



**NOTICE OF SPECIAL MEETING
GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT (GVS&DD)
BOARD OF DIRECTORS**

**9:00 a.m.
Friday, June 12, 2009
2nd Floor Boardroom, 4330 Kingsway, Burnaby, British Columbia**

To consider a presentation on next steps and content to be used in development of the Solid Waste Management Plan

R E V I S E D A G E N D A

A. ADOPTION OF THE AGENDA

1. June 12, 2009 Special Meeting Agenda

Staff Recommendation:

That the Board adopt the revised agenda for its special meeting scheduled for June 12, 2009 as circulated.

B. PRESENTATIONS

1. Sweden Study Tour

Designated Speakers: Metro Vancouver Delegation

[Presentation](#)

2. Background and Current Status in Development of the Solid Waste Management Plan

Designated Speaker: Johnny Carline, Commissioner/Chief Administrative Officer

3. A Comparative Analysis of Options for Management of Waste After Recycling

Designated Speaker: Konrad Fichtner, AECOM

[Presentation](#)

[Full Report](#)

4. Air Quality Modelling Analysis of Options for Management of Waste After Recycling

Designated Speaker: Roger Quan, Division Manager Air Quality Planning

[Presentation](#)

[Full Report](#)

5. Next Steps and Content to be used in Development of the Solid Waste Management Plan

Designated Speaker: Johnny Carline, Commissioner/Chief Administrative Officer

C. ADJOURNMENT

Staff Recommendation:

That the Board conclude its special meeting of June 12, 2009.

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Metro Vancouver

**Management of Municipal Solid Waste in
Metro Vancouver –**

A Comparative Analysis of Options for Management of Waste After Recycling

Prepared by:

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Project Number:

80563 108052

Date:

June 2009

To view the full report, please click here

Executive Summary

Synopsis

Metro Vancouver has outlined ambitious waste diversion initiatives in the Zero Waste Challenge – Goals, Strategies and Actions document. After these initiatives have been implemented, over one million tonnes of municipal solid waste (MSW) will still require treatment and disposal because it cannot be practically and economically recycled. The MSW that remains after exhaustive application of waste avoidance, reduction, reuse, recycling and composting is the subject of this report.

Three MSW technologies are reviewed: Mechanical Biological Treatment (MBT) to stabilize waste before landfilling or to produce a refuse derived fuel for industrial use; waste-to-energy (WTE) with energy recovery (electricity and heat); and landfilling with landfill gas (LFG) utilization.

Eight integrated waste management scenarios using different configurations of the three technologies, in combination with existing waste management facilities, were compared. The scenarios included: treating all MSW using MBT before landfilling; producing refuse derived fuel for industrial use; adding WTE capacity within Metro Vancouver; adding WTE capacity out of the region; landfilling untreated waste locally; and landfilling untreated waste out of region in a bioreactor landfill. In all scenarios, the Vancouver Landfill and the Metro Vancouver WTE Facility continue to operate, and recycling continues to be optimized.

The environmental and financial burdens and benefits of the eight scenarios were reviewed using life cycle assessment and financial analysis. The results will inform the decision Metro Vancouver must make to manage MSW when updating its solid waste management plan.

Background

Metro Vancouver is updating its Solid Waste Management Plan (SWMP). The plan is one of a series of plans based on the principles outlined in the Metro Vancouver Sustainability Framework. The SWMP is also based on the provincial waste management hierarchy which consists of six steps that outline in descending order of priority the strategies for waste management. At the top of the hierarchy are the preferred strategies: waste avoidance and waste reduction.

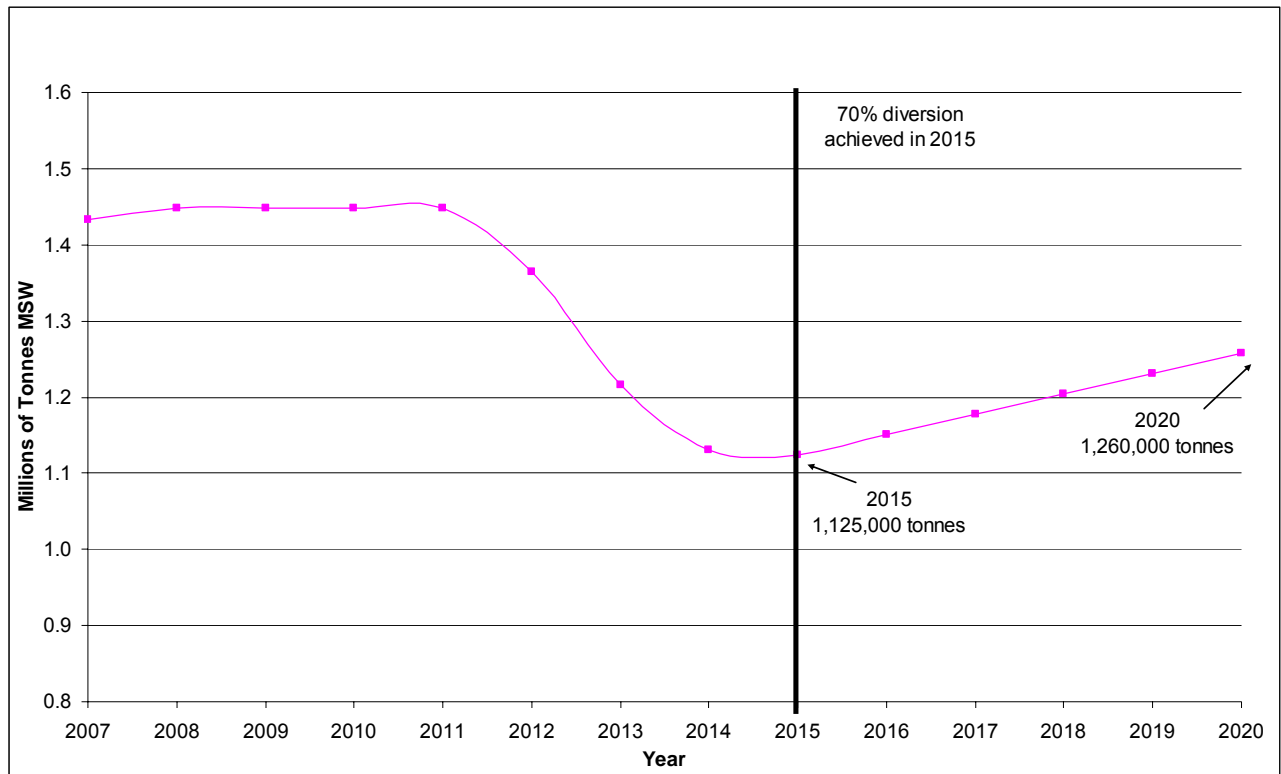
The next two steps in the hierarchy are reuse and recycling. These are waste diversion strategies. The Metro Vancouver Zero Waste Challenge proposes a number of actions to increase waste diversion from the current rate of 55% to 70% by 2015. As a point of reference, the 2006 Canada-wide waste diversion rate was 22%.

