Hamilton-Wentworth

Air Quality Initiative

Summary Report

OCTOBER 1997

ACKNOWLEDGEMENTS

The Hamilton-Wentworth Air Quality Initiative (HAQI) is a cooperative initiative of many partners within Hamilton-Wentworth including government, industry, community, non-government organizations and academia. Numerous parties have contributed to this summary report, either directly or indirectly, and are hereby acknowledged.

The summary report draws heavily upon the "Technical Reports" of the four HAQI workgroup and several supplementary report. The primary authors of those reports and other key supplementary reports are listed in Appendix C. Without the contribution of the chairs and members of the working groups, the writing of this report would not have been possible.

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Many government staffs participated in the preparation of this report. The Regional Municipality of Hamilton-Wentworth's team included Rosemary Foulds, Doug Frost, Cathy Plosz and Bill Pearce. The Ministry team included Denis Corr, Frank Dobroff and Eric Loi. The Environment Canada Team included Anita Wong, Bill Booty and Esther Bobet. Jane Marshall provided valuable assistance in the preparation of the report and in organizing the consultation meetings.

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EXECUTIVE SUMMARY

Air quality has always been an area of concern in Hamilton-Wentworth. There is evidence of improvements in Hamilton-Wentworth's air quality over the last 40 years, due to emissions reductions by industries and enforcement of regulations by government. However, more work is needed to ensure continued improvements and explore more effective strategies for managing the air quality into the next century and beyond. As one step to address the concerns of the community, the Regional Municipality of Hamilton-Wentworth, Ministry of Environment and Energy, and Environment Canada started the Hamilton-Wentworth Air Quality Initiative (HAQI). This document focuses on the synthesis of existing local ambient air data, modelling information, health research and community surveys. This report is the result of a collaboration between agencies and individuals in the community who share an interest in air quality issues.

One of the challenges faced in the design of the assessment study was deciding which pollutants are the most important. In order of priority on human health effects, the pollutants selected for the HAQI study are:

1. Inhalable/Respirable Particulates ($PM_{10/2.5}$), particularly Sulphates (SO_4),
2. Ground Level Ozone (O_3),
3. Sulphur Dioxide (SO_2),
4. Nitrogen Oxides (NO_x),
5. Carbon Monoxide (CO), and
6. Air Toxics.

It is estimated that there are at least 90 premature deaths per year, and up to as many as 321 premature deaths, as a consequence of current air quality in Hamilton-Wentworth. Further, there are 300 additional hospital admissions per year due to current air quality in Hamilton-Wentworth. Inhalable particulates and especially its sulphate component have by far the greatest impact, accounting for 76% of the air pollution related premature mortalities and 64% of the air pollution related hospital admissions.

These pollutants come from a variety of sources. Some are local, while others are well beyond municipal boundaries. In the industrial areas, industrial activities can contribute more than 50% to the inhalable particulate concentrations. In the neighbourhoods located farther from the industrial areas, approximately 55% of the inhalable particulates come from sources outside of Hamilton-Wentworth, 30% come from urban sources such as cars and 15% come from industrial sources. Weather also plays an important role in air quality, as the prevailing south and west winds bring pollution from outside the Region, and temperature inversions trap local emissions.

The general level of pollution from industrial sources has declined since the 1970s, when controls were first brought in. Vehicle exhaust also has an impact on air quality. In the past 20 years, the number of vehicles using the roads have increased significantly. Even though

emission control standards have become more stringent, these benefits have been offset by the increases in vehicle usage and congestion on the roads. Modelling results show that in the absence of continued improvements in vehicle technologies, emissions of nitrogen oxides, carbon monoxide and hydrocarbons from transportation sources will increase by 26% to 36% by the year 2021 (during morning rush hours) based on current vehicle use, existing vehicle emission controls and enforcement, and population growth projections. These estimates indicate emissions from transportation sources will have the potential to be an even more significant source of air pollution in Hamilton-Wentworth in the future.

Air quality is of great concern to the citizens of the region, highlighted most recently by the Plastimet incident. The Ministry of Environment and Energy logs about 500 complaints about air quality annually and the issue receives frequent media coverage. This is not surprising, since health studies have connected air quality, particularly inhalable and respirable particulates, ground level ozone and sulphur dioxide, with premature mortality and hospital admissions. Not only are people concerned about air quality, a study undertaken during HAQI's investigations show people are prepared to pay an extra $40 per month in property tax to improve air quality and reduce the health effects. Poor air quality also adversely affects a Region's image as a place to live, to invest and to do business.

Clearly, there is support for measures to improve air quality. The research which was compiled during the HAQI helps to focus ongoing efforts to further control emissions. Three sources have been identified: industry, transportation and transboundary pollution. Some industries in Hamilton-Wentworth have already committed to voluntary reductions. One example is the draft Environmental Management Agreement between Environment Canada, Dofasco and the Ministry of Environment and Energy. These and other initiatives need to continue. In the transportation sector, a strategy to modify automobile and truck use is needed. This is a challenge, but one which needs to be taken up in order to reduce the rapid growth of emissions from this source. To reduce transboundary pollution, the federal government must continue its negotiations with the United States to reduce emissions from sources which contribute significant amounts of pollution to Ontario. The provincial and municipal governments should support the federal government in the negotiations.

The key recommendations for future actions to improve air quality in Hamilton-Wentworth should focus on inhalable particulates and sulphates. The following measures can help:

1. Promote public awareness to show the public how they can make a contribution;
2. Implement code of practice/guidelines/best available control technology for industrial sources, with emphasis on inhalable particulates and sulphates;
3. Control fugitive dusts;
4. Implement Strategic Options Process (SOP) recommendations;
5. Establish standards for vehicle emissions and vehicle emission testing;
6. Establish anti-idling bylaw;
7. Reduce the number of single-occupancy automobile trips;

8. Enact commercial vehicle maintenance standards;
9. Achieve more efficient commercial vehicle flow;
10. Reduce transboundary pollution;
11. Develop and implement energy conservation measures; and
12. Research to identify and evaluate information about health and environmental effects, sources of pollutants and projections of future trends in emissions.

Finally, it is important that actions are taken on the findings and recommendations in this report. There are a number of measures which could be taken to improve air quality. Measures to strengthen the regulatory authorities in their dealings with persistent offenders are needed. Other measures may be accomplished through partnerships. One potential of the HAQI is an opportunity to build on the partnership to carry out the recommendations. The recent experience with the serious fire in Hamilton reinforces the importance of continued dialogue and partnership. An interim organizational structure is proposed in this report for implementing the recommendations of the study and exploring the long term management of air quality in Hamilton-Wentworth

GLOSSARY OF TERMS

AAQC	Ambient Air Quality Criteria, established by the MOEE for various airborne pollutants
CCME	Canadian Council of Ministers of the Environment
CO	Carbon Monoxide*
COA	Canada-Ontario Agreement, respecting the Great Lakes Basin ecosystem (1994).
Exceedance	Exceedance in this report refers to ambient air concentrations that are above (or exceed) the Ministry of Environment and Energy's ambient air quality criteria.
HAQI	Hamilton-Wentworth Air Quality Initiative
HSR	Hamilton Street Railway
IMULATE	Integrated Urban Simulation Model
Inhalable Particulate	Particles equal to or less than 10 micrometers in aerodynamic diameter, which are particles that are easily inhaled.*
MOEE	Ontario Ministry of Environment and Energy
NO_x	Nitrogen oxides, which consist of nitrogen dioxide (NO_2) and nitric oxide (NO). Nitrogen oxides react with volatile organic compounds in the presence of sunlight to form ground level ozone.*
NPRI	National Pollutants Release Inventory
O_3	Ozone, a molecule consisting of three oxygen atoms. It is an important component of photochemical smog, which is formed as a result of chemical reactions between nitrogen oxides and volatile organic compounds in the presence of sunlight in the lower atmosphere. Ozone also occurs naturally in the upper atmosphere, where it shields the earth from harmful ultraviolet rays.*
PAH	Polycyclic aromatic hydrocarbons, a class of organic compounds with multiple six carbon (benzene) rings. Some of the compounds, such as benzo[a]pyrene are known carcinogens.*
ppb	Pollutant concentration in units of parts per billion, volume/volume

PM_{10}	Particles equal to or less than 10 micrometers in aerodynamic diameter, also referred to as inhalable particulates.*
$PM_{2.5}$	Particles equal to or less than 2.5 micrometers in aerodynamic diameter, also referred to as respirable particulates.*
Respirable particulates	Particles equal to or less than 2.5 micrometers in aerodynamic diameter, that can easily penetrate into the lung.*
SO_2	Sulphur dioxide is colourless gas that can be converted via a number of atmospheric reactions to sulphuric acid and sulphate particles.*
SOP	Strategic Options Process
TSP	Total suspended particulates are particles that are generally smaller than or equal to 100 micrometers in aerodynamic diameter.*
μm	Micrometre or micron, one-one millionth of a metre in length, which is a commonly used measure of the size of small particle.
$\mu g/m^3$	Micrograms per cubic metre, a commonly used concentration unit for air pollution
VOC	Volatile Organic Compounds are a class of compounds containing at least one carbon atoms and are volatile. Nitrogen oxides react with volatile organic compounds in the presence of sunlight to form ground level ozone.*

* further details on these compounds can be found in the Lung Association Hamilton-Wentworth's series of 6 Factsheets (The Lung Association, 1996).

1 INTRODUCTION AND MANDATE

HAQI History

Hamilton-Wentworth Air Quality Initiative (HAQI) began in response to a number of interests. First, over the years, a number of programs have been developed to reduce the emissions of specific pollutants. While these programs have met with varying degrees of success, a comprehensive approach to air quality problems has not emerged. As a result, a patchwork of knowledge about specific pollutants has been developed, but, the "big picture" continues to elude those who are interested in air quality issues.

Second, the Council of the Regional Municipality of Hamilton-Wentworth signalled its interest in air quality issues in its Official Plan, Vision 2020. The goal for Air Quality is "to ensure the Region has the best air quality of any major urban area in Ontario by the year 2000" (Region of Hamilton-Wentworth, 1993a). It is impossible to achieve this objective without a clear idea of the priority pollutants and their sources. Air quality improvements are only one of several quality-of-life initiatives highlighted by the Vision 2020 plan. The multi-stakeholder process for the Hamilton Harbour Remediation (RAP) has seen significant investments in water quality improvements that are now producing exciting, concrete results. A similar strategy is proposed to achieve equally positive results in air quality improvements. The Region also began working on greenhouse gas reductions in January 1995 after signing the Canadian Declaration on Climate Change and the Urban Environment. In November 1996, Regional Council made a commitment to reduce carbon dioxide emissions in Hamilton-Wentworth by 20% from 1990 levels by the year 2005.

The interest in HAQI also rests with the Ontario Ministry of Environment and Energy (MOEE), which has air quality as one of its mandates. In Windsor, the MOEE conducted an extensive study of air toxics during 1991-1994. The HAQI offered the opportunity for a similar type, but broader scope, community study in Hamilton-Wentworth. The Regional Municipality of Hamilton-Wentworth gave its strong support to the HAQI, as the foundation for new policy and program initiatives.

People who live and work in Hamilton-Wentworth have also expressed their concerns about air quality issues. In 1993, the MOEE received over 500 complaints from the public about air quality and bad odours. The July 1997 fire in north Hamilton has heightened this interest.

In 1996, the Regional Municipality of Hamilton-Wentworth, MOEE and Environment Canada initiated a partnership to undertake such an air quality assessment study in Hamilton-Wentworth. The HAQI is the first step to study and make recommendations pertaining to air quality issues that affect the Region.

1.1 STUDY AREA

The focus of this study is the Region of Hamilton-Wentworth (Figure 1). It has several features which create a unique environment for consideration of air quality issues.

