A CONCERNED CITIZEN'S VIEW

Beachville Dump

ABSTRACT

Climate-change and human-health related costs can no longer be externalised by business and industry if our quality of life and social equality are to be preserved or enhanced. Historic solutions to modern problems need to be questioned and quantified. An in-depth understanding of the issues related to the Walker Industries' proposed dump project in Beachville will enable factual dialogue and a search for better alternatives.

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Disclaimer: The author is not a licensed professional engineer and has used prior employment experience and on-line research in the development of this document. All data herein are estimates for discussion only. No author statements or implications are to be considered legally binding.

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Beachville dump greenhouse gas emissions. Rev: August 15th 2019

Preface

Until today most dump operations enjoyed low costs and high profitability by passing off a major part of their operating expenses and risks to taxpayers and the environment. Urgent climate-change mitigation and local health issues require that those costs, previously externalised in the development of landfills, now be considered as a business cost to be fully absorbed by the project. Only by doing this can a true cost/benefit analysis be presented to the public, regulatory and permitting bodies.

The "Made-in-Ontario Environmental Plan" (the Plan), under the purview of the Ministry of Environment, Conservation and Parks and those foreign nations who have now ratified the COP series climate accords, dictate the need for more scrutiny of all greenhouse gas emission sources and accounting for them. Mitigation measures can only be truly successful when an in-depth, holistic approach is taken.

What is not clear is whether the MOECP will consider the proposed Walker Industries' Beachville dump site a candidate for the "make-the-polluter-pay" policy under the Plan. Accounting for all emissions related to the project, including delivery truck emissions, may require Walker to pay appropriate fines or levies under the Plan given that the proposed project is a private venture relying on cost and risk externalisations to the taxpayer and the environment for profit maximisation.

The U.S. based Environmental Protection Agency (EPA) states that dumps account for approximately 20% of methane emissions in the USA. Based on lifestyle similarities one can assume that the proportion approximates to that in Canada. Methane (a major component of dump gas emissions) greenhouse effect is 25 times that of carbon dioxide so its potential to contribute to climate change is significant.

Other dump gas pollutants include volatile organic compounds, possibly including benzene, carbon tetrachloride, chloroform, ethylene dichloride, perchloroethylene, trichloroethylene, vinyl chloride and vinylidene chloride, organosilicon derivatives (both from decomposition and contaminated soil used for dump capping) and other gaseous compounds having varying, adverse health effects on humans and animals. The composition and volume of these supplementary pollutants vary with deposited materials but are estimated by the EPA at 2% of global, human-caused methane volume.

In addition to deleterious gasses generated within the dump there are other, related pollutant sources. Until such time as the landfill is capped and receives no further materials, diesel exhaust and fine particulate emissions from numerous delivery trucks and on-site waste handling machinery will add to the overall emissions inventory.

Costs related to diesel engine emissions, wear and tear on roads, catastrophic salination of watercourses during winter, the provision of emergency services and road capacity expansion have traditionally not been fully considered in dump developments as they have been, quite legally, externalised to the taxpayer and environment. As a business input they are considered "free" except for fees directly incurred by the enterprise for driver and vehicle licensing, fuel taxes, insurance and property taxes. By definition, previously externalised waste transportation and on-site handling emission sources must be included in any climate and adverse health-effects calculation and the resultant cost/benefit analysis used in public discourse and the permitting decision.

The Beachville dump and Future Oxford

The potential impact of the proposed dump on the Future Oxford sustainability plan is significant. Although the Ministry of Environment, Conservation and Parks (MECP) has ordered an in-depth environmental assessment, it is unlikely, based on past practise including 10 years of neglect, to account fully for all local gas and particulate emissions and derived gaseous compounds (collectively, dirty air) related to this development. As mentioned previously, it now undermines the holistic approach essential to meet Ontario's and Canada's greenhouse gas reduction obligations.