The last two steps of the hierarchy, recovery and disposal, are the focus of this report. These last two steps are the strategies used to address the waste remaining after all practical efforts to avoid, reduce, reuse, and recycle the waste have been exhausted. This portion of the waste stream is defined in this report as municipal solid waste (MSW).

The management of MSW presents challenges. The most valuable and extractable materials have been removed through reuse and recycling, and the remaining waste is highly commingled and contaminated. For the foreseeable future, technology and market requirements will continue to make it impractical to separate and clean this material for further recycling.

Despite intensive waste reduction and diversion efforts, MSW quantities are expected to increase due to population growth in Metro Vancouver. When 70% waste diversion is achieved in 2015, the amount of MSW requiring treatment and disposal is expected to be 1.1 million tonnes. Figure E-1 illustrates the initial downward trend in MSW due to increased diversion, followed by an upward trend of total tonnages attributable to population growth.

Figure E-1. Estimated MSW Requiring Disposal in Metro Vancouver



In 2008, the Metro Vancouver Board directed staff to commission a report by an outside consultant to “assess the relative characteristics and merits of landfill and waste-to-energy (various technologies) as a means to process or dispose of the remaining 30% of the waste stream”. In accordance with the Board’s directive, this report examines options for managing MSW. The report details three processes for waste treatment and disposal: mechanical biological treatment (MBT), waste-to-energy (WTE), and landfilling, and explores the role each could play in an integrated waste management system. For the purposes of this report, the WTE and MBT facilities were modeled as having less capacity than required to process the total

amount of MSW shown in Figure E-1. This has been done to provide a buffer for additional diversion beyond the 70% target.

Waste Management Technologies

MBT is a generic term for a combination of technologies that sort MSW, dry the organic portion, and may produce refuse derived fuel (RDF). The specific types of technologies are selected based on the role that MBT will play in a waste management system. For this study, two types of MBT product were evaluated: RDF and stabilized waste for disposal.

WTE covers a range of thermal technologies that extract the energy in waste while reducing its volume and rendering it inert, including mass burn, gasification and plasma arc technologies. Mass burn is the WTE technology selected for further study. Mass burn technology is used by the majority of WTE plants in the world. For this study, it was assumed that new WTE capacity established within Metro Vancouver would recover energy by generating electricity and providing district heating. WTE facilities outside Metro Vancouver would produce electricity only.

The landfill technology (for new facilities) chosen for this analysis is the bioreactor landfill. This type of landfill enhances conventional landfill design and produces LFG faster for better energy recovery and utilization. It also shortens the active life of the landfill. For this study, it was assumed that any new bioreactor landfill would be located outside the Lower Mainland.

All three technologies can meet regulatory requirements for environmental protection and human health. The environmental impacts and costs of the three technologies vary.

Eight Comparative Integrated Waste Management Scenarios

In order to support decision making, the report examines different combinations of MBT, WTE and landfilling as integrated waste management solutions. The following eight waste management scenarios (Table E-1) show various ways that the technologies could be deployed to manage the projected 1.26 million tonnes of MSW in 2020 after 70% diversion has been achieved. The existing Metro Vancouver WTE Facility and Vancouver Landfill continue to operate in all scenarios.

Of the first five scenarios involving energy recovery, the first three solutions are located within the region, and the next two are located outside the region. Scenarios 6, 7 and 8 focus on landfill technologies. Scenarios 6 and 7 are in-region solutions and Scenario 8 requires out of region disposal capacity. Scenario 6 includes a processing step before landfilling, but no energy recovery.

Table E-1. Scenario Descriptions

Scenario Number	Scenario Name	Description
1	Large new WTE	A new WTE facility with a capacity of 750,000 tonnes per year is built in the region; the balance of MSW is sent to existing local WTE and landfill.
2	Moderate new WTE	A new WTE facility with a capacity of 500,000 tonnes per year is built in the region; the balance of MSW is sent to existing local WTE and landfill.
3	In-region use of RDF product from MBT	An MBT plant with a capacity of 500,000 tonnes per year is built in the region. It produces RDF that is used within the region (the user was modelled as a cement kiln). The balance of MSW is sent to the existing local WTE and landfill.
4	Out of region use of RDF product from MBT	An MBT plant with a capacity of 500,000 tonnes per year is built in the region. It produces RDF that is used outside the region. The balance of MSW is sent to the existing local WTE and landfill.
5	Waste exported out of region to WTE	A new WTE facility with a capacity of 500,000 tonnes per year located is built outside the region; the balance of MSW sent to existing local WTE and landfill.
6	Local landfilling of MBT product	A new MBT plant built in the region stabilizes all MSW for disposal at the Vancouver Landfill.
7	Maximize local Landfilling	The Vancouver Landfill accepts the maximum authorized capacity of 750,000 tonnes of MSW per year; the balance is trucked to a new bioreactor landfill, located outside the region. There is no additional processing or waste treatment.
8	Maximize out of region Landfilling	The Vancouver Landfill accepts 230,000 tonnes of MSW per year and the balance is trucked to a new, bioreactor landfill located outside the region. There is no additional processing or waste treatment.

Life Cycle Assessment

The potential environmental impacts of the eight scenarios were estimated using life cycle assessment (LCA). For each of the eight scenarios, LCA constructs an inventory of the material and energy inputs and outputs and the potential environmental impacts at each stage of the waste management process, including transportation, processing, and disposal. LCA also calculates direct and indirect emissions and avoided emissions. Avoided emissions are realized from the recovery of energy and materials. The recovery of energy and materials avoids emissions associated with the creation of new materials and the generation of energy from fossil fuels, such as natural gas.

The results of the LCA are used to summarize the effects that the eight scenarios may have on the environment. The results of the LCA also enable a comparison of the strengths and weaknesses of the different scenarios in terms of energy and environmental performance. Finally, the LCA is able to show the potential impacts of different options according to geographic location. This enables an assessment of the impact of emissions on the Lower Fraser Valley (LFV) airshed.