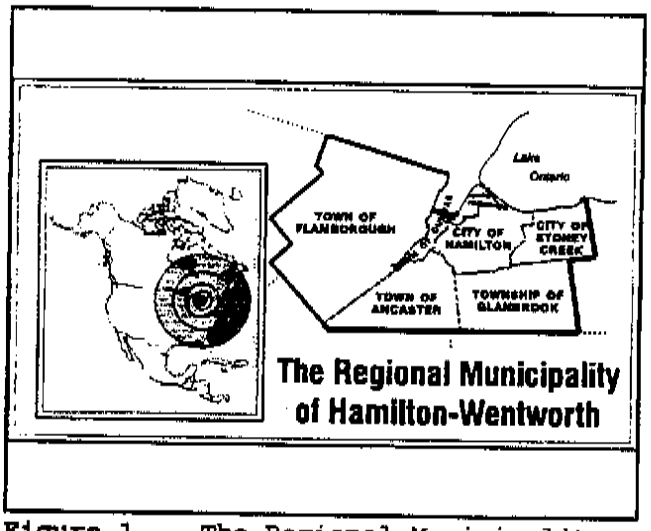

Figure 1 The Regional Municipality of Hamilton-Wentworth

The Region is situated on the southwest end of Lake Ontario on a sheltered natural harbour. Most of the heavy industry borders the harbour's southeast shore. The Niagara escarpment surrounds the harbour and cuts through the Region. It creates geographically defined communities and is a major wildlife corridor. Hamilton-Wentworth is also the gateway to the Niagara Peninsula as much of the traffic between Southern Ontario and the U.S. passes through the Region.

Over 468,000 people live in Hamilton-Wentworth, which is also home to a major university, two of the largest steel companies in Canada with associated secondary industries and a centre for medical research. The Hamilton-Wentworth regional municipality includes the communities of Hamilton, Stoney Creek, Glanbrook, Ancaster, Dundas and Flamborough..

The same features which give Hamilton-Wentworth its natural beauty have also led to the intensification of environmental impacts as the region has grown. The enclosed nature of Hamilton Harbour and surrounding inlets contribute to the buildup of aquatic pollutants from both industry and other development. The protective effect of the escarpment allows the buildup of airborne pollutants. These effects can be exacerbated by high volumes of traffic and the dense concentration of industry.

1.2 HAMILTON-WENTWORTH AIR QUALITY INITIATIVE GOALS AND OBJECTIVES

HAQI's goal is to utilize all existing and available resources and information to identify priorities in air quality management using a cooperative, multi-stakeholder approach.

There are four objectives:

1. Identification of impact areas and priority pollutants using complaint records and monitoring station data.

2. Determination of variables that have an effect on airborne levels of the identified compounds. These variables could include the types of sources, total loadings, types of receiving areas, distance from emissions.

3. Data collection, synthesis and analysis using the existing geographic information, computer modelling data, and decision support systems.

4. Provision of information and recommendations to businesses, public sector organizations, governments, and households to influence the way they conduct their affairs.

1.3 HAQI ORGANIZATIONAL STRUCTURE AND PARTICIPANTS

The project team for the initiative consisted of a Coordination Group, a Consultation Group, and the four Workgroups: 1) Aesthetics, Odours and Economics; 2) Environment; 3) Human Health; and 4) Transportation/Land Use (Figure 2).

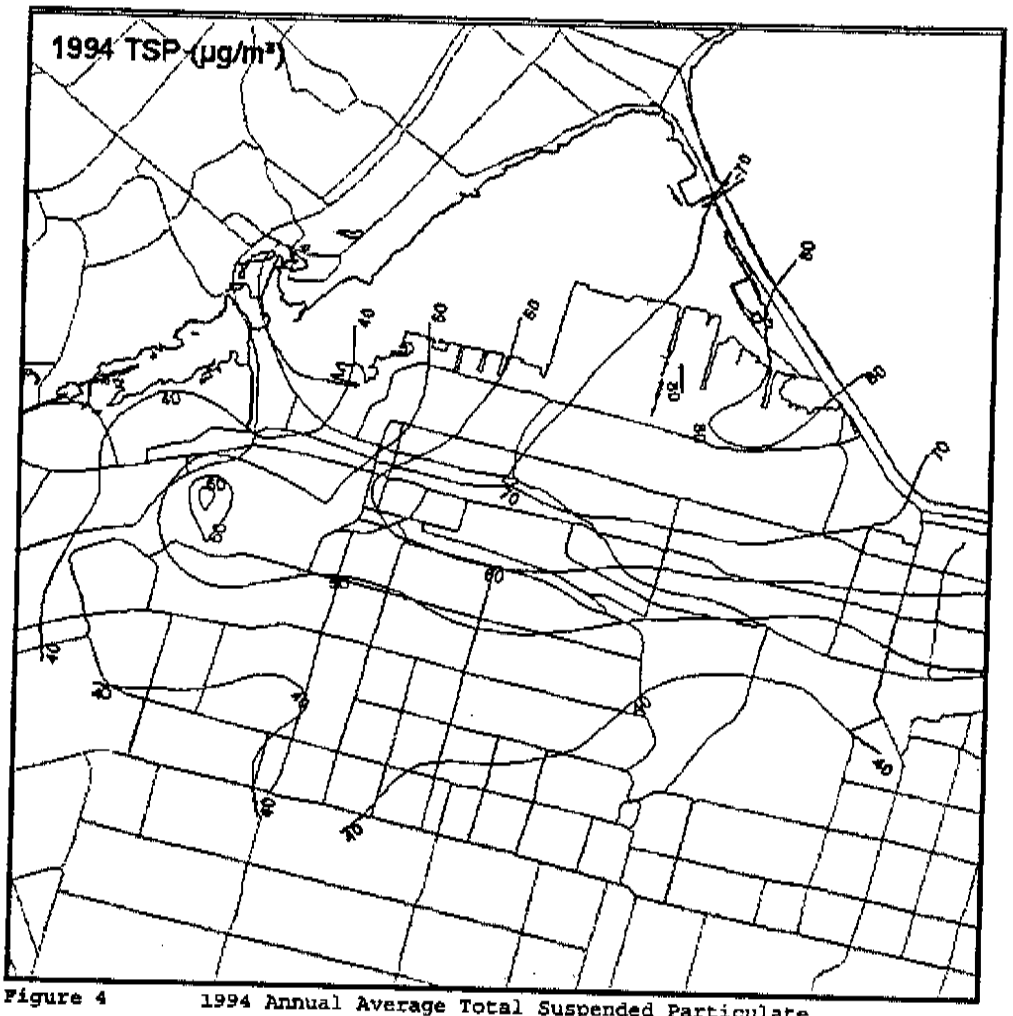

Figure 4 1994 Annual Average Total Suspended Particulate Concentration Isopleths for the Hamilton

Source: Prepared by the Environment Workgroup based on MOEE data

Inhalable and Respirable Particulate

Inhalable particulate is the fraction of airborne particles that is less than 10 μm in diameter and is often referred to as PM_{10}. Approximately 40-60% of total suspended particulates (TSP) is composed of inhalable particulate. 'Respirable particulate' or $PM_{2.5}$ refers to those particles that are less than 2.5 μm in diameter and which pose a greater health risk due to their ability to travel to the deepest part of the respiratory tract. Inhalable particulates originate in part as direct emissions from industrial stacks and fugitive sources, vehicles, wood burning fireplaces and wind-blown dust from roads, construction sites and agricultural areas. Another significant fraction is generated by chemical reactions in the atmosphere, which result in the formation of sulphates, nitrates, organic compounds.

The MOEE has proposed an interim 24 hour average ambient air quality criterion of 50 $\mu g/m^3$ for inhalable particulates. In addition, the "Smog Plan" being developed for Ontario will be addressing emissions that contribute to inhalable/respirable particulates. Measurements of inhalable particulates in Hamilton-Wentworth began first in the late 1970s. In 1991, MOEE started its regular inhalable particulate monitoring at four sites in Hamilton. Figure 5 compares inhalable particulate and sulphur dioxide concentrations in Hamilton-Wentworth to other cities in recent years. The levels of inhalable particulates in the downtown areas of Hamilton are comparable to other urban centres in southern Ontario such as Toronto and Windsor.

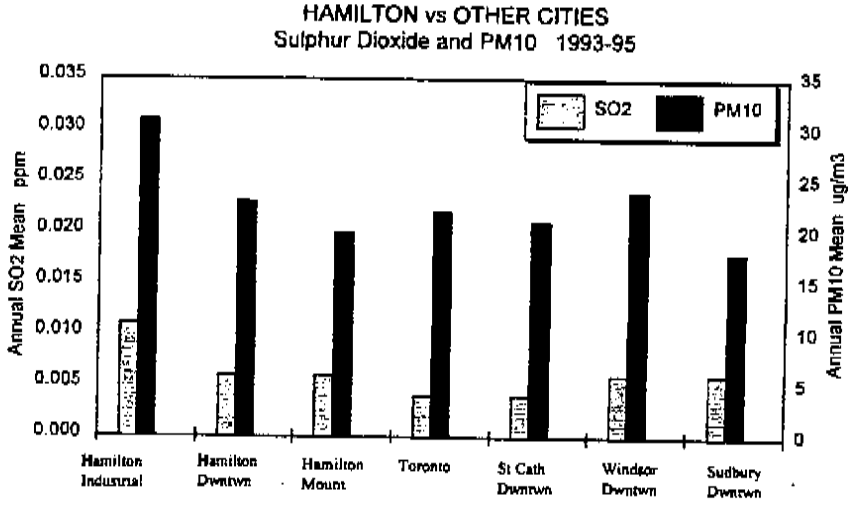

Figure 5 Inhalable Particulates (PM10) and Sulphur Dioxide Annual Average Levels in Hamilton (1993-95)

Because of strong influence from long range transport (LRT), the annual average levels of fine particles are consistent across Hamilton-Wentworth. However, there are obvious influences from industrial and urban sources. Levels are slightly higher near the industrial zone and in the downtown areas.

Upwind and downwind concentrations of fine particles across the industrial area were examined for days with steady easterly winds. Using this technique the impacts of industrial emissions become more obvious. On average, industries can add approximately 30-40 $\mu g/m^3$ of inhalable particulates to the air concentrations downwind, e.g., in the urban areas of Hamilton (Figure 6).

2.2 QUANTIFYING THE HEALTH IMPACTS OF HAQI PRIORITY POLLUTANTS

The 'Human Health Working Group' (Pengelly at al., 1997) addressed the concerns of the community by developing a better understanding of the health risks associated with selected airborne environmental contaminants in Hamilton-Wentworth. The objective was to determine which of the contaminants have the greatest potential to cause adverse impacts on human health.

The Workgroup agreed to address the community concerns by focusing on two main groups of air pollution:

1) The first group contained pollutants for which there are measurable acute or immediate health effects in the population attributable to distinct air quality parameters. These include inhalable/respirable particulates and sulphates, ozone, sulphur dioxide, carbon monoxide and nitrogen oxides. Measurable health effects can be addressed by applying projections from the epidemiological literature (real data on real people) to the local population. These projections are based on real measurable effects such as hospital admissions and premature death associated with ambient air levels of these pollutants in numerous cities in North and South America and Europe.

2) The second group (air toxics) included carcinogens and substances with other chronic or long term health effects, whose impacts can be estimated in the local population by risk assessment procedures. These substances include cadmium, hexavalent chromium, manganese, lead, benzene, 1,3-butadiene and benzo[a]pyrene. These risk assessment procedures provide an estimate of the health risk to the local population according to the concentrations found in ambient air and are based on animal testing or human epidemiology studies.

Health Effects

A number of health effects are associated with the pollutants examined by the Human Health Workgroup. A few of the effects are highlighted in this section. Further details of the risk assessment can be found in the Human Health Workgroup report (Pengelly et. al., 1997).