The air-emissions vectors related to this dump development are:

- Gaseous emissions resulting directly or indirectly from the decomposition of waste deposited in the dump.
- Exhaust gas emissions from diesel powered equipment used to handle the waste on site.
- Exhaust gas emissions from on-highway trucks used for waste delivery.

Emissions from deposited material.

Since it's impossible to know, in advance, the exact composition of the deposited material it's necessary to use generic data typical of other dumps. The MECP uses a figure of 125 cubic feet of gas (mainly methane) per long ton of mixed municipal waste. This is the total discharge over the per-ton dumped material decomposition life.

This is an average figure as historic data suggest that emission rates can vary between 100 and 180 cubic feet per ton depending on the amount of organic material in the waste mix. Non-organic waste such as non-degradable plastics and drywall would have much lower emissions rate. Since much of the waste may originate from larger multiple-unit dwellings, where recycling and recovery rates are currently very low, the number of 125 cubic feet per ton (or 3.48 cubic meters/metric tonne) can be used with reasonable confidence to estimate the emissions of gas.

Most modern dumps have a gas collection system comprising a non-corrodible pipe network with headers and condensate drains. Careful dump design and project management ensures

that between 40% and 60% of gaseous emissions are captured. Gas not captured percolates into the atmosphere and is known as “fugitive emissions”. It is worth reiterating that this gas, with high methane content, is approximately 25 times more potent as a greenhouse gas than an equivalent mass of carbon dioxide.

The simple science behind this is that methane absorbs about 25 times more heat energy than an equivalent mass of carbon dioxide. But, it’s not a straight comparison over time as carbon dioxide remains in the atmosphere for thousands of years whereas methane tends to fully decompose after about ten years. The data offered in this article are really a snapshot for simplicity.

For this reason, dumps usually combust the gas (flaring) or use it as a fuel for on-site electrical power generation. The gas can also be “cleaned” (non-combustible and low heat value constituents removed) and the resultant higher-quality methane injected into the natural gas transmission system as a “renewable”. However, when burned, it remains a CO2 source. Natural gas is in over-abundance and makes this option economically questionable.

On-site combustion results in emissions to the atmosphere of carbon dioxide and other contaminants, including particulates that vary according the composition of the decomposing material. Some methane (usually 1% -2%) can also enter the atmosphere because of methane “slip” which is where unburned methane passes out of the combustion device exhaust. The potential for methane slip is higher when a reciprocating engine, that uses it as a fuel, runs at low load or has been improperly maintained. The negative effect of methane slip must be included in total emissions to atmosphere.

Effects of on-site methane combustion.

Most modern dumps, containing a high proportion of organic (decomposable) material, have on-site generating facilities that use the methane gathered from the site to produce electricity which is fed into the local grid. This makes better use of the gas than flaring (i.e., an open flame).

Typically, the combustion of one unit-volume of methane results in approximately 24 times the volume of CO2 but, for simplicity, knowing the polluting relationship per tonne of methane and CO2 is sufficient for this study.

On-site combustion merely turns one air pollutant, methane, into others, primarily carbon dioxide with some oxides of nitrogen (NOx) and particulates. While the combustion process has a relatively fixed methane/carbon dioxide conversion ratio, the amount of NOx and particulates varies with the emissions “Tier” level of the internal combustion engine and any exhaust gas after-treatment system. The site developer should confirm the proposed “Tier” level of any intended on-site power generation equipment. Minimising NOx emissions helps reduce the acidification of precipitation (rain and snow) and minimising particulates, that contaminate human respiratory systems and is a suspected carcinogen, is critical.

The Proceedings of the National Academy of Sciences in a July 2016 report identified a further compound called magnetite (a form of iron oxide) as a constituent of some emitted particulates from the process of combustion and other sources that are common in dump operation and waste transportation. While its findings are not yet conclusive the following statement is available on its website: http://www.pnas.org/content/early/2016/08/31/1605941113

"We identify the abundant presence in the human brain of magnetite nanoparticles that match precisely the high-temperature magnetite nanospheres, formed by combustion and/or friction-derived heating, which are prolific in urban, airborne particulate matter (PM). Because many of the airborne magnetite pollution particles are <200 nm in diameter, they can enter the brain directly through the olfactory nerve and by crossing the damaged olfactory unit. This discovery is important because nanoscale magnetite can respond to external magnetic fields, and is toxic to the brain, being implicated in production of damaging reactive oxygen species (ROS). Because enhanced ROS production is causally linked to neurodegenerative diseases such as Alzheimer's disease, exposure to such airborne PM-derived magnetite nanoparticles might need to be examined as a possible hazard to human health."