For each scenario, the LCA reviewed the following emissions and outputs expected in 2020:

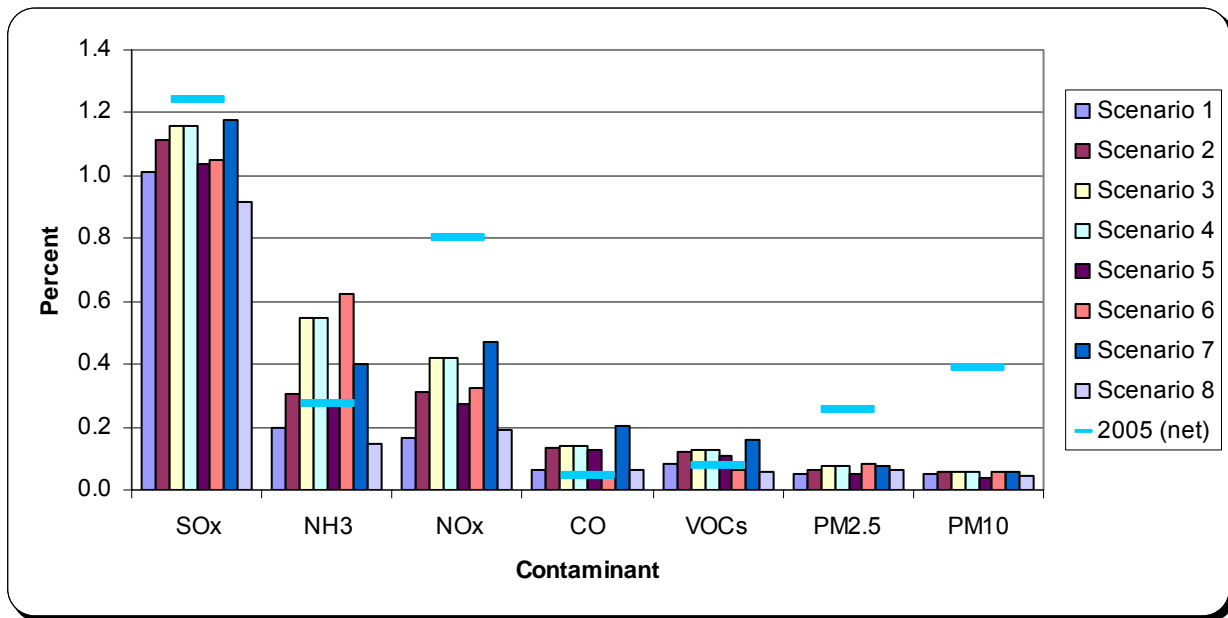
- common air contaminants (SO_x, NO_x, CO, PM, VOCs and NH₃);
- selected air toxics: mercury and dioxins and furans;
- energy production and consumption;
- vehicle fuel consumption; and
- greenhouse gas (GHG) emissions.

Emissions were identified according to their general location: within the Lower Fraser Valley (LFV) airshed; elsewhere in BC, and unknown locations. Net common air contaminants were evaluated on a LFV airshed basis; net GHG emissions were considered on a provincial basis.

Net emissions of each of the common air contaminants for each scenario are shown as a percentage of total projected emissions in the LFV in Figure E-2. For all eight scenarios the contribution to overall emission levels in the LFV airshed is very small (1.2% or less). Several of the key contaminants, such as NO_x, SO_x, PM₁₀ and PM_{2.5} are lower than the current contribution of waste management air emissions in the LFV. The blue horizontal lines in the figure show the level of emissions from current solid waste management activities as measured in 2005 for reference.

NO_x emissions are of particular interest because they are precursors to the secondary formation of ozone and PM_{2.5}. Figure E-2 shows that Scenarios 3, 4 and 7 have marginally higher NO_x emissions than the other scenarios, and therefore slightly increased potential to impact ozone and secondary PM_{2.5} formation. However, overall NO_x emissions from waste management in 2020 are projected to be lower than current levels.

Figure E-2. Contribution of Waste Management Scenario Emissions to LFV Total Emissions Projected for 2020



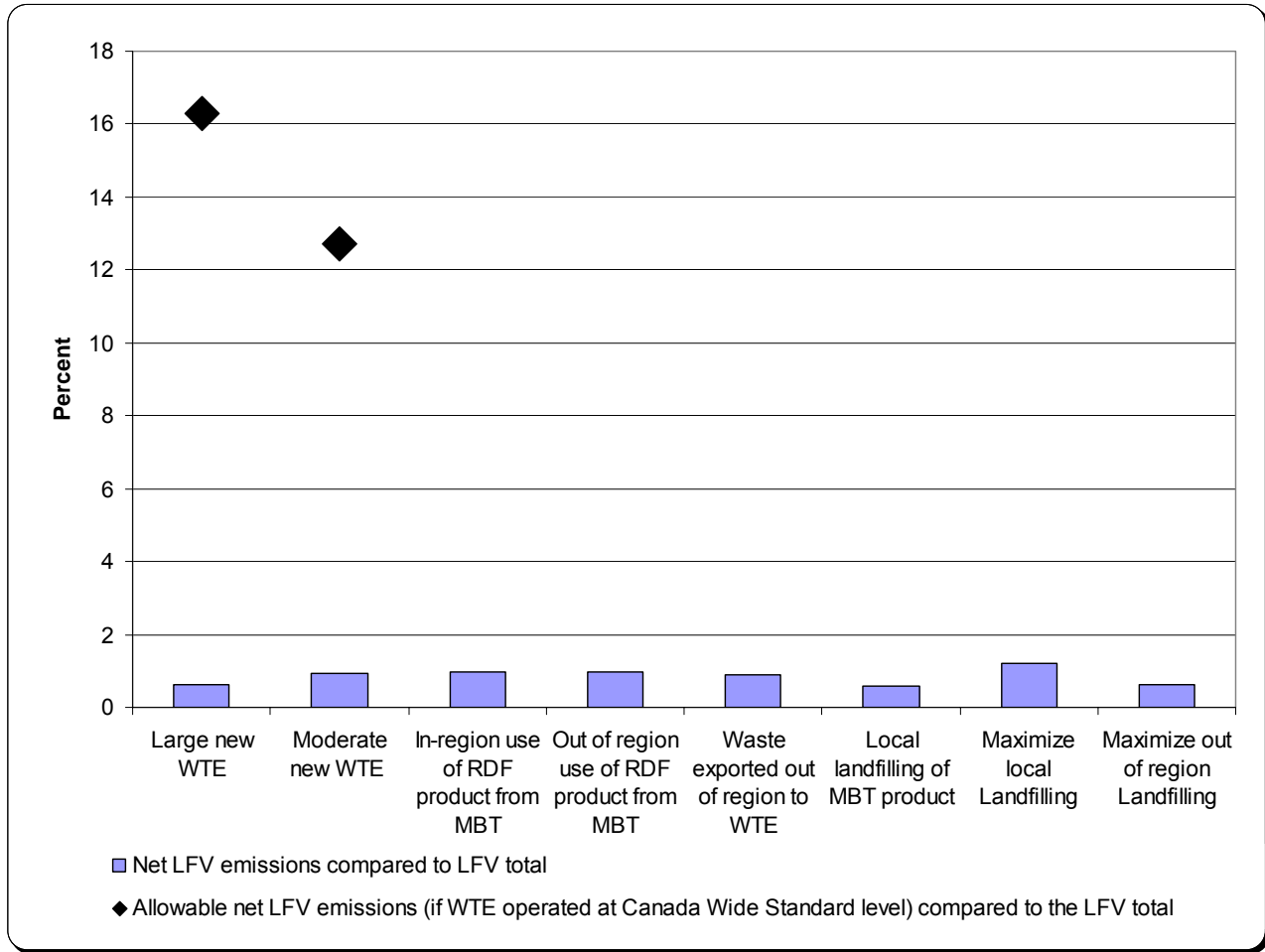
For common air contaminants (CAC) in the LFV and net GHG emissions in BC, the following major conclusions were reached:

- SO_x emissions for all scenarios are similar and represent about 1% of total LFV emissions, which is similar to the contribution of SO_x emissions from existing waste management facilities.
- There is greater variability in the net LFV emissions of NH₃, representing between 0.1 and 0.6% of total LFV NH₃ emissions, which is greater than the contribution from existing waste management facilities.
- Net LFV emissions of NO_x range from about 0.2 to 0.4% of total LFV NO_x emissions, which is about half the contribution from existing waste management facilities.
- Net LFV emissions of VOCs and CO are less than 0.2% of total LFV emissions for all scenarios, which is similar to the contribution from existing waste management facilities.
- Net LFV emissions of PM_{2.5} and PM₁₀ for the various scenarios are all less than 0.1% of total LFV emissions, which is much less than the existing contribution from waste management facilities although this difference could be due to fugitive dust emissions, which were not considered in the LCA analysis.
- Scenarios 1 and 8 tend to have the lowest CAC emissions whereas Scenarios 3, 4 and 7 tend to have the highest CAC emissions.