Inhalable particulate exposure has been linked to increased mortality. This association is found in metropolitan areas in North America including Toronto, Detroit and Los Angeles. Studies show that an increase of 10 $\mu g/m^3$ could increase the total mortality rate by 1 percent (MOEE, 1996). Certain groups, such as children and the elderly seem to be more sensitive to this problem.

There is considerable discussion currently on the issue of what are the important inhalable particulate species and what is their biological mechanism of action. Some studies have

pointed toward sulphates as the most important species on the basis of its association mainly with the smaller respirable fraction, its chemical reactivity and animal and clinical exposure studies.

Admissions to hospitals for respiratory conditions such as asthma and bronchitis tend to increase during periods of elevated sulphur dioxide or sulphates. SO_2 was identified as one of the pollutants responsible for inducing premature mortality in susceptible persons in the London, England smog episodes in 1952. Sulphur dioxide can react in the atmosphere to form sulphate particles. More recent studies have shown increased mortality and hospitalization, especially in people with cardio-respiratory diseases, with increases in sulphate level.

Ozone is particularly harmful to people with respiratory conditions such as asthma or chronic bronchitis. Studies have linked increases in ozone levels with increases in cardio-respiratory diseases. An increase of 10 ppb in ozone concentration could increase the respiratory hospital admission rate by 0.9 percent (MOEE, 1996). Ozone also reduces lung function, even at levels equal to the one hour Ontario ambient air quality criterion of 80 ppb.

Carbon monoxide has long been recognized as a pollutant with adverse health effects, and in high concentrations, it is lethal. Recent papers have also related exposure to low concentrations of CO with hospitalization for congestive heart failure in patients over 65 years of age (Pengelly et. al., 1997).

There have been many studies on the effects of NO_2 on health, particularly on respiratory symptoms or pulmonary function in children. However, there have been few studies on hospital admissions or mortality, except for a European study of 15 European cities in 10 countries (Pengelly et. al., 1997).

Cadmium, hexavalent chromium, benzene, benzo[a]pyrene and 1,3-butadiene are considered to be carcinogens. Cadmium can also induce damage to the kidney. Lead and manganese have adverse effects on the nervous system. The emphasis of the HAQI toxics health assessment is primarily on cancer outcomes. Only the risk from inhalation was estimated as part of the HAQI, and therefore, the assessment may underestimate the risk from all routes of exposure for these contaminants.

Results

The health effects results, as summarized in Table 5, demonstrate a substantial burden of illness and premature deaths associated with air pollution in Hamilton-Wentworth. The estimated health effects for the air pollutants have been expressed as the number of premature mortalities, hospital admissions and excess cancer cases. As noted earlier, air pollutants such as inhalable/respirable particulates and sulphates, ozone, sulphur dioxide, carbon monoxide and nitrogen oxides are associated with hospital admissions and premature deaths. Air toxics are associated with chronic or long term effects such as cancer.

2.3 MONETARY VALUATION OF HEALTH EFFECTS

Monetary valuation of the impacts of health effects have been undertaken as part of HAQI. The monetary value estimates are calculated based on the amount people are willing to pay for reduction in risk of death, or to avoid health effects. The Aesthetics, Odours and Economics Workgroup used the data from Haglar-Bailly (1995) to estimate the monetary values of the health effects identified in Table 5. The monetary values of the health effects are estimated to be in the range of $860 million for premature mortality, $2 million for hospital admissions and less than $2.6 million for cancer (Cincar, 1997). These estimated values are associated with the human health effects due to current levels of air pollution in Hamilton-Wentworth.

2.4 SUMMARY OF PRIORITY POLLUTANTS

HAQI has attempted to focus on scientific evidence and point to policy options that will generate real improvements. It should be recognized that conventional wisdom may not be good science and it may cause public expenditures and policies to be ineffectively targeted. The HAQI findings on impacts and sources will help to guide actions for maximum improvements.

HAQI found Inhalable/respirable particulates, sulphates, ground level ozone, sulphur dioxide, nitrogen dioxide and air toxics to be the most important air pollutants in Hamilton-Wentworth. The total premature mortality due to exposure to these air pollutants are estimated to be at least 90 and could be as high as 321. The corresponding number of hospital admissions is estimated to be about 300 per year. Of the pollutants studied in the HAQI, inhalable particulates and especially their sulphate component have by far the greatest health impact for the residents of Hamilton-Wentworth. They represent approximately 76% of the air pollution related premature mortalities and 64% of the air pollution related hospital admissions, based on the medium confidence estimates..

The sources of the pollutants vary. For inhalable particulates in Hamilton-Wentworth, long range transport, urban and industrial sources are all significant contributors. During days with steady winds, industrial operations can contribute more than 50% of the inhalable particulate levels at nearby downwind sites. In the typical urban areas, long range transport can contribute approximately 55% to the inhalable particulate levels on an annual basis, urban sources account for approximately 30% and industrial sources contribute approximately 15%.

3 SOURCES OF AIR POLLUTION IN HAMILTON-WENTWORTH

There are three main air pollution problems in Hamilton. The first is the industrial impact on nearby residential areas. The second are short term episodes due to pollution buildup throughout the city during temperature inversions especially during the spring and fall. The third is due to long range transport of pollutants from outside the region.

Emissions from multiple sources (e.g., industries, vehicles) contribute to the ambient air pollutant levels. The level at any specific time is dependent on the location, distance from the sources and the meteorological conditions. Sources of pollution can be hundreds or thousands of kilometres away and still impact Hamilton-Wentworth.

Because long range transport of pollutants is a factor in local air quality, this chapter begins with an examination of the role of weather. The role of industry and transportation are also reviewed. Historic emission patterns are reviewed and future trends are discussed.

3.1 METEOROLOGY AND AIR POLLUTION IN HAMILTON-WENTWORTH

In Hamilton-Wentworth, three weather features influence air quality: wind direction, temperature inversions and on-shore lake breezes. The prevailing winds are from the southwest and west. Winds from the southwest can carry ozone, inhalable/respirable particulates and other pollutants from the U.S. When the winds blow from the northwest, they are relatively clean and may carry away locally generated pollution.

Temperature inversions are fairly common in the spring and fall. During an inversion, cool air at the ground level is trapped beneath warmer air higher in the atmosphere. Pollutants become more concentrated as the air is stagnant, resulting in poor air quality episodes. The Niagara Escarpment can contribute to inversions by trapping the pollutants between the escarpment and Lake Ontario.

Inversion effects can be made worst by on-shore lake breezes. Warm air from the city and industries rises which draws in cool air from the lake. In the case of Hamilton, emissions from the industrial area can be recirculated and concentrated across the City.

3.2 INDUSTRY TRENDS

Generally, industrial emissions have declined over the last 20 years. The most improvement was observed in the 1970s when industries introduced pollution controls on major emission sources and better industrial practices/fugitive control programs. Ambient levels and emissions of total reduced sulphurs[3] (TRS) and nitrogen dioxide over 1975-1995 illustrate this trend (Figures 9 and 10).

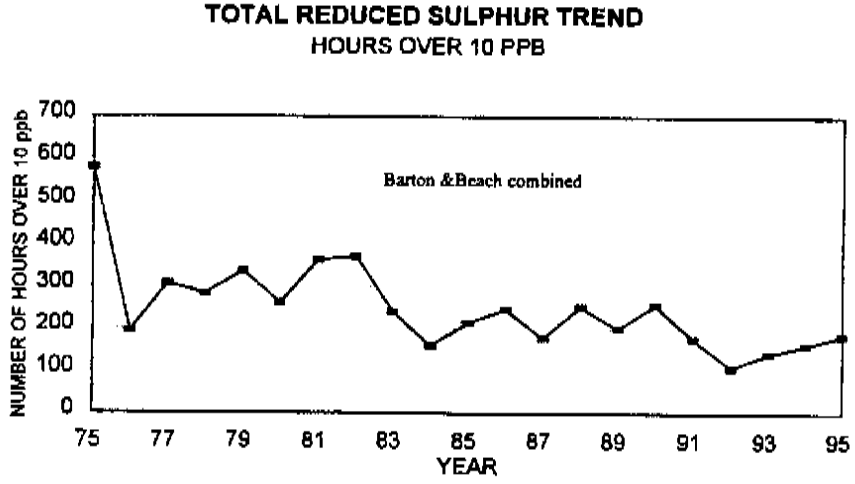

Figure 9 Trends in Number of Total Reduced Sulphurs Hours Above 10 Parts Per Billion

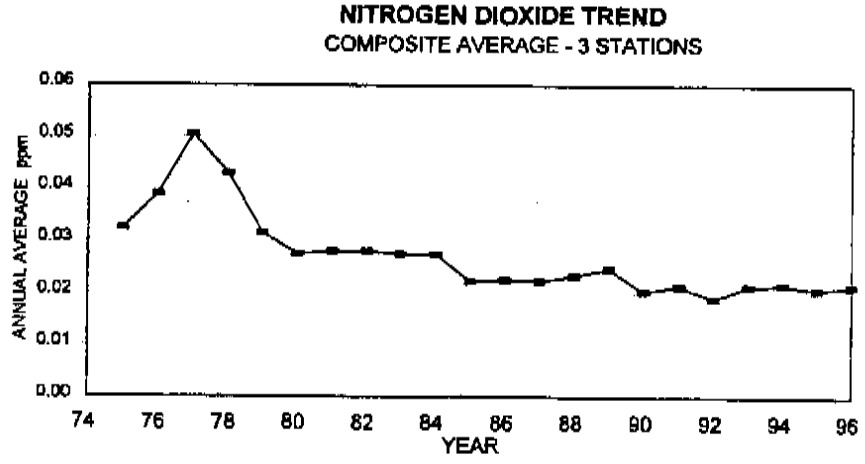

Figure 10 Nitrogen Dioxide Trend for Hamilton-Wentworth (1975-1995)

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[3] Total reduced sulphurs are odorous compounds that are emitted primarily by slag quenching and coke ovens in the iron and steel industry

Fluoride levels have also shown a steady decline throughout most of Hamilton, except near the Hamilton Brick Co., where levels in 1995 were again well above the Ontario ambient air quality criterion (AAQC). Although fluoride does not pose a threat to human health, slight to severe injury to vegetation has been observed in the vicinity of the plant. Hamilton Brick has upgraded their drying oven, reduced the temperatures and installed a more efficient kiln to address the problem. The use of control technology is under consideration.

Among the priority pollutants identified in Chapter 2, there have been some improvements as well. Dust levels have improved in Hamilton. Many of the industries have applied road sealants, road washing and landscaping measures to reduce fugitive dust. Municipal government staff has also modified road cleaning practices. Other measures included the banning of apartment incinerators in 1989. However, the AAQC (4.5 g/m^2/month) is still exceeded at 10 locations in Hamilton. This highlights the need to maintain, expand and improve the fugitive dust control programs.

The Regional Municipality of Hamilton-Wentworth operates a Solid Waste Reduction Unit (SWARU) in Hamilton. SWARU's control system was recently upgraded to improve the efficiency of acid gas capture. Stack testing conducted in early 1997 showed downwind (point and impingement) concentrations of dioxins and furans were well below the MOEE's point of impingement standard.

Black fallout is solid particles of air pollution, comprised largely of carbon, which occur in a variety of sizes. Black fallout in Hamilton can come from inefficient industrial combustion, the steel-making industry, vehicle emissions, poorly operated home and industrial heating systems, wood burning, and upsets during carbon black manufacturing and waste incineration. Black fallout has become a major concern in parts of Hamilton in recent years. Complaints of black soot on lawn furniture, vehicles, and buildings are common.

The dust and suspended particulate levels near Redland Quarries have improved since the late 80s with the use of new electrostatic precipitators and fugitive dust control measures. However, the AAQCs for suspended particulate and dustfall are sometimes exceeded at the sites near the quarry and processing plant.