Clearly any threat to human health, particularly diseases that could affect our expanding senior population resulting in reduced quality of life and increased long-term health care costs, need to be identified and monitored for validity.

An August 7th 2019 article by Wency Lueng, a Globe and Mail health reporter, offers an updated analysis of further research on the linkage between PM2.5 particulates and the increasing incidence of dementia. Although affliction has been traditionally linked to "genetics and life experiences", its recent escalation has caused several leading scientists to take a much closer look at airborne particulates. This is based on observations that "dirty air may also alter the way people think and behave", particularly those living close to major highways, garbage dumps and emitting industries. Parallel research is being conducted on the possible linkage between particulates and autism that, along with dementia, is showing unexplained escalation and a growing burden on society.

What must be avoided, at all costs, is underestimating or understating potentially negative health effects that could advance into a tragic and costly, full-blown crisis like that of asbestos or the pesticide DDT.

For additional concerns on the overall health effects of particulates: https://www.theguardian.com/society/2019/jul/12/billions-of-air-pollution-particles-found-in-hearts-of-city-dwellers?

Emissions related to waste delivery and on-site handling.

Traditionally, dump developments have not internalised the cost of the polluting effects of waste delivery (primarily trucking) and from on-site waste handling and management equipment. Legally they are not obliged to do so but escalating focus on climate-change and

human health issues requires that both are fully quantified and considered in the public cost/benefit analysis.

Quantifying diesel engine emissions from trucks and on-site handling equipment is problematic as it depends on:

1. Kilometres travelled in Oxford County.
2. Average, per truck installed engine power rating.
3. The number of on-road and off-road vehicles employed.
4. The emissions "Tier" level of diesel engines in those vehicles.
5. The ratio of work time versus idling time.

It would likely be unrealistic to believe that all diesel engines used in on-road and off-road equipment for this project would comply with the latest emissions "Tier" level. Empirical observation of trucks used for hauling waste materials suggest that they are frequently older, higher-polluting models employed for lowest direct business cost.

The trucking of time-sensitive goods, where no other economical option exists, is mostly justifiable in terms of the cost of resultant pollution. But the trucking (usually one-way hauls) of near zero-value waste materials has an extraordinarily high cost to the environment and the taxpayer and this is exacerbated when older technology (lower "Tier") vehicles are used.

Diesel engine pollutants.

Much progress has been made in recent years in reducing major pollutants from diesel engines. Improved combustion, electronic controls, vehicle systems integration and effective exhaust gas after-treatment are generally a result of standards imposed by North American regulatory bodies with the Environmental Protection Agency, Transport Canada and Environment and Climate Change Canada being the primary drivers. Diesel engines, particularly if they only conform to lower emission "Tiers" are still significant polluters and comprise a substantial proportion of the 35% of Ontario greenhouse gas emissions generated by transportation.

Diesel engine primary exhaust pollutants comprise:

- Carbon dioxide.
- Hydrocarbons.
- Oxides of nitrogen - NOx (mitigated with catalytic convertors at higher "Tier" levels).
- Particulates (mitigated with dry particulate filters at higher "Tier" levels). Of this list carbon dioxide and nano-particles are of concern at all "Tier" levels.