Mercury emissions occur from all three types of facilities examined. WTE and cement kilns release mercury from the combustion of MSW; MBT facilities release mercury from processing MSW; and landfills release mercury from the distribution and compaction of MSW at the working face and through the combustion of LFG. It must be noted that the mercury emitted is not created as a result of waste treatment and disposal; it is present in MSW, with typical sources being fluorescent lamps, electrical switches and relays, thermostats, thermometers and batteries. British Columbia's extended producer responsibility (EPR) program will be expanded to cover mercury containing wastes and it is expected that the mercury content of MSW will decrease as a result, which in turn will further decrease mercury emissions and releases from MSW treatment and disposal. In addition, introduction of stringent regulations have resulted in the implementation of technologies that have reduced mercury emissions from WTE plants to a fraction of what they once were. The current average mercury emission from the existing WTE Facility of 2 µg/m³ is well below the Canada Wide Standard for mercury of 20 µg/m³. This standard is considered one of the most stringent standards in the world.

The contribution of net dioxin and furan emissions from the various scenarios to total emissions in the LFV (based on data from 2000 and 2006) is illustrated in Figure E-3. The figure does not include point sources from outside the country that contribute to the airshed, therefore the contributions on a percentage basis as shown are likely overestimated. The black diamonds in the graph show what the Canada Wide Standards for dioxins and furans would theoretically allow, and these are considered one of the strictest standards in the world. The lowest overall dioxin and furan loading in the LFV is from Scenarios 6, 1 and 8.

Figure E-3. Contribution of Waste Management Scenario Dioxin and Furan Emissions to Total Emissions in LFV (based on 2000 and 2006 data)



To provide context, the following points compare net emissions of the various waste management scenarios with emissions from heavy duty vehicles. As a reference, there are 85,000 heavy duty vehicles registered in the Lower Fraser Valley, which does not include out of province-registered heavy duty vehicles travelling through the region.

- Net PM_{2.5} emissions are equivalent to emissions from about 1,500-2,600 heavy-duty vehicles.
- Net NO_x emissions are equivalent to emissions from between 700 to 2,000 heavy-duty vehicles.
- Net emissions of dioxins and furans are equivalent to emissions from between 2,700 and 5,600 heavy-duty vehicles.

Air Quality Modelling

The LCA analysis provides information on emissions loading only, i.e., the quantity of emissions released to the atmosphere. It cannot predict resulting ambient air quality in relation to the quantity of emissions released. Air quality is a function of the interaction of different chemical and physical processes in the atmosphere. After air contaminants are released from industrial stacks, tailpipes and other sources, they are diluted and dispersed by the wind and other atmospheric phenomena. They then combine with contaminants already in the air and can be chemically transformed through chemical reactions.

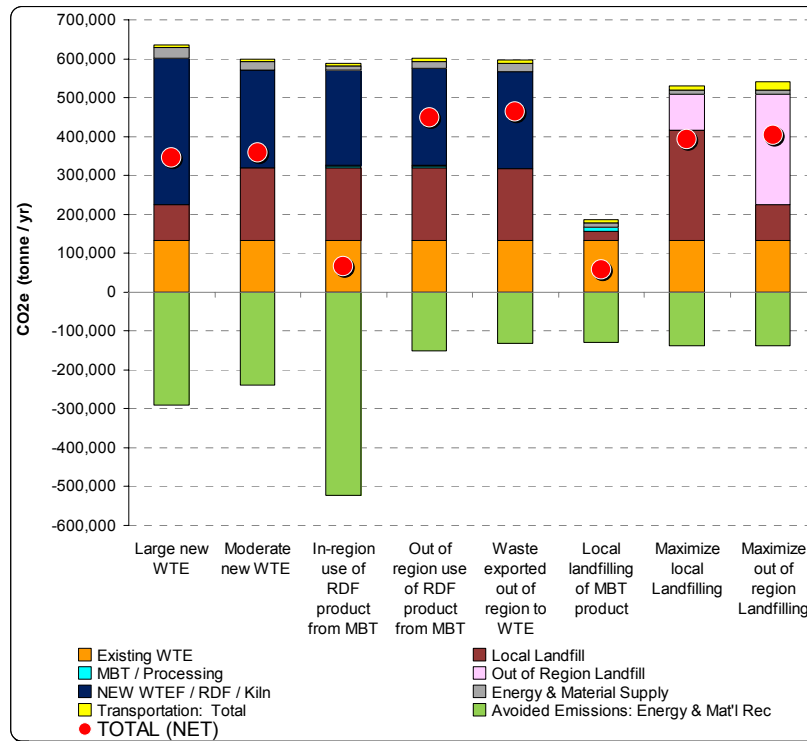
Ambient air quality is monitored by a network of monitoring stations in the LFV, and is characterized as being acceptable most of the time. However, under certain episodic conditions related to weather and emissions loading, air quality can deteriorate to unacceptable levels. Ground-level ozone and visibility issues are key concerns in the eastern portion of the airshed.

Considering the small contribution of solid waste-related emissions to the total LFV emissions, as well as the results of previous regional modeling conducted by Environment Canada, it is anticipated that solid waste-related operations will not significantly impact air quality in the LFV. In order to understand the details of the regional air quality impacts more fully, Community Multi-scale Air Quality (CMAQ) modelling is currently underway to account for the cumulative impact of all emission sources, meteorology and terrain effects, and to fully characterize any changes in ambient air quality in the LFV associated with each of the eight scenarios in the year 2020. The impact on local air quality (the area in proximity to the source) can only be determined once facility location and details of the emissions from these options are determined, using local scale dispersion modelling.

Greenhouse Gas Emissions

Climate change is a global issue, and both the provincial government and Metro Vancouver have adopted targets to reduce greenhouse gas (GHG) by 33% from current levels by 2020. All of the waste management technologies and scenarios considered emit greenhouse gases. Carbon dioxide is the main GHG emitted by WTE or facilities burning RDF. Landfills and potentially MBT facilities release methane, a potent greenhouse gas. Fuel consumed during waste transport and material handling also contributes to GHG emissions. Figure E-4 shows the base case results of the LCA for GHG emissions.