Philip Environmental operates a solid non-hazardous industrial waste landfill at a site that was formerly operated as a limestone quarry by Taro Aggregates. The main air quality effects from this site relate to dust emissions and occasional odours. The company's suspended particulates (TSP) data (1991 and 1994) indicated exceedances of the daily TSP AAQC downwind of the site at the edge of the property during dry conditions. Odour concerns exist and are related to volatile organics (VOC) emissions. However, modelling of landfill gases and ambient air sampling by

the MOEE did not show any exceedance of the MOEE's AAQCs. Some complaints have been received and continue to the present day. As part of the Certificate of Approval granted to the company in 1996 to landfill the East Quarry, VOC (and TSP) monitoring was required in 1997. Those results are pending.

Ground level ozone is heavily influenced by long range transport. More than 50% comes from sources originating from the U.S. The AAQC for ozone is exceeded less often in the urban/industrial areas of Hamilton than in rural areas downwind. This is due to the scavenging of ozone by locally produced NO_x. Nonetheless, the AAQC for ozone is exceeded at all Hamilton-Wentworth locations. The MOEE is developing an Ontario Smog Plan to address the issue of smog, which include ground level ozone.

Benzo[a]pyrene (BaP) levels continue to exceed the AAQC at several sites in Hamilton. BaP (an air toxic) is associated with incomplete combustion from sources such as fireplaces, wood stoves, and coke ovens. The high levels of BaP in Hamilton appear to be associated with industrial activities since high levels are often correlated with winds passing over the industrial zone. Both Stelco and Dofasco have made improvements in the past and have long term programs to identify and reduce PAH and VOC emissions. For example, Dofasco has reduced coke consumption through the use of heavy oil in their blast furnace, and Stelco has implemented coal injection into the blast furnace. Over the short term, coke oven doors could be upgraded and sealed to minimize leakage. Over the long term, some of the coke ovens may have reached their viable life and the companies could consider rebuilding them or replacing them with cleaner processes.

Industries in Hamilton continue in recent years to improve their operations. A few highlights include:

- Dofasco, Environment Canada and MOEE have just drafted an Agreement to reduce emissions of benzene, odours and other VOCs;
- Columbian Chemicals will implement a multi-million dollar environmental program over the next two years to reduce black particulates and SO_2 emissions.
- the Hamilton Environmental Industrial Association has been formed to focus on further environmental improvements, particularly in the field of air quality;
- NO_x and VOC emission reductions are being developed by industrial sources, including the iron and steel sector, as part of Ontario's Smog Plan,
- Bulk gasoline terminals are developing vapour recovery systems to help reduce this source of VOC emissions; and
- SWARU installed an acid gas scrubber in 1996 to reduce its acid gas emissions.

3.3 TRANSPORTATION TRENDS

A growing contributor to air quality problems in Hamilton-Wentworth is the transportation sector. Unlike industrial sources which have levelled off, and in some cases, are declining, transportation sources have the potential to increase significantly over the next three decades.

Although vehicle emission reduction technologies have offset some of the emissions, the rapid increase in auto, light truck and heavy commercial vehicle use over the past two decades suggests that technological improvements will not make up for the projected increased in vehicular traffic.

3.3.1 HISTORIC TRENDS

Studies of transportation patterns show vehicle use has been increasing:

- The number of single person vehicle trips in Hamilton-Wentworth is increasing. In 1974, 60% of all trips were made by solo drivers. In 1991, this had increased to 66%, while other modes of transit (as a passenger, using transit, walking/cycling, etc.) declined. The latter form of transit produce far less pollution per trip.
- Public transit ridership in Hamilton-Wentworth is declining. In 1984, buses carried 29.8 million passengers. In 1995, the total number of passengers was 20.4 million. A bus with 10 passengers produces far less emissions per trip than there would be if each of the 10 drives their own vehicle. Bus emissions depend on:
  - the age of diesel buses (newer buses emit less pollutants);
  - fuel (there are fewer pollutants from natural gas than from diesel fuel); and
  - maintenance (regular tune ups and emissions testing).
- People are commuting longer distances to work. More people are leaving the Region to work and more people who work here live outside the Region. Discretionary trips are also getting longer. Longer journeys mean more emissions.
- There has been a shift in cargo transport from rail and marine to trucks. In Ontario, truck transit is on the rise. The details of this increase and its effects have not been studied in Hamilton-Wentworth and are considered to be a major gap in our knowledge.

Vehicle exhaust contains most of the priority pollutants identified in Chapter 2. Emissions are greater in larger vehicles, and the emission standards for commercial vehicles are less stringent than those for private automobiles. In Hamilton-Wentworth, the total emissions of particulates from heavy duty trucks are approximately the same as that for cars, even though there are far fewer trucks on the road. Stop and start situations also mean more emissions. Clearly, more traffic in the future will contribute to a decline in air quality.

3.3.2 MODELLING FUTURE TRENDS

Historic increases in vehicle use suggest vehicle emissions will increase as a factor in air quality. During the course of the HAQI study, researchers at McMaster University used IMULATE[4], a simulation model, to generate automobile emissions at 10 year intervals from 1991 to 2021. Five scenarios were developed to understand the relative importance of various factors in determining emissions.

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[4] Integrated Model of Urban Land-use, Transportation, and Environmental Analysis

- ***Base:*** road networks to remain unchanged in extent and capacity.
- ***New Roads:*** incorporate all the Region's commitments to future improvements and expansions, including the Red Hill Expressway and the bypass of Highway 5 around Waterdown.
- ***Technological Improvements:*** improvements in vehicle emission performance (with New Roads).
- ***25% Transit:*** assumes 25% of morning rush hour trips are made by transit as compared with 11% now (with New Roads).
- ***Dispersed Land Use:*** assumes new developments would be at a density comparable to Westdale, an 'old suburb' neighbourhood of Hamilton (with New Roads).
- ***Concentrated Land Use:*** assumes infill instead of peripheral development (with New Roads).

Table 6 summarizes the detailed results of the model simulations under the six policy scenarios.

Table 6 Percentage change in key variables for morning rush hour period, 1991-2021*.

Scenario	Vehicle Kilometres Travelled (%)	Average Congested Speed (%)	Emissions of HC (%)	Emissions of NO_x (%)	Emissions of CO (%)
Base	22.0	-7.5	62.2	30.9	63.6
New Roads	24.9	-1.8	35.5	26.3	37.1
Technological Improvements[1]	24.9	-1.8	-31.6	-27.6	-28.3
25% Transit Scenario[1]	11.8	1.3	6.7	11.1	8.1
Dispersed Land Use[1]	27.5	-1.9	35.7	26.6	37.3
Concentrated Land Use[1]	20.6	-1.6	33.0	24.7	34.6
*Percentage changes are defined over values for 1991 Base Scenario.					

[1] These scenarios use the road network assumed under the New Road scenario

Source: Kanaroglou et. al., 1996

It should be noted that the IMULATE modelling did not explore the effects of additional truck traffic which may use the Red Hill Expressway bypass. In addition, modelling was not conducted to estimate particulate emissions, which are key to human health impacts.

Within these limitation, the key findings of the IMULATE modelling exercise are summarized as follows:

- Assuming that vehicle technology remains constant, the projected growth in population and increased use of cars between the years 1991 and 2021 leads to significant increases of hydrocarbons (62%), NO_x (31%) and CO (64%).
- Because of the impact of congestion on emissions, a 10% reduction in the number of cars on the road will result in a reduction of greater than 10% in emissions.
- Technological improvements to automobiles offer the most promise for lowering or at least reducing the growth in emissions due to an increase in populatiou and auto use. Without the projected gains assumed from technology improvements, emissions from light vehicles would increase dramatically over the next two decades.
- Increasing the level of public transit use could have a major impact on slowing the growth of transportation emissions. Promotion of high occupancy vehicle use, car-pooling, or the use of smaller, more innovative public transit, would offer similar gains.
- More concentrated land use patterns could lead to reductions in emissions from transportation sources, although a large portion of the Region is already built out and will not be significantly altered over the next 10-20 years.
- New and improved roads will reduce congestion and thus will also reduce emissions of air pollution from transportation sources in the short term. However, in the longer term, construction of new roads will encourage an increase in car use thus increasing air pollution.

3.3.3 POLICY IMPLICATIONS OF MODELLING

The findings of the McMaster modelling efforts are important factors in establishing a policy direction to achieve better air quality in Hamilton-Wentworth. These findings suggest that it is essential that technological improvements (auto emissions controls) take place, as expected, in order to reduce automobile emissions. Another key to reducing these emissions will be to reduce the total kilometres driven. A 10% decrease in automobiles on the road will lead to greater than 10% decrease in emissions because there would be less stopping and starting (i.e., less congestion). Therefore, after technology improvements, the next best routes to emissions reduction would be programs that reduce rush hour congestion.

3.4 SUMMARY OF SOURCES AND TRENDS

Emissions from the industrial sector have decreased. The general level of pollution from industrial sources has declined since the 1970s, when controls were first brought in. Generally, higher levels of the priority pollutants are measured in close proximity to the sources. The exception to this is ground level ozone, where local sources of NO_x can temporarily lower the ozone levels in the area. Opportunities to reduce emissions exist as companies upgrade to cleaner and more efficient equipment and processes. There are also some other initiatives underway which will help to reduce the industrial emissions in Hamilton-Wentworth.

Vehicle exhaust also affects air quality. In the past 20 years, the number of vehicles using the roads have increased significantly. Even though emission control standards have become more stringent, these benefits have been offset by the increases in car usage and congestion on the roads. Based on current vehicle use, existing vehicle emission controls and enforcement, and population growth projections, emissions from transportation sources will have the potential to be an even more significant source of air pollution in Hamilton-Wentworth in the future. Programs to reduce vehicle kilometres travelled, such as car-pooling and alternative forms of transportation, will be discussed in Chapter 4.

4 PRIORITIES FOR FUTURE ACTION

It is important to identify pollutants, where they come from, and the effects they have. It is equally important to examine strategies to reduce emissions. This chapter looks at a number of strategies which can be undertaken to improve air quality. A key to any successful strategy is the extent of public interest. This is discussed before the recommendations for action.

4.1 COMMUNITY INTEREST AND SUPPORT

The extent of public interest in an issue is often expressed through the degree of involvement. Involvement can be described as a continuum ranging from no actions, to complaints, to committee activities. With respect to complaints, the MOEE records the number and types of complaints received from the public. About 65% of the 1,139 complaints received in 1994 dealt with issues related to air pollution such as bad odours, dust fallout, and soiling.

There has been considerable committee activity in Hamilton's north end. In the early 1990s, local residents formed the Homeside Environmental Committee to attract attention to the suspended particulates problems in residential areas close to industrial activities. The Homeside Committee and local residents' complaints led to the establishment of the Homeside Community Environment Project Workgroup. The Workgroup membership is drawn from residents, MOEE officials, municipal politicians, and Regional Public Health Department. The group investigated the health and property impacts of black fallout, which is mostly carbon particles. Although this type of pollution is not considered a major threat to health, it is visible (soiling and soot) and causes property damage as a result.

The activities of the Committee also lead to a study (Elliot et. al., 1997) of residents in the north end of Hamilton by the Regional Public Health Department. A telephone survey was used to reach residents in the northeast Hamilton. The survey investigated three issues:

1) the nature of concerns about air quality;
2) knowledge of the linkage between human health and air quality; and
3) prevalence of health problems linked to priority pollutants.

The survey (402 respondents) found most people surveyed are concerned about the various types of air pollution:

- 82% about industrial stack smoke;
- 71% about air pollution in general;
- 70% about black soot; and
- 57% about traffic exhaust.

Residents are also adversely affected by non-health impacts. Almost three quarters of respondents (74%) described disruptions in lifestyle due to deposits of black soot, including not being able to

hang laundry outdoors, having to keep doors and windows closed, and soiling particularly to cars and lawn furniture. The survey also found 31% of respondents believed pollution-related odours were affecting their daily lives through psychosocial effects such as neighbourhood stigma.

