignore the more fundamental study on cumulative impacts. Given these two issues it would be of interest to enquire as to the expertise and experience of the RJB reviewers.

Conclusion – I believe that RJB's review was inadequate

7. CRC Terms of Reference Questions

CRC, in their Air Quality Peer Review Terms of Reference provided to me, required a number of questions to be addressed by me. I address those questions below.

- What air quality monitoring is being proposed by the applicant and is it adequate;

It may be that some limited monitoring is being proposed by the proponent (AQA s.3.1.1.1. Crystalline Silica) but this is not clear from their report as what was written is not understandable. It can only be said, at this point, that whatever is proposed is not adequate as it is not explained appropriately. Assuming what was meant was airborne monitoring for crystalline silica, then this still leaves other contaminants unmonitored, and therefore is still not adequate.

- What dust mitigation plan is being proposed by the applicant and is it adequate; and

Dust mitigation is proposed (primarily road dust watering) but it is not defined on a quantitative, verifiable basis; therefore it is not adequate.

- An evaluation of technical completeness.

Due to the numerous technical issues identified above I do not believe that the RWDI evaluation is technically complete.

- Determining whether the conclusions and recommendations in support of the development application are valid.

The conclusions and recommendations are not valid for the various issues noted above (lack of evaluations, non-conservative assessments, etc.) as the issues may well lead to higher, and perhaps significantly higher, community-level exposures.

- Has the applicant properly identified the implications of the proposed operation for the adjacent mushroom farm and is the proposed mitigation with regards to this particularly sensitive use adequate?

The applicant has not assessed the effect of emissions on any ecological elements and other operations around the site including the mushroom farm; therefore, any mitigation mentioned is without basis with respect to this receptor. The mushroom farm may represent a particularly sensitive receptor with regards to the requirement for controlled environments for its growing operations.

8. Conclusions

RWDI's conclusions, that the resultant air quality levels are acceptable, are not supported by their analysis because many components of the analysis are missing and many analyses were conducted on a non-conservative basis. Considerable reworking of the analysis is required, as set forth below.

9. Further Work Required

These are provided in the approximate order that they should be conducted:

1. Complete a full review of all data and calculations conducted by RWDI and presented in their assessment.

2. Major reworking of the AQA, corrections and explanations based on the issues raised in the screening-level analysis presented in this report, and the more fulsome review mentioned in 1, above.

3. Use the (corrected) preliminary modelling study to help identify locations to conduct background monitoring.

4. Conduct background air monitoring; meanwhile conduct site-specific sampling (for aggregate composition, for example).

5. Re-do modelling with site-specific input and site-specific background data.

6. Assess need for mitigation and predict effectiveness of mitigation (e.g., road dust watering controls) on a quantitative, conservative basis.

Curriculum vitae

FRANCO DIGIOVANNI, PhD
Senior Air Quality Modeller, Partner and Manager of Air Quality Modelling Section,
Airzone One Limited (since 1999)
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Services Provided:

- Air quality modelling, emissions determinations and inventories, air regulatory compliance
- 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 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]

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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:

Since 2000, I have written approx. 60 air quality modelling impact assessment reports for regulatory approval in Ontario and in other jurisdictions, and also for legal (land use/land rezoning) disputes. These have included dust studies for surface mining (aggregate) operations. I have also designed, implemented and reported on numerous indoor mould assessments.

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. 2012-13. Reviews for World Bank on proposed lignite-fuelled electricity generating plant in Eastern Europe (continuing).

Airzone One Ltd. 2012. Approximately 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.

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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 XXXXXXX pulp and paper mill, XXXXX. Conor Pacific Report 0-4171-08.

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DiGiovanni, F. 1999. Report on site vegetation surveys, and assessment of land use category data collection technique. DiGiovanni Scientific Report, May, 1999.

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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.

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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 $PM_{2.5}$ 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)

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	**T**raining and mentoring for staff of 7 in air quality modelling, air emissions permitting and emissions reporting.