Figure E-4. GHG Emissions



Scenario 6 has the lowest base case GHG emissions due to the fact that the waste is stabilized and produces less methane when landfilled. In this scenario, emissions are low, but there is also no energy recovery and therefore no emissions are avoided. Scenario 3 has the next lowest base case net GHG emissions because GHG emissions from combusting RDF are largely balanced by avoiding the use of fossil fuels in cement kilns. In Scenario 1, district heating systems and electricity generated from recovered energy result in the reduced consumption of fossil fuels, which in turn lowers net GHG emissions. According to the LCA, the GHG associated with waste management are small in comparison to regional or provincial totals. GHG emissions can be minimized through energy and fuel conservation and energy recovery.

Energy Generation and Fuel Consumption

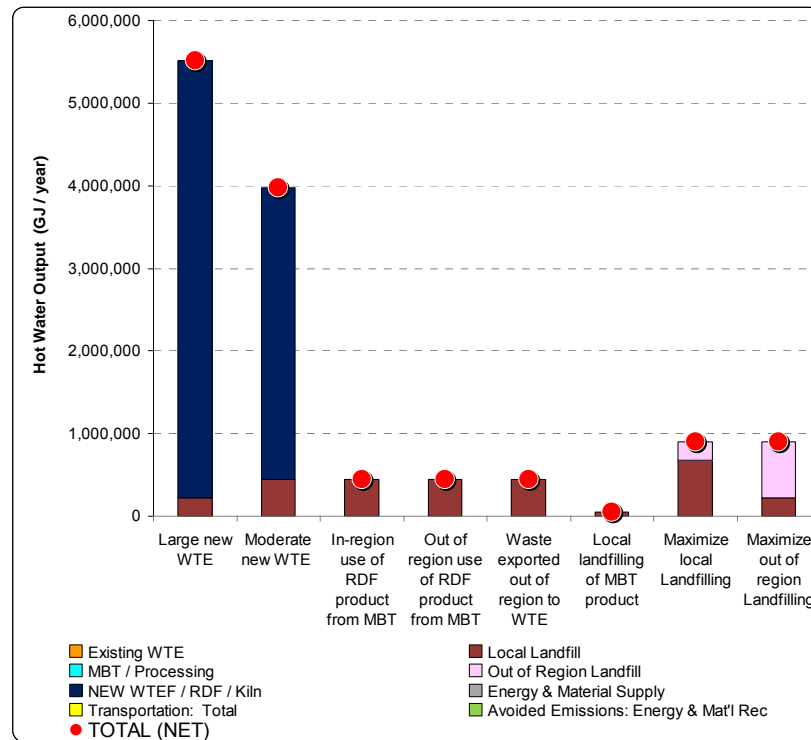
Energy is generated in all scenarios, but the differences in energy production are significant. The highest energy production is in Scenarios 1 and 2. In these two scenarios, energy is recovered as electricity and as hot water for district heating; as a result, thermal efficiencies of over 90% are achieved. Scenarios 4 and 5, generate electricity only, and achieve thermal efficiencies approaching 30%. Landfills recover energy from burning LFG, but it is less than any form of WTE. The least amount of energy is recovered in Scenario 6, because the MBT process stabilizes the waste before it is placed into a landfill, reducing the production of LFG.

Management of Municipal Solid Waste in Metro Vancouver:
 A Comparative Analysis of Options for Management of Waste After Recycling

The amount of energy captured for district heating is shown in Figure E-5, and the recovered energy in the form of electricity is presented in Figure E-6. From these graphs it can be seen that Scenarios 1 and 2 provide the highest recovery of energy for district heating. It is recognized that not all of the energy will be used all the time, and a minimum of 50% and maximum of 90% district energy uptake has been modeled in this study.

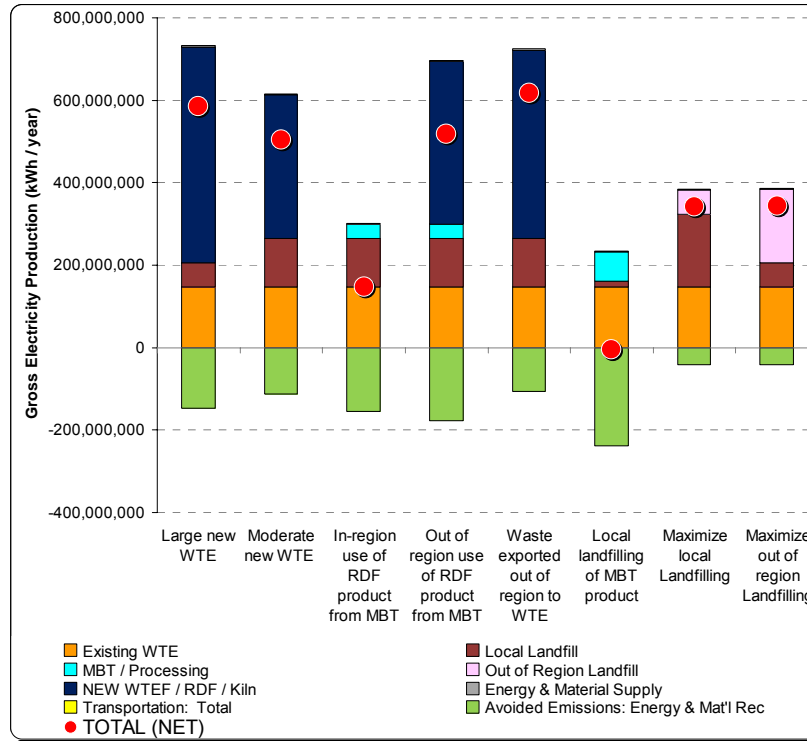
The highest net generation of electricity is in Scenarios 1, 2, 4 and 5, where MSW or RDF is used directly for electricity production. RDF used in a cement kiln (Scenario 3) replaces fossil fuels, but does not generate electricity. Some electricity is generated from LFG, but it is lower than what can be achieved through the application of WTE technologies.