The survey found residents connected air quality with concerns over human health. Seventy-two percent of those surveyed believed air pollution would likely lead to health effects for themselves, and two thirds believed air pollution would likely lead to health effects for others in their household. Respondents reported substantial prevalence of asthma, emphysema and bronchitis in their households. This rate is currently being examined relative to rates reported in other studies.

To complement this information, the Hamilton-Wentworth Air Quality Initiative also supported a region wide survey, undertaken by researchers in the Department of Economics at McMaster University (Muller and Diener, 1997). This survey established the extent of concern and investigated how much citizens are willing to pay to improve air quality.

The results illustrate a significant level of concern about air quality. A majority of respondents (58%) thought the air quality in their neighbourhood was worse or much worse than the rest of Southern Ontario. Respondents were concerned or extremely concerned about health effects (81.2%), black fallout (70%), bad odour (58%), and poor visibility (56%). Hamilton-Wentworth residents perceive air quality is as important or more important than other prominent issues of concern. For instance, residents believe air quality was equally or more important than issues such as taxes and snow removal. However, residents believe air quality was equally or less important than issues such as the quality of the education system and unemployment.

Generally, the survey results indicate residents are prepared to pay for improvements to air quality through increases in their property taxes. Specifically, respondents indicated a willingness to pay the following:

- $40/month to reduce health impacts (hospital admissions for cardio-respiratory diseases and premature deaths) by one third; and
- $13-$14/month to reduce black fallout, bad odours and poor visibility days by a third.

It is important to note that the willingness to pay estimates were based on hypothetical choices. Willingness to pay in real situations may be ten times less. However, if residents are willing to pay even one tenth of the amount indicated in the survey, the monthly contribution would be $4/month. Such a contribution translates to a total of $8 million for the entire region.

Whether people participate voluntarily (through complaints), or through more systematic methods, there is a great deal of interest and concern about air quality in Hamilton-Wentworth. There are concerns about links between air quality and human health and people are prepared to devote a portion of their property tax to improving air quality in the region.

4.2 ACTIONS TO IMPROVE AIR QUALITY IN HAMILTON-WENTWORTH

The following recommendations were developed through the HAQI for wider consideration. As such they should be considered preliminary. They are grouped below according to emission sources: industry, transportation (private and commercial) and other (eg: transboundary pollution, fugitive dust, heating and cooling). There are also recommendations which apply to all sources (e.g., public awareness, research, monitoring).

The recommendations are not listed in order of priority for addressing human health effects. Priorization should focus on efforts to reduce inhalable particulates and sulphates, since they have been identified as having the most adverse human health impacts.

4.2.1 ACTIONS TO REDUCE INDUSTRIAL SOURCES

The regulation of releases of pollution by industrial firms has undergone numerous changes over the past half century. Prior to the 1950s, there was virtually no regulation of industrial emissions. Municipal government was often the first level of government to try to reduce discharges into the environment by requiring at least minimal pollution abatement efforts. In the late 1960s and early 1970s, the Provincial and Federal governments began to develop standardized regulatory systems which ensured consistent pollution control measures. By the late 1980s, the command and control approach made significant progress in air quality improvements. More recently, the Federal and Provincial Governments have begun to promote voluntary environmental programs among industrial firms, to complement and enhance the use of regulations.

Experience in Hamilton-Wentworth shows industries are willing to work with government and local residents to deal with significant environmental problems. MOEE can complement these voluntary efforts by focusing its attention on persistent polluters and those that fail to act. Reluctance by any party to take action will result in slow progress in reducing emissions and less than level playing field between competitors. The application of consistent and comprehensive standards could include at least some of the following types of programs.

Recommendation No. 1: Implement Code of Practice/Guidelines

Over 30 Codes of Practice and Guidelines are being developed (or have been developed) under the 1990 Phase I NO_x/VOC Management Plan (CCME, 1990). These codes and guidelines cover sectors/equipment such as industrial boiler/heaters, bulk gasoline terminals and service stations, vehicle emission standards, surface coating operations, organic chemical plants, etc. Industries should implement these codes or guidelines. MOEE and Environment Canada should work with industry to ensure these codes/guidelines are implemented.

Recommendation No. 2: Develop Best Available Control Technology and Practices for Major Sources

Best available control technology (BACT) and practices are needed for major sources (especially inhalable particulates). Industries should develop and implement BACT for major sources, especially inhalable particulates. As part of the BACT development process, industries should: compile an emission inventory of inhalable particulates for their operations, identify applicable pollution prevention, control or other reduction measurements, and develop action plans to implement BACT for major sources. MOEE and Environment Canada should work with industry to ensure BACT is applied universally within a reasonable period of time.

Recommendation No. 3: Implement Strategic Options Process (SOP) Recommendations

The Strategic Options Process is an initiative of the Federal Government under the Canadian Environmental Protection Act (CEPA). It has just completed a multi-stakeholder consultation on options for reducing toxic substances by the steel manufacturing sector. The resulting recommendations call for enhanced voluntary programs, and non-regulatory environmental performance standards, backed up by possible regulatory requirements under CEPA.

Environment Canada is working with the MOEE and industry to deliver the SOP recommendations. It is recommended that the iron and steel sector implement the recommendations of the Strategic Options Process. Recommendations under the SOP should be integrated with actions to address other issues such as greenhouse gases, ground level ozone and inhalable particulates, where possible. A review of the effectiveness of the SOP recommendations will be conducted in 1999 so further actions can be taken as appropriate.

Recommendation No. 4: Continue Permitting Programs

The MOEE currently issues certificates of approval for stationary sources of air pollution in the province. A number of reforms are proposed under Responsive Environmental Protection. The proposed changes would encourage the use of pollution prevention equipment and streamline the approvals process. The MOEE should continue to develop/enforce air quality/source performance standards to protect the environment.

Recommendation No. 5: Establish Industry-Local Resident Liaison Committees

Surveys and community activism show residents in Hamilton-Wentworth are concerned about air quality. The monitoring and ambient air data show the industrial sector is a significant source of emissions. A mediation mechanism would be useful for residents and industrial firms to exchange information and opinions, discuss options for dealing with air pollution problems, and try to identify priorities. It is important to provide residents with the latest scientific data, presented in plain language. This will allow residents, industry and public authorities to focus on those areas where funds will be most productive.

4.2.2 REDUCE EMISSIONS FROM PRIVATE VEHICLES

The findings of this report show the use of private vehicles is a key to improving air quality in Hamilton-Wentworth in the future. This is a challenge because, unlike industry, there are numerous individual users who make individual decisions which together add up to a significant amount of emissions. There is no denying the convenience of a private vehicle in this auto oriented community. Nevertheless, the results of the studies show the need to modify private vehicle use in order to improve air quality. Auto emissions are also a big factor in the generation of greenhouse gases. Therefore, the following recommendations to modify auto use will have multiple benefits.

Recommendation No. 6: Reduce the number of Single-Occupancy Auto Trips

The Region's most recent Transportation Review (completed in 1996) placed a heavy emphasis on promoting public transit, bicycle and pedestrian travel. However, the Transportation Review Final Report[5] projects that even if its objective of an increase in public transit's share of peak A.M. trips from 1991 average of 11% to 20% in 2021 is attained, the number of auto trips during the morning rush hour will rise from 61,700 to about 78,700. As a result, additional measures will be required to obtain a significant reduction in the amount of air pollution generated by road vehicles transportation in the Region.

The Regional Transportation Review recommended the following changes to encourage people to leave their vehicles at home.

- **HSR Bus Services:** Express bus transit should be operated on arterial roadways along major corridors, improved passenger terminals and shelters (security, convenience, etc.) should be set up throughout urban areas, priority should be given in some places to public transit vehicles. Major new passenger terminals should be established at McMaster University, Eastgate Square, Limeridge Mall and Downtown Hamilton.

- **Urban Development:** New urban development should be better designed and located to accommodate public transit and pedestrian/bicycle travel. Methods of ensuring this include new requirements in zoning bylaw and the subdivision process promoting access to public transit and pedestrian/bicycle paths, development incentives along major public transit routes, a more balanced administrative and financing scheme for public transit, an emphasis on infilling in serviced urban areas and promotion of improved GO services as an alternative to inter-urban auto commuting.

- **Promote Cycling**: A major commitment to facilitate cycling transportation is needed that will provide for the storage and transportation (on HSR) of bicycles throughout the Region, which

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[5] P.52, Delcan, 1996

will also give safe and convenient access to cyclists by way of a system of dedicated routes, and promote safe, courteous and efficient cycling.

- **Promote Walking**: A new emphasis on pedestrian networks both in Downtown Hamilton and in new suburban developments is required. To improve the situation in new developments, higher priority must be given by planners and developers to sidewalks and walkways, to amenities such as lighting, benches, and other street fixtures, and to the siting and location of structures (e.g., shopping facilities should be built close to the street with parking on the side or back to minimize pedestrian distances). To improve the situation in the core, a comprehensive plan for the Central Area in Hamilton is needed that will incorporate a Hughson Street pedestrian facility, walkway guides for visitors, and combined pedestrian/public transit shelters, with consideration for personal safety.

- **Discourage Parking Downtown**: Parking in the central core should be discouraged using levers such as zoning requirements (including the "cash-in-lieu" system), changes in City of Hamilton Parking Authority pricing, and carpooling incentives, while parking facility development should be promoted in certain areas where access to public transit and/or car-pooling is provided.

Recommendation No. 7: Minimize the emissions of private vehicle use

The following strategies/programs are recommended to minimize the use of vehicles and emissions.

1. Promote car-pooling, particularly among long-distance commuters where public transit is not an attractive option (e.g., people commuting from Ancaster or Hamilton Mountain to northern Mississauga or from Carlisle to downtown Hamilton).

2. Establish a computerized car pool registries that promote the financial and environmental benefits of car-pooling, even if undertaken on an occasional basis.

3. Encourage voluntary vehicle emission testing campaigns and work with local garages to offer discounts on engine tune ups.

4. Minimizing discretionary trips.

Regional residents should also be made aware of the impacts of their vehicle use on air quality. This campaign should stress the advantages of driving at times other than during rush hour (to avoid start and stop traffic), the need to use appropriate vehicles that produce lower emissions (e.g., small vehicles for single-occupant commuting), and the advantages of occasionally telecommuting and working at home.

The Region and other partners may want to initiate innovative pilot projects to explore alternative transportation models that rival the immense convenience advantages of automobile transportation. These could include pick-up/drop-off transit services operated by major employers like Stelco,

McMaster or the Region, small vehicle HSR service in suburban areas during rush hour, or employer-subsidized car-pooling (e.g., an employee who drives others is given free parking and a car-pooling bonus).

Recommendation No. 8: Establish Standards for Vehicle Emissions and Implement Vehicle Emissions Testing

The Federal government has undertaken several initiatives to provide clean fuels and vehicles. In June 1996, tougher motor vehicle emissions standards were announced for light duty vehicles. A diesel fuel regulation restricting the amount of sulphur in on-road diesels was passed in February 1997 and a draft benzene in gasoline regulation was published in May 1997. Further, the control of sulphur in fuel and emissions of toxic substances are being assessed. The Federal Government should continue to establish standards for emissions for various classes of vehicles.

Preventive maintenance is also needed to ensure on-road vehicles will meet vehicle emission standards. The Province's recently announced Drive Clean Program will require the regular testing of emissions from passenger cars, light trucks, heavy duty buses and trucks starting in 1998. Testing for cars and light trucks in Hamilton-Wentworth and the Regional Municipalities in the Greater Toronto Area will begin in late summer or early fall of 1998. The program will be expanded to other parts of the province in later years. The progress of the program should be monitored to ensure emission reductions are achieved by passenger cars and light trucks in Hamilton-Wentworth.