Older trucks and off-highway vehicles may also emit substantial NOx depending on their year of manufacture and standard of maintenance. With greater congestion on highways and highway intersections serving the dump project (exacerbated by approximately 170 trucks dedicated to the Beachville site), it is reasonable to expect considerable engine idling and increased particulate emissions with frequent vehicle acceleration and braking. Trucks climbing hills or gearing down to slow down compound the problem. Older off-road vehicles used for waste

handling and compaction will add substantially to particulate emission inventory due to frequent directional changes and acceleration. Conversely, current emission "Tier" engines will minimise most particulates with the exception of nanoparticles.

Potential landfill project lifetime emissions.

Based on a 17.4 million tonne total dump capacity the following two direct lifetime emissions scenarios are possible:

1. No on-site landfill gas combustion (all gas vented to atmosphere): **1,032,000 tonnes C02 equivalen**t (based on methane being 25 times more polluting than carbon dioxide).
2. On-site recovery and combustion of 50% of landfill gas volume with remainder as fugitive: **664,000 tonnes CO2 equivalent.**

These are emissions potentially generated within Oxford County from the dump, include waste delivery and handling equipment and are based on recognised industry information sources.

Not included but also significantly deleterious to the environment, humans, flora and fauna, are:

a) Ground level ozone (see below).
b) Fine particulates from carbon combustion with known human health hazards.
c) Other particulates, especially of nano-size, that have a very high likelihood of human toxicity as relates to lung, heart and brain health, according to Dr. Ray Copes et al
d) Other fugitive volatile organic compounds that may be generated and may act alone or combine with other compounds that are toxic to humans.
e) Brake friction material dust that may contain asbestos generated from the calculated 567,000 truck movements required for 17,400,000 tonnes of waste delivered to the site. Asbestos is a recognized aggressive carcinogen that has now been totally banned in Canada.

Ground level ozone.

Ozone is not generated directly by internal combustion engines but forms when NOx, methane (CH_4) and VOCs are exposed to sunlight in stagnant air. Given that these pollutants are likely to be present in significant quantities at the dump site there is elevated potential for harm to humans, flora, fauna and property according to Environment and Climate Change Canada, https://www.ec.gc.ca/air/default.asp?lang=En&n=590611CA-1:

"Ozone is known to have significant effects on human health. Exposure to ozone has been linked to pre-mature mortality and a range of morbidity health end-points such as hospital admissions and asthma symptom days. In addition to its effects on human health, ozone can significantly impact vegetation and decrease the productivity of some crops. It can also injure flowers and shrubs and may contribute to forest decline in some parts of Canada. Ozone can also damage synthetic materials, cause cracks in rubber, accelerate fading of dyes, and speed deterioration of some paints and coatings. As well, it damages cotton, acetate, nylon, polyester and other textiles."

Since hotter summers are anticipated in southern Ontario, it follows that the proposed dump has the potential to generate significant volumes of ground-level ozone over the long term. Given the prevailing air current direction in summer (from the southwest) its impingement on Oxford County could be broad and deleterious. This is counter to Future Oxford's sustainability goals and will add to healthcare and property maintenance costs and could reduce agricultural productivity.

Summary.

Airborne pollution from the Beachville dump is of equal or greater significance than groundwater contamination mainly because its effects will be apparent over both the short and long-term. Walker Industries have not discussed how they intend to minimise airborne pollutants in and around the project. Even if they are not legally obliged to do so the County of Oxford and other community stakeholders should request full consideration of this by the Ontario MECP. Walker Industries must offer an air-emissions inventory, covering all sources, over the life of the project, that is individually peer-reviewed and audited by independent subject-matter experts.

Given the accelerating understanding of the probable and seriously negative health effects of dirty air this aspect of dump operation must receive full ministerial consideration.

Claims by MECP that an air emissions inventory is not legally necessary for the permitting process would be counter to the intent and objectives of heir "Made-in-Ontario Environmental Plan". The proposed Beachville dump project would be a significant new source of greenhouse gas emissions in Ontario. It will have a very negative impact on citizen's property and health within and beyond Oxford County.

End.

Disclaimer: Statements made herein are preliminary and should be verified by an independent subject matter expert.

Disclosure: The author owns common stock of Canadian National Railway and may own stock in other rail freight carriers managed by independent funds.