Figure E-5. Potential Heat Capture as Hot Water (District Energy)



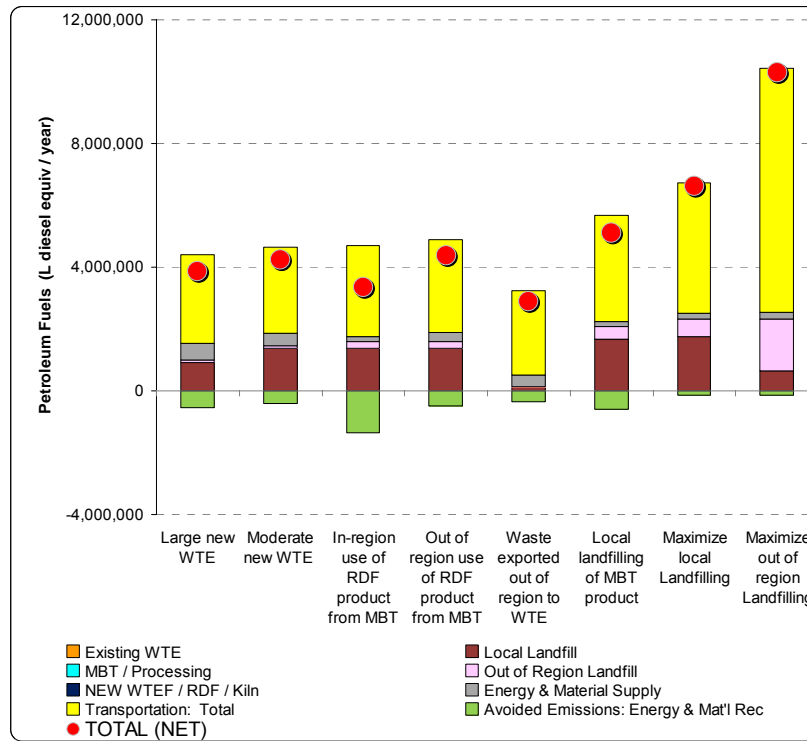
Management of Municipal Solid Waste in Metro Vancouver:
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Figure E-6. Net Electricity Production



Fuel consumption is highly dependent on trucking distances for the waste and the amount of waste handling required using heavy equipment. Therefore, the scenarios with the most trucking, Scenarios 7 and 8, have the highest fuel consumption. The closer the treatment facilities are to the source of waste, the lower the fuel requirements for transportation as seen in Figure E-7.

Figure E-7. Fuel Consumption



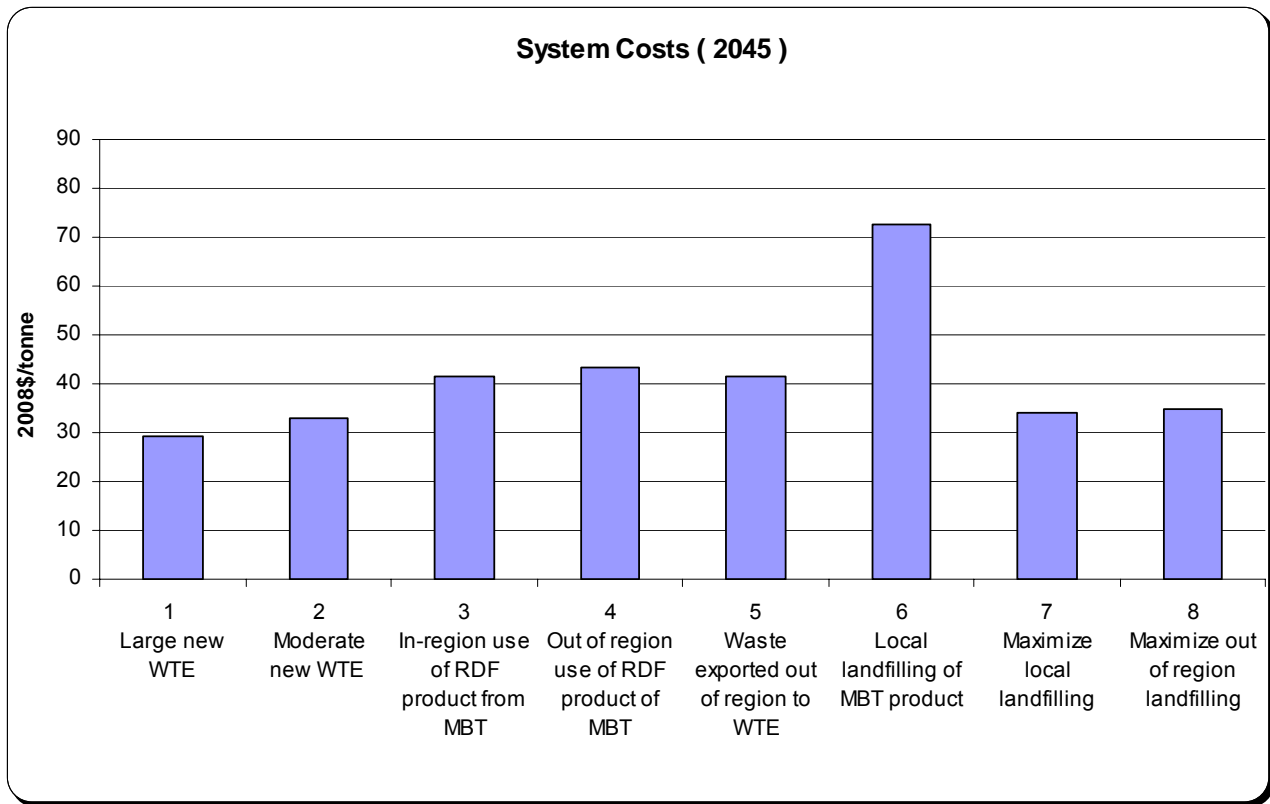
Financial Model

A financial analysis was conducted to provide a comparative evaluation of the eight scenarios over the course of a 35 year timeframe (2009-2045). The model was developed at a level appropriate for the nature of the cost information. The model examines cash flows and accounting costs and revenues. Levelized (lifecycle) costs and annual accounting (cost recovery) charges were calculated for each of the eight scenarios.

Assumptions were made about future energy prices, discount rates and inflation. Variations were explored with a sensitivity analysis. For the purpose of the financial analysis the assumption was made that any new WTE facilities built in the region (Scenarios 1 and 2) would be owned by Metro Vancouver. Infrastructure in the other scenarios would be privately owned and operated on the basis of a tipping fee charged to Metro Vancouver. This reflects the current situation, where Metro Vancouver owns the existing WTE Facility and the out of region landfill is privately owned and operated. Out of region WTE and RDF facilities operating in 2020 would also be expected to be privately owned and operated on the basis of tipping fee contracts.

Figure E-8 presents the levelized costs or real charge per tonne for the treatment and disposal of MSW for each scenario over a 35 year planning period.