Green Venture, a non-government organization, is currently providing voluntary auto emission testing through its Clear the Air program. The program, currently supported by Environment Canada and the Region of Hamilton-Wentworth, conducts testing facilities at a number of temporary locations around the Region. This program should continue until the mandatory system is put into place.

Recommendation No. 9: Anti-Idling By-Laws

Idling a vehicle for more than 10 seconds generates more emissions than turning the engine off and restarting it. An anti-idling bylaw, enacted by Area Municipalities, would help to discourage unnecessary idling of vehicles.

4.2.3 REDUCE EMISSIONS FROM COMMERCIAL/FLEET VEHICLES

Recommendation No. 10: Enact Commercial Vehicle Maintenance Standards

Strict commercial vehicle maintenance standards, including maintenance of engines and pollution control devices, should be implemented and enforced. As indicated in Recommendation No. 9, the Province's recently announced Drive Clean Program will require the regular testing of emissions from all heavy duty buses and trucks starting in the summer of 1998. The progress of the program should be monitored to ensure emissions are reduced from the heavy duty trucks and buses.

Recommendation No. 11: Achieve More Efficient Commercial Vehicle Flow

Truck traffic should flow through the Region with as little stopping, starting and idling as possible. Possible ways to achieve this include minor improvements to road systems, special routing of truck traffic, and banning of truck traffic on specific routes during periods of heavy congestion. Better traffic management through electronic controls and the use of 'time-of-day' adjusted tolls could also prove useful.

Recommendation No. 12: Greening of Fleets

There are a number of steps which can be taken to reduce emissions from vehicle fleets:

- scheduling trucking shipments to off peak hours;
- replace older trucks with newer and cleaner trucks;
- altering fleet technology (i.e., emissions control equipment, type of engine or fuel)[6];
- specify use of trucks that meet the minimum standards, in purchase contracts; or
- switch to rail.

Industries, Province, Regional Municipality and Area Municipalities should examine their fleets practices for opportunities to reduce emissions. Organizations in Hamilton-Wentworth should also form a partnership to have joint purchasing of zero or very low emission vehicles.

4.2.4 OTHER SOURCES

Recommendation No. 13: Control Fugitive Dusts

It is recommended that a program of fugitive dust controls be implemented by industries and municipalities in Hamilton-Wentworth. These programs would include:

- Establishment of bylaws in planning and licensing requiring paving or dust suppression of unpaved areas;
- Establishment of bylaws addressing fugitive dust controls, limits on the size of outside storage piles and clean-up of dust which is dragged out of work yards;
- Establishment of operating standards for trucks, by Municipalities/MTO, to prevent fugitive blow off from loads; and
- Implementation of fugitive dust control programs using best available control technology (BACT) on a site specific basis.

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[6] The HSR has already made a major commitment to purchasing natural gas powered buses, and this strategy should be continued. Their lead could be followed by industry, commercial fleets, the Region, the Area Municipalities, and utilities like Hamilton Hydro.

A fugitive dust program could include regular sweeping and cleaning of roads within industrial areas and industrial sites, applying water (or other dust suppressants) on unpaved roads, applying storage pile dust control techniques, use of cleaning stations for trucks to prevent track out of dirt, covering open trucks, measures for material transfer (eg. covering conveyors, minimize the drop distance of materials, etc.), planting more tree screens and other vegetation, and paving any heavily used trucking areas that are currently unpaved.

Recommendation 14: Reduce Transboundary Pollution

A significant amount of the inhalable particulates and ground level ozone in Hamilton-Wentworth is a result of long range transport of pollutants from outside the region. It is recommended that all levels of government - federal, provincial and regional/municipal - engage the U.S. in discussions and negotiations to further reduce these emissions.

The concept of HAQI should be marketed to communities upwind of Hamilton-Wentworth. Industries and other organizations in the Hamilton-Wentworth should promote the benefits of a HAQI approach.

Recommendation No. 15: Develop and Implement Energy Conservation Measures

The release of pollutants is inherently linked with the production of electrical power, burning of fossil fuel for heating purposes, and the use of fuels in vehicles. Therefore, programs geared at conserving energy and preventing pollution in these areas can lead to improvements in air quality, including reductions in inhalable particulate and ground level ozone levels, two of the priority pollutants identified in this study. Furthermore, these improvements can also reduce greenhouse gas (GHG) emissions which can lead to climate change. Other strategies to reduce GHG cover urban form and greenspace management, building management and energy conservation, transportation, waste and resource management, procurement policies, and education campaigns.

Industries, Region and Province should combine existing programs with similar objectives to avoid duplication of efforts and maximize the benefits. Since GHG reduction strategies can also lead to improved air quality and reduce other pollutant emissions, these efforts should be linked to avoid duplication of efforts. A number of program areas are identified below for further consideration.

Municipal Energy Reduction Programs

The Regional Municipality of Hamilton-Wentworth is currently undertaking an Energy Management Project, which will produce an energy use inventory at 21 Regional facilities and strategic plans to finance and implement energy efficiency opportunities. The Regional Municipality of Hamilton-Wentworth and the City of Hamilton have already committed to reducing GHG emissions such as carbon dioxide and nitrous oxides by 20% by the year 2005. As part of this commitment, the City and Regional Municipality are developing action plans to identify how the reductions will be achieved.

Industrial Energy Reduction Programs

The Federal Government promotes energy efficiency in industries through the Canadian Industry Program for Energy Conservation (CIPEC) and the Industry Innovators Initiative. Many industries have also committed to reducing GHG emissions through participation in the Voluntary Challenge and Registry (VCR) Program. Energy conservation measures should be promoted within Hamilton-Wentworth since it will result in some benefits to air quality.

Pilot Project - Alternative Energy

Organizations such as the Regional Municipality, Area Municipalities, industrial companies, McMaster University and school boards should investigate the use of pilot projects that incorporate the use of new alternative energy technologies such as solar power, to explore the economic viability of this type of technology.

Subsidies for Energy Audits

Hamilton-Wentworth Green Venture is a not-for-profit community based local partnership committed to energy, water and waste reduction, education, green space conservation and the greening of small businesses. Continual support and additional partnerships for Green Venture should be encouraged.

The MOEE's Clean Production Services (CPS) program provides expert advice, support tools and other assistance to Ontario industries to reduce energy and water consumption, emissions and waste generation. CPS also provides services to accelerate the introduction of green/innovative production processes and raise the awareness of industrial competitiveness with cleaner production processes.

District Heating and Co-generation

In 1982, a turbine generator was installed at the SWARU, making the plant the first in Canada to produce electric energy from municipal waste. Hot water from SWARU is also being used in a district heating program at the Woodward Water and Waste Water Treatment Plant.

Currently, the Regional Municipality is participating in a feasibility study for a District Energy System in the downtown area. District energy systems utilize thermal energy (as hot water, steam or chilled water) from a central plant which is distributed through underground pipelines to individual buildings for use in heating or cooling systems. The advantages in initiating such a project include: recovering waste energy as an energy source, greater energy conservation, lower GHG emissions, and resource conservation. The district energy system that is being reviewed could greatly decrease CO_2 emissions within the Region of Hamilton-Wentworth. This project would also incorporate waste energy from Stelco and transformed it for use in the Downtown Core. Thus, it could incorporate residential, commercial and institutional buildings. This project is a partnership with Natural Resources Canada, The Regional Municipality of Hamilton-Wentworth and the City of Hamilton. Because there would be a significant decrease in the use of fossil fuel as an energy source, a great savings in GHG emissions will be seen.

The Area Municipalities, Regional Municipality and Industries should promote and investigate further use of District Heating and Co-generation projects.

4.2.5 PUBLIC AWARENESS

To improve the air quality in Hamilton-Wentworth, people need to know more about the sources and impacts of air pollution and what they can do to help. Other public awareness campaigns have resulted in large-scale behavioural change (eg. blue box recycling, and drinking and driving). There is a need to raise the awareness of the community so that they will respond through individual actions (e.g., voluntary testing of vehicle emissions) and through support for air quality improvement programs. The campaign should demonstrate that:

- people and the environment suffer from air pollution;
- reducing air pollution will usually result in financial savings rather than higher costs; and
- improved air quality will make Hamilton-Wentworth a more attractive place to invest, to do business and locate jobs.

Recommendation No. 16: Promote Public Awareness through Social Marketing

The Human Health Workgroup of HAQI has worked with The Lung Association Hamilton-Wentworth to undertake a user-friendly review of the health literature and produce six "Fact Sheets" dealing with inhalable particulates, ground level ozone, sulphur dioxide and sulphates, sources, weather effects and further reading (references). The Fact Sheets[7] complemented static displays that were used by The Lung Association to stimulate interest in air quality issues among high school students or community groups. These types of activities should be continued and complemented by other conduits for such messages including:

- Videos placed in public service slots on local television stations;
- Air quality pamphlets and displays to be used in malls, schools and other public places;
- Information sheets or pamphlets distributed to all households along with the Region's news sheet or through other organizations such as the Lung Association, Hamilton Automobile Club or Green Venture;
- Updates on air quality issues in the print media;
- Combine Air Quality issues with other high profile municipal environmental initiatives, such as Vision 2020, reducing discharges to the municipal waste water system, and reducing the production of greenhouse gases in Hamilton-Wentworth; and
- Hamilton-Wentworth Air Quality information website.

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[7] Copies of the Fact Sheets can be obtained from The Lung Association, Hamilton-Wentworth (503 Concession Street, Hamilton, ON L9A 1C4).

4.2.6 MONITORING, RESEARCH AND DEVELOPMENT

The findings collected during this first step in the air quality initiative indicate there are significant gaps in our knowledge about air quality. They point to a need for continued monitoring, research about the impact of emissions, increased public awareness and ongoing review and priority setting. The following recommendations address the monitoring, research and development issues identified by HAQI.

Recommendation No. 17: Expand Capability for Inhalable/Respirable Particulate Monitoring

The air monitoring network in Hamilton-Wentworth should be improved for inhalable particulates, respirable particulates and sulphates. Currently, the air monitoring network contains four continuous monitors and four non-continuous monitors for inhalable particulates. An additional monitor will be added on the Mountain. New respirable particulate monitors are becoming available and should be added to the network.

Recommendation No. 18: Maintain Current Monitoring System

The current air monitoring network should be maintained as it provides both source oriented monitoring and population exposure data. The network is able to track improvements in source control, as well as provide the basis for ongoing estimates of health impacts.

Recommendation No. 19: Expand Mobile/Portable Monitoring Capabilities

Because of the complexity of air movements in Hamilton-Wentworth, emergency situations and the large numbers of individual sources (both industrial and vehicular), mobile monitoring capability should be added to enable the tracking of individual source impacts across the Region. Another promising tool to enhance the information base is use of remote sensing equipment, such as LIDAR, which can scan the entire Region on an ongoing basis.

Recommendation No. 20: Maintain Government Scientific/Laboratory Capabilities

Government scientific and laboratory capabilities should be maintained to assure consistency, standardization, and dependability and to take advantage of economies of scale. Government has traditionally maintained a key role in ensuring adequate protection of the environment. Scientists/technical staff in the MOEE provide independent assessments and quality assurance checks on laboratory testing results, atmospheric modelling studies, ambient air and stack testing programs, and human health and environmental impacts. More involvement and contributions by industry, municipal government and other organizations would enhance/complement the current government capabilities in these areas.

Recommendation No. 21: Research about the Origins, Characteristics and Health Impacts of Particulates

One of the most important findings of HAQI is that very limited knowledge exists about the type of pollution that posed the greatest threat to human health: inhalable/respirable particulates. Not only is little known about how particulates adversely affect human health, there is only limited information about the sources of inhalable/respirable particulates in Hamilton-Wentworth (e.g., specific direct sources such as transportation and industry, or indirect sources such as gaseous reactions).

Inhalable/respirable particles can be made up of a number of constituents, including sulphates, nitrates, elemental carbon, organic compounds, metals and soil dust. Medical and scientific research are unclear about the impact of these constituents on human health. More research is needed to identify which types of inhalable particulates are most hazardous and how they damage human tissues. Within inhalable particulates, there is some evidence that respirable particulates (those below 2.5 microns in diameter) are the particles that do most of the damage. If follow-up research proves this to be true, emphasis should be placed on sources of respirable particles (eg. diesel engines, and combustion processes).

More information is needed on the sources of primary particles produced by human activities in Hamilton-Wentworth. Iron and steel manufacturing, diesel engines, and wood combustion in residential fireplaces are known to be major contributors to particulate at different locations. However, more research is needed to identify the activities that generate these particles, the quantities emitted and the characteristics of the particles. This information will allow the development of cost-effective initiatives to target the most potent sources of particulates.

Recommendation No. 22: Analyze and Model Transportation Emissions

A major gap in our knowledge is the lack of good information on truck traffic. Truck traffic appears to be growing year by year but only Province-wide estimates of kilometres travelled and emissions produced are available. In Hamilton-Wentworth, the Ministry of Transportation and the City of Hamilton Traffic Department provide gross estimates of truck traffic as a percentage of traffic at a number of major highway and road intersections. However, these are not always accurate and do not specify the type or size of commercial vehicles (vehicles such as small delivery trucks and eighteen-wheel transports can be counted in the same category). Information on the amount and type of emissions that are produced by these vehicles is also scarce, especially with regard to inhalable/respirable particulates. Improved information collection and analysis in these areas are needed to provide a better understanding of how the commercial truck sector is affecting air quality, and to identify the most important targets for improvements in technology and behaviour.

A recent trend is the increase of 'non-work-related' or discretionary trips about which there is little information. In Hamilton-Wentworth, small, occasional surveys, such as the 'Transportation Tomorrow' survey have investigated discretionary trip patterns. Future research needs to investigate

non-work-related trips in a much more in-depth manner. Some questions to address are: Which types of activities account for discretionary trips? How long and frequent are these trips? For what proportion of total transportation emissions do discretionary trips account?

Recommendation No. 23: Research on the Impact of Air Toxics on Ecosystems

One of the more important impacts on the Region's natural ecosystems is the atmospheric deposition of large quantities of persistent toxics such as PCB, PCDD and PCDF into the aquatic environment. Persistent toxics do not break down naturally in the environment: they are deposited in fatty tissue with increasing concentrations higher up the food chain. Research on PCB and PAH deposition into the Hamilton-Wentworth watershed is needed to identify and eliminate these sources.

Other compounds, such as PAHs, can cause cancer. Research undertaken for the Hamilton Harbour Remedial Action Plan (RAP, 1992) indicates that approximately 6% of the PAHs loadings to the Harbour come from atmospheric deposition and that approximately 18% of PCB loadings to the Harbour come from the atmosphere[8].

Recommendation No. 24: Develop an emissions inventory and carry out atmospheric modelling.

Emissions inventory and atmospheric modelling are important tools for understanding how emissions contribute to air quality. An inventory for inhalable particulates, respirable particulates, and toxics is not available for Hamilton-Wentworth. It is recommended that MOEE/EC work with industry and other parties to compile emission inventories for the priority pollutants identified (inhalable particulates, respirable particulates and toxics).

Atmospheric modelling is crucial to understand the importance of local sources and long range transport. Inhalable particulates, respirable particulates and ground level ozone are strongly influenced by long range transport. Modelling of these pollutants requires the use of models on a regional scale. It is recommended that MOEE/EC use existing ozone modelling results to further assess the contribution of long range transport to air quality in Hamilton-Wentworth. It is also recommended that the MOEE/EC conduct research to develop an inhalable/respirable particulate modelling package.

For pollutants with localized impacts (e.g., inhalable particulates, dustfall, black fallout, total suspended particulates), modelling can provide guidance in developing an effective mitigation strategy. It is recommended that localized modelling (e.g., Industrial Source Complex -ISC- model,

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[8] The atmospheric loading is calculated only for the Harbours water surface. If stormwater runoff from the watershed is included, the contribution from atmospheric loading will increase

CAP) also be undertaken by MOEE to further refine the estimates of relative contributions of different sources to the ambient levels in Hamilton-Wentworth.

Recommendation No. 25: Review and Continued Refining of Environmental Priorities

Air quality is an important environmental issue in Hamilton-Wentworth. Although the MOEE's West Central Region has a sophisticated system of monitors and dedicated core of researchers, technicians and abatement staff, the Region and area municipalities have very few programs or initiatives to deal with air quality issues, and few programs to deal with air quality in a cooperative, multi-organizational manner.

It is essential that air quality in Hamilton-Wentworth receive adequate attention. A systematic evaluation of environmental issues is needed along with the establishment of priorities. Suggested criteria for this evaluation include the immediacy of the problem, the known extent of the threat to human health and natural ecosystems, the potential for major catastrophes, and the cost of abatement and/or remediation.

4.3 CONCLUSIONS

It is clear that air quality is a concern of the citizens of Hamilton-Wentworth, based on the limited information in this report. The MOEE logs over 500 complaints about air quality annually and the issue receives frequent coverage in the media. This is not surprising, since health studies connect air quality, particularly inhalable and respirable particulates, ground level ozone and sulphur dioxide, with premature mortality and hospital emissions. Not only are people concerned about air quality, HAQI's investigations show people are prepared to pay for improvements to air quality as well.

The research which was compiled during the HAQI shows a number of gaps in knowledge and areas for further research. More details about the health and environmental effects of the pollutants, the sources of the pollutants and projections of future trends in emissions are needed to create an effective strategy to improve air quality in Hamilton-Wentworth.

In the meantime, the current research shows efforts to control pollution needs to be focused on industry and transportation. The current regulatory environment for industrial emissions emphasizes voluntary actions. An example of this is the draft Environmental Management Agreement among Environment Canada, Dofasco and the MOEE. These and other initiatives need to continue. In the transportation sector, a strategy to modify automobile and truck use is needed, along with changes in land use policy. This is a big challenge, but one which needs to be taken up in order to reduce the rapid growth of emissions from this source. Three additional areas where action could be taken to improve air quality are: transboundary pollution, fugitive dusts and energy conservation.

A key to the success of any program to improve air quality is ensuring that the findings of this report are translated into action. The final chapter of the report proposes a structure to keep this initiative moving.

5 PROPOSAL FOR A FUTURE ORGANIZATIONAL STRUCTURE

The HAQI was developed as a one year information collection/analysis and priority identification process. While supportive of the initiative, nevertheless, participants have continually expressed their desire for actions that can be taken immediately to address air quality problems and to improve the Region's air quality. The following proposal is provided as a possible framework for beginning program planning and implementation in certain areas while still allowing for further research, program development and priority refinement in the future. A major theme in the following proposal is that while several types of program initiatives can and should be undertaken immediately that a significant amount of work must still be done in areas such as program financing (who will pay for what), organizational development (what should the coordination mechanism look like) and research and priority refinement (which types of pollution are the worst and which sources can be most effectively abated). The interim organization would serve as a pilot to explore the options that would best serve Hamilton-Wentworth.

5.1 ORGANIZATIONAL PRECEDENTS AND MINIMAL REQUIREMENTS

Preliminary research into air quality improvement initiatives elsewhere in North America indicated that they can be categorized into four types:

- **Regulatory:** In most of North America a provincial or state environment department will issue and enforce regulations, monitor air quality, and respond to complaints from the public and investigate (and possibly charge) firms and individuals that may be breaking the law. In both Canada and U.S., the federal governments have also passed relevant legislation and are involved in limited monitoring and law enforcement. In some jurisdictions, municipalities are also involved in regulation development and enforcement.

- **Air Quality Districts:** In California and British Columbia, air quality management districts operating at the regional level provide a full array of air quality monitoring, regulation, and management programs. These districts have a significant degree of financial independence, and can levy fees and fines on firms and individuals that are releasing pollution into the air. These districts also have a comprehensive system of monitoring, emission inventories, and industry and transportation emission reduction programs (e.g., levies on firms that do not promote ridesharing, promotion of best available technology by specific industrial sectors, etc.).

- **Industrial Societies or Associations:** In certain parts of North America such as Sarnia, major industrial firms have come together to develop and implement self-regulating programs that reduce emissions. These efforts generally include developing emission reduction targets and planning/response mechanisms, setting up or financing a monitoring system that can identify specific point sources, and coordinating relations with the regulatory authorities and local residents.

• **Air Quality Improvement Coalitions:** In some communities (Alberta and New Brunswick), a coalition of local residents, government and regulatory authorities, industrial firms, and other interested parties have combined to develop and implement air quality management plans. These initiatives are very similar to the Hamilton Harbour Remedial Action Plan process which has addressed water quality issues in Hamilton-Wentworth for about a decade. These processes generally do not involve the transfer of regulatory authority or program responsibility from organization to another, but are coordinating and priority-identification mechanisms. These bodies also have the benefit of being goal oriented, with a positive rather than a punitive approach.

Preliminary discussions involving participants in the HAQI process, and members on the Consultation Group indicate that as a minimum, a new approach is needed that has the following attributes:

- Ongoing public consultation and involvement;
- Maintenance if not improvement of the current air quality monitoring and modelling capabilities presently administered through the MOEE's West Central Region;
- A coordinating entity that will identify priorities, and develop and implement air quality improvement programs that by necessity require multi-agency and multi-organizational cooperation;
- Increased finance and staffing for programs devoted to air quality improvement in Hamilton-Wentworth; and
- Close ongoing cooperation and coordination with the industrial sector.

5.2 INTERIM ORGANIZATIONAL PROPOSAL

An interim organizational proposal has been developed for consideration/discussion by potential partners (e.g., Industries, Region Municipality, MOEE, EC). The proposed organization would serve to "kick start" the program development and implementation phase of the process. The following organizational structure would allow for one of any number of structures to be established, but would facilitate a start to program planning and implementation that should at least partially satisfy calls for action in the short term. It is assumed that the following organizational structure could easily evolve into any type of structure (e.g., air quality districts, provincial/municipal partnership in conjunction with an industrial society, or continued coalition model), depending on the priorities, concerns and resources of various stakeholders. This interim structure was developed using:

- Knowledge of existing organizational structures and programs in Hamilton-Wentworth;
- Available information on alternative systems used in other parts of North America;

- The "minimum requirements" for a structure provided by the roundtable discussions involving HAQI participants, the Region Municipality and MOEE; and

- Experience gained from the HAQI process itself (e.g., who is willing and able to contribute to such a process).

5.2.1 BASIC STRUCTURE

An environmental air quality strategy is needed and a "clean air"coalition is recommended to promote it. The coalition (referred to as the "Better Regional Environmental Air Quality Throughout Hamilton-Wentworth's Ecosystem" - BREATHE) would include representatives of six key groups:

(1) Public, Health and Environmental Groups;
(2) Industrial Companies/Associations/Groups;
(3) Academia
(4) The Region of Hamilton-Wentworth [and possibly one or more of the Area Municipalities];
(5) Ontario Ministry of Environment and Energy (MOEE); and
(6) Environment Canada.

The BREATHE coalition would meet as a whole between four and ten times a year, depending on the perceived requirements of the constituent members, and whether or not a successor structure would be developed to replace the BREATHE. Administrative and support staff would in the interim be provided by the MOEE and Region. The BREATHE as a whole would serve as a mechanism for discussions on research, and policy and program development and implementation, and the coordination of efforts and resources. The body would have only advisory powers and would report to the Region, MOEE and Environment Canada. All resources and efforts contributed by various stakeholders would be purely voluntary in nature.