Figure E-8. Real Charge per Tonne over Planning Period

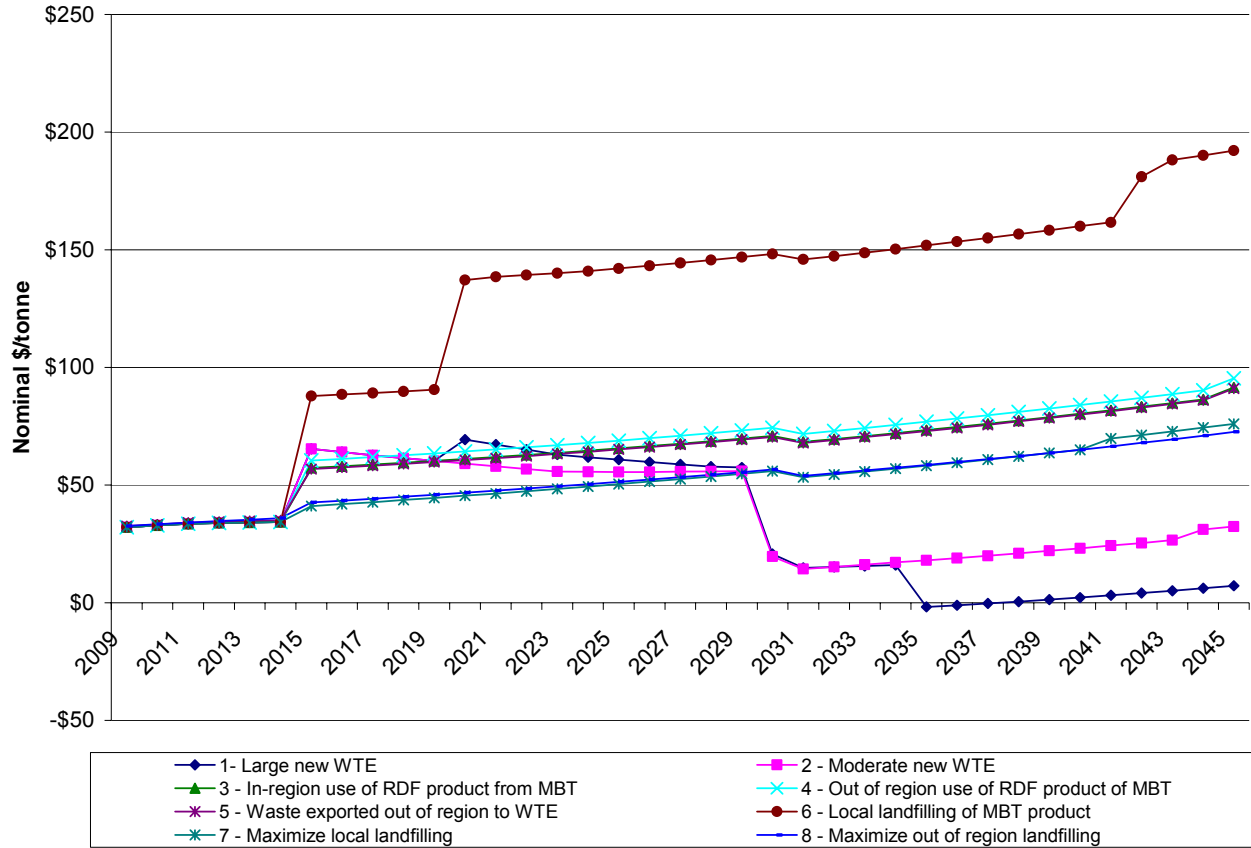


The scenarios with the lowest levelized costs are those with in-region WTE and district heat (Scenarios 1 and 2). These are followed by the two landfill-only scenarios (Scenarios 7 and 8). In-region and out of region RDF use (Scenarios 3 and 4), as well as out of region WTE (Scenario 5), are slightly more costly than the in-region WTE because of additional transportation costs and the lack of revenue from district heat. The most costly scenario is 6, which processes MSW and then takes the stabilized product to a landfill. This is because of the cumulative cost of processing, trucking and landfilling, without any offsetting revenue from the production of energy.

Figure E-9 shows the annual budget impacts for each scenario. They are expressed in nominal dollars per tonne (actual dollars in each year allowing for inflation) and reflect the annual charge per tonne required in each year over the planning period to generate enough revenue to pay for the debt service and net operating costs of the scenarios in each year. These costs do not include collection, transfer station and other system costs, which are included in the current tipping fee of \$71 per tonne. Therefore, the costs can be compared with each other, but should not be compared with the current tipping fee.

Scenarios 1 and 2 exhibit relatively high annual accounting costs over the initial (15 year) amortization period because of the large debt service charges in those years. However, after the capital expenditures are fully amortized, the annual accounting costs fall sharply.

Figure E-9. Accounting Costs under Baseline Conditions



Waste Management and Employment

The levels, types and location of employment generated by the different scenarios depend on the technologies employed and the location of the facilities.

In-region WTE facilities generate the highest number of jobs for the Metro Vancouver area, both during and after construction. For example, if a 500,000 tonne per year facility were built (Scenario 2), it would be a \$470 million investment, which would employ local engineers, designers, contractors and trades for the construction of the facility. Once the facility is operational, it would provide about 50 skilled positions for a period of 40 to 50 years, plus indirect benefits to local supply and maintenance contractors for the same time period. Considerable employment would be generated by the construction, operation and maintenance of a district heating system that would be built to utilize the energy available from a WTE facility.

MBT facilities would also provide employment during construction and operation, although less so than WTE. MBT would generate about 20 to 25 long term jobs for a 500,000 tonne per year operation. There would also be similar employment benefits to local supply and maintenance contractors.

Large landfill operations generate up to 40 full time positions. In addition, if the landfill is located outside the region, there will be employment for truck drivers delivering MSW to the landfill. Most of the jobs would be located in the communities surrounding the landfill. There are ongoing periodic capital expenditures associated with landfills, namely the construction of new cells. This work, which also includes the installation of piping and instrumentation for leachate and LFG management, is usually carried out by local contractors.

Report Structure

This report is organized into two parts. Part 1 includes Sections 2 to 6 and provides background information for the discussion and analysis of alternative treatment technologies for treating MSW that are presented in Part 2.

Part 1 includes the following sections:

- Section 2 describes the existing waste management system in Metro Vancouver and explains why the Region is exploring alternative treatment technologies to deal with the management of MSW in the future.
- Section 3 is an overview of the general regulatory context for MSW management in BC.
- Section 4 describes the regulatory and policy context specifically as it relates to greenhouse gases. This section helps provide context for why greenhouse gases are such an important consideration in the choices of MSW management technologies.
- Section 5 is a summary of trends in MSW management and provides context on emerging best practices for treating MSW.
- Section 6 is a detailed technical description of the alternative technologies that are the subject of this report: WTE, MBT and landfills.

Part 2 of the report includes Sections 7 to 12: The purpose of Part 2 is to demonstrate how MSW might be treated and disposed in Metro Vancouver. This is accomplished using scenario analysis to present the financial and environmental costs and benefits of the different scenarios. A life cycle assessment (LCA) was conducted to understand the environmental effects of each scenario. The results of the LCA were used together with financial data to conduct a financial analysis of each scenario. The results of the LCA and financial analysis were then used to compare the scenarios.

Part 2 includes the following sections:

- Section 7 introduces the eight integrated waste management scenarios that were developed for the scenario analysis. The eight scenarios are alternative configurations of existing facilities combined with the new treatment technologies described in Section 6.
- Section 8 provides an overview of the assumptions and data used in the LCA and financial analysis of the eight scenarios.
- Section 9 describes the scope and purpose of the LCA.
- Section 10 summarizes the results of the LCA.
- Section 11 describes the results of the LCA for air emissions in the context of air quality for the Lower Fraser Valley.
- Section 12 describes the financial analysis methods and results.

Appendixes are attached to the report and provide the following additional information:

- WTE facility performance data
- Emissions data from commercial MBT projects
- Sensitivity analysis

This report was prepared by AECOM, assisted by:

- The Sheltair Group for the Life Cycle Assessment
- RWDI Consulting Engineers and Scientists for air quality assessments and context
- Marvin Shaffer for the financial model
- Rambøll Danmark A/S for WTE facility performance data
- Juniper Consultancy Services Ltd. UK for emissions data From commercial MBT projects

To view the full report, please click here

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CONSULTING ENGINEERS
& SCIENTISTS

EXECUTIVE SUMMARY

CMAQ Modelling of Possible Solid Waste Management Scenarios

Project Number: #0920063A

June 11, 2009

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To view the full report, please click here

EXECUTIVE SUMMARY

RWDI AIR Inc. was retained by Metro Vancouver to compare the relative potential regional air quality impacts due to eight solid waste management scenarios in 2020 and one sensitivity case. The most recent version of the Community Multi-scale Air Quality (CMAQ) modelling system that was developed for Environment Canada for the Pacific Northwest was used. CMAQ combines emissions, meteorology and atmospheric chemistry to predict ambient concentrations of air contaminants. CMAQ is a tool used by policy makers to compare the impacts of different air emission related policy options. For this study, results for the 2020 solid waste management scenarios are compared to a 2005 base case, 2005 being the year of the most recent emission inventory for the Lower Fraser Valley (LFV). The focus of this study is to assess the potential impacts of the various scenarios on regional ambient concentrations of ozone and particulate matter (PM), two air contaminants of concern from both a health and a visibility (smog and haze) perspective in the LFV.

The model domain covers most of British Columbia and some of Alberta and Washington State. However, results are presented for a 164 km by 164 km area that encompasses most of the LFV and the Gulf Islands. The period modelled is an ozone-rich portion of the Pacific 2001 summer monitoring campaign from August 9 to 16 that consists of meteorology conducive to ozone formation and has been used by Environment Canada in previous studies. By modelling this period, the worst-case regional summer air quality impacts will be estimated.

Emissions data inputs to the CMAQ model for the 2005 base case were adapted from the 2005 emission inventory developed by Metro Vancouver for the LFV airshed, which includes all of Metro Vancouver, most of the Fraser Valley Regional District (FVRD), and Whatcom County in Washington State. For the 2020 scenarios, emissions from solid waste management are based on the results of the life cycle assessment conducted by the Sheltair Group in support of a study prepared for Metro Vancouver by AECOM Canada Ltd. analysing eight different scenarios for managing the municipal solid waste that remains after all practical efforts to reduce, reuse and recycle waste have been exhausted. Emissions data for all other non-waste management sources are based on the LFV emission inventory forecast for 2020. Results from the life cycle assessment indicate that there will be emissions from solid waste management for the foreseeable future; however, future waste management emissions under any scenario are comparable to 2005 emissions and are very low relative to airshed totals (representing from less than 0.1% to 1.2% of total emissions depending on the air contaminant).

The LFV emission inventory and forecast indicates that total emissions of nitrogen oxides and volatile organic compounds, which are precursors to the secondary formation of ozone and particulate matter, are predicted to decrease in the LFV from 2005 to 2020. By contrast, during the same period, total emissions of ammonia and sulphur dioxide, which are precursors to the secondary formation of particulate matter, are predicted to increase.

Overall, the CMAQ model results show decreases in maximum predicted ozone and PM_{2.5} concentrations in most areas of the Lower Fraser Valley between 2005 and 2020. The decreases in ozone tend to be greater than the decreases in PM_{2.5}, most likely because of the expected decrease in emissions of both of the major ozone precursors – nitrogen oxides and volatile organic compounds – but in the case of particulate matter some of the precursor emissions are expected to decrease while others are expected to increase.

There is very little difference in the CMAQ model results for the various solid waste management scenarios. The differences between scenarios are well within the error of the model. Also, the differences between scenarios are much less than the overall differences between 2005 and 2020, which indicates that the predicted changes in regional air quality are derived mainly from changes in other emission sources, such as improvements in vehicle emissions.

Although this study is based on an eight-day summer ozone episode, it is expected that the air quality improvements predicted for this episode would translate into overall annual improvements. Annual improvements in ozone and PM_{2.5} concentrations can be linked to changes in incidences of various health outcomes, including illness and death.



GVS&DD Board Meeting Date: June 12, 2009

To: Board of Directors

From: Johnny Carline, Chief Administrative Officer

Date: June 5, 2009

Subject: **Next Steps in Development of the Solid Waste Management Plan**

Recommendation:

That the Board direct staff to prepare a draft Solid Waste Management Plan using the AECOM Canada Ltd. report "Management of Municipal Solid Waste in Metro Vancouver – A Comparative Analysis of Options for Management of Waste After Recycling" in conjunction with a report on airshed modeling and related health impacts, as reference documents, for a presentation to the Waste Management Committee on September 9, 2009.

1. PURPOSE

To obtain direction from the Board on development of the draft Solid Waste Management Plan (SWMP).

2. CONTEXT

In accordance with Board direction from July 25, 2008, staff have developed two reports on:

- i) the strategies and actions to achieve a 70% diversion target by the year 2015 (referred to as the Zero Waste Challenge), and
- ii) an independent comparative analysis of the options for managing the waste remaining after recycling.

The first report was used as the reference document for the Zero Waste Challenge public consultation which was conducted from April 1 through May 15, 2009. Following consideration of the input received from the consultation program, the Board adopted the diversion target of 70% by the year 2015.

The second report, developed by AECOM Canada, has been completed, and has been supplemented by an airshed modeling report prepared by air quality consultants RWDI. These two reports will be used as reference documents in the development of the draft SWMP.

At the REAC meeting of June 5 the following resolution was passed: "That the Regional Engineers Advisory Committee receive the AECOM Canada Ltd. report "Management of Municipal Solid Waste in Metro Vancouver – A Comparative Analysis of Options for Management of Waste After Recycling" in conjunction with a report on airshed modeling and related health impacts, as reference documents for development of the draft Solid Waste Management Plan and associated public consultation."

A range of communications activities has been developed to support the release of the AECOM and RWDI reports that will reiterate Metro Vancouver's primary goal of waste

reduction through the Zero Waste Challenge, and commitment to highest and best use of the waste remaining after recycling, consistent with our commitment to sustainability.

3. ALTERNATIVES

The Board could:

- a. Direct staff to prepare a draft Solid Waste Management Plan for presentation to the Waste Management Committee on September 9, 2009, or
- b. Direct staff to develop a consultation program specifically on options for the management of post-recyclable waste.

Staff recommends alternative a.

4. CONCLUSION

In accordance with Board direction from July 25, 2008, staff have prepared two reports which address the strategies and actions to achieve a 70% diversion target by the year 2015, and an independent comparative analysis of the options for managing the waste remaining after recycling. It is recommended that staff now prepare the draft Solid Waste Management Plan using these reports as reference documents, and present the draft plan to the Waste Management Committee on September 9, 2009.