Six Work groups would be formed to address the priorities that were identified by the HAQI, and any additional priorities that are identified in the future by the BREATHE. The Work groups are:

- Program/Policy Development Workgroup;
- Industrial Workgroup;
- Energy Conservation Workgroup;
- Transportation Workgroup;
- Social Marketing/Public Education Workgroup; and
- Research/Development Workgroup.

The workgroups would work independently of the much larger BREATHE, but would be provided with input, assistance and/or financial aid by organizations and individuals making up the BREATHE.

5.2.2 ROLE AND COMPOSITION OF WORKGROUPS

Workgroups would consist of people with a variety of backgrounds and affiliations. In general, these people would fall into the following categories:

(1) Staff from the Region, MOEE, Environment Canada or other government agency or office;

(2) Staff from private sector firms (e.g., large industrial companies), non-governmental organizations (NGOs) and academia; and

(3) Volunteers from academia, government agencies, NGOs, industrial firms and the general public.

Workgroups would attempt to implement priority programs identified in this report or by the BREATHE. Each workgroup would be given a relatively limited set of objectives and responsibilities to avoid overlaps and confusions. Each workgroup would have a chair or co-chairs who would be responsible for coordinating the groups' activities and communicating with the BREATHE. Details of the six workgroups are described below.

A. Program/Policy Development Workgroup:

This group would review air quality and other environmental programs at the municipal, provincial and federal level and would suggest improved priorities and resource allocation based on criteria established by the BREATHE. Criteria could include threats to human health, impacts on natural ecosystems, and public opinion. Members should include people with a broad knowledge of environmental and health issues, program development and administration, and/or finance and economics.

This workgroup would also work closely with the other workgroups to focus on the use of alternative/innovative concepts such as economic incentives/disincentives, emissions trading, voluntary measures, self regulation, use of environmental management systems, and district air management programs.

B. Industrial Workgroup:

This group would work on finding ways to reduce emissions from industrial activities. This group may be divided into subgroups to deal with specific issues (e.g., particulates, steel sector, specific geographic areas, etc.). Members should come from industrial companies, MOEE, Environment Canada, Regional Environment Department and concerned residents.

The group would:

- document past actions and identify future activities that will reduce emissions to the atmosphere;
- encourage all industries in Hamilton-Wentworth to develop action plans to reduce emissions of the priority pollutants identified by HAQI;
- secure commitments from industries through a wide variety of instruments (e.g., binding agreements, memoranda of understanding, peer pressure) to ensure reductions are achieved;
- monitor and report on the performance of the industrial sector in reducing emissions;
- consult with local community on planned and ongoing efforts to improve air quality; and
- review existing hazard assessment and management programs for prevention of future emergency situations.

It is acknowledged that the Hamilton-Wentworth Air Quality Stakeholders Committee and the Hamilton Industrial Environment Association are existing groups that have been formed to address many of the these same issues. It is recommended that these groups be approached to serve as the forum for an Industrial Workgroup.

C. Energy Conservation Group:

This group would coordinate the BREATHE's efforts with other energy reduction, greenhouse gas reduction and sustainable development initiatives that would contribute to a reduction in emissions. Possible areas of overlap and coordination include municipal and industrial energy conservation programs, and residential energy conservation programs. This group could also examine and explore concepts such as district heating, alternative fuels, etc.

Members of this group should include at least the following organizations: NGOs (e.g., Green Venture), municipalities, major electrical and natural gas utilities, MOEE and Environment Canada.

D. Transportation Workgroup:

There are three (3) subgroups under the Transportation Workgroup. They are:

- Multiple Occupancy/Public Transit Promotion/Cycling Pedestrian Promotion;
- Vehicle Emissions Testing; and
- Alternative Fuels/Technology.

The objectives of each subgroup are as follows.

Multiple Occupancy/Public Transit Promotion: This group would be charged with developing new and innovative programs to reduce the growth in vehicle use. These types of programs and activities would include developing ride-share programs, flex-time arrangements, levelling of the playing field between subsidies to cars and subsidies to public transit (e.g., eliminating free parking for cars unless public transit pass alternatives are provided), and developing innovative

forms of public transit and multi-occupancy travel that can service low-density suburban locations. Green Venture is currently already initiating ride-share programs in Hamilton-Wentworth with assistance from Environment Canada and the Region. People in this group should include representatives of relevant NGOs (e.g., Green Venture), public transit (e.g., HSR, DARTS, GO Transit), private public transit operators (Airways Transportation), Area Municipal traffic and public works departments, the Regional Transportation Department, the Ministry of Transportation, bicyclists' organizations, and the Hamilton Automobile Club.

Vehicle Emission Testing: This group would be given the objective of monitoring the progress and evaluating the results of the Province's Drive Clean vehicle emissions testing program. The group would also promote the testing and repairing of vehicles in the Region that emit high levels of pollution. Voluntary emissions testing for light duty vehicles has already begun to take place through the efforts of the Hamilton Automobile Club, which has had periodic free testing clinics, and through Green Venture, which has initiated a testing program throughout Hamilton-Wentworth with assistance from Environment Canada and the Region. The Province announced the Drive Clean vehicle emissions testing program earlier, which starts in the fall of 1998 and covers Hamilton-Wentworth.

People on this group should include representatives of the Ministry of Transportation, MOEE, Green Venture, the Regional Transportation Department, and the Hamilton Automobile Club.

Alternative Fuels/Technology: This group would be given the task of exploring opportunities for and promoting the use of alternative vehicles and fuels. Potential programs include conversion of vehicle fleets or part of vehicle fleets in organizations such as municipalities, Provincial Ministries, local utilities (natural gas, electric, phone, and cable utilities), and large industrial organizations. The Region's public transit service, the HSR, has already purchased significant numbers of natural gas buses. Alternative power sources to be investigated include natural gas engines, propane engines, hydrogen engines, fuel cell technologies, gasohol engines, and dual gasoline/alternative fuel engines. Joint purchasing of zero emission or very low emission vehicles should also be explored. Members in this group should include representatives of HSR, Union Gas, municipal and provincial departments with responsibility for fleets of vehicles, utilities that have their own vehicle fleets, and the MOEE.

E. Social Marketing/Public Education Workgroup:

This group would be responsible for communicating information on the sources and impacts of air pollution in Hamilton-Wentworth to the public at large, and for developing and implementing programs that would change behaviour in ways that would reduce air pollution emissions. This group's activities would tie into the work of other groups such as energy conservation, vehicle emissions testing, and the multiple occupancy/public transit groups. Initial efforts would focus on initiatives to enlist public understanding and participation, such as planting of 100,000 trees, or the promotion of bus-pass purchases by employees.

F. Research/Development Workgroup:

This workgroup would undertake or initiate research into the following areas:

- **Particulate Research:** Review research on the origin, characteristics and impacts of inhalable/respirable particulates (including sulphates). Use the research data to determine/refine the understanding of contributions to inhalable/respirable particulate levels in Hamilton-Wentworth from the various sources (e.g., sulphates, nitrates, industrial emissions, residential sources, vehicles, fugitive dust, long range transport).

- **Truck Traffic/Emissions Research:** collect and interpret information on truck movement within Hamilton-Wentworth and emissions by trucks of priority pollutants such as inhalable/respirable particulates, NO_x, VOCs, and carbon monoxide. Project truck emissions in Hamilton-Wentworth using vehicle emissions, origin/destination, vehicle type, and traffic congestion information.

- **Human Health/Psychosocial Impacts:** Examine and evaluate the literature on human health, refine the human health effect estimates from the various air pollutants and undertake further risk assessment research. Explore the psycho-social impacts and its links to air quality and human health.

- **Emissions Inventory Development:** Compile information on estimated emissions (especially inhalable/respirable particulates) of both stationary and mobile sources (on a grid by grid basis). Verify these estimates with other techniques where possible. The goal of this exercise is to develop an accurate and comprehensive emissions database to support modelling efforts and development of a sound air improvement strategy.

- **Atmospheric Modelling and GIS:** This group would use computer modelling and geographic information systems to provide a better understanding of the contributions of various sources to air pollution, and to support the development of an air quality improvement strategy.

- **Environmental Impacts Research:** This group would coordinate and initiate research on the impact of air pollution on natural vegetation, farm crops, and aquatic environments, with a particular emphasis on damage to vegetation by ozone and the direct and indirect transport of persistent toxics into Region.

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APPENDIX A
PARTICIPANT LIST HAMILTON-WENTWORTH AIR QUALITY INITIATIVE

Consultation Group

Burke Austin, Community Action for Parkdale East
Dennis Charko, Canada Pipe Company Ltd.
Ed Cocchiarello, Dofasco
Geraldine Copps, Councillor
Rick Lane, Stelco
Henry Merling, Councillor
Robert Korol, McMaster - BARC
Margaret MacDonald, The Lung Association
David Matchell, Redland Quarries Inc.
Cathy Pengelly, The Lung Association
Dave Robinson, Greensville Againt Serious Pollution
Roy Salisbury, Citizens for a Sustainable Community
Ishwar Singh, Mohawk College
Frank Wells
David Wilson, Councillor

Transportation/ Land Use

Co-Chair: Peter Campbell, MOEE
Co-Chair: Doug Frost, RMHW

William Anderson, McMaster
John Ellis, Friends of Red Hill Valley
Andrew Head, RMHW
Pam Hubbard, RMHW
Bill Janssen, City of Hamilton
Pavlos Kanaroglou, McMaster
Pauline Mitchell, Hamilton Automobile Association
Bill O'Brien, Hamilton Street Railway
Roy Salisbury, Citizens for a Sustainable Community
Bill Snodgras, Ministry of Transportation

Aesthetic, Odours and Economics

Co-Chair: George Vance, ECOLO
Co-Chair: Eric Loi, MOEE

Alan Diener, McMaster
Frank Dobroff, MOEE
Susan Elliot, McMaster
Robert Hall, RMHW
John Jarvie, Homeside Environmental Committee
Andy Muller, McMaster
Chris Cincar, MOEE

Coordination Group

Esther Bobet, EC
Denis Corr, MOEE
Doug Frost, RMHW
Eric Loi, MOEE

Human Health

Chair: David Pengelly, McMaster

Ron Bell, MOEE
Brandon Birmingham, MOEE
Donald Cole, McMaster
Denis Corr, MOEE
Bill Hunter, RMHW
Pavel Muller, MOEE
Roy Salisbury, Citizens for a Sustainable Community
Lesbia Smith, Ministry of Health
Akos Szaokolcai, MOEE

Environment

Chair: Denis Corr

Burke Austin, Community Action for Parkdale East
Ron Bell, MOEE
Rob Bloxam, MOEE
Bill Booty, EC- CCIW
Gary Bowen, MOEE
Robert Barlow Cash, Ecologistics
Ed Cocchiarella, Stelco
Frank Dobroff, MOEE
Bill Gizyn, MOEE
Louise Knox, RAP
Steve Lamming, Sheridan College
Eric Loi, MOEE
Brian McCarry, McMaster
Mike Shackleton, MOEE
Gayle Soo-Chan, MOEE
Anita Wong, EC
Simon Wong, MOEE

EC- Environment Canada
MOEE - Ministry of Environment and Energy
RMHW - Reg. Mun. of Hamilton-Wentworth

APPENDIX B
WORKGROUP OBJECTIVES

1)*Aesthetics/Odours/Economics (AOE)*

- Determine public perception of air quality problems in H-W
- Characterize non-health related air quality problems (dustfall/ soiling, odour, smoke and property damages)using available complaint and monitoring data
- Determine socio-economic effects from existing air quality in H-W

2) *Environment*

- Assemble existing monitoring, inventory and modelling data, for use by the various Workgroups
- Conduct modelling where possible to provide better understanding of the local meteorology, partitioning of pollutants within the environment and source contributions at the receptors
- Evaluate the impacts of air quality on the ecosystem, including vegetation, wildlife, aquatic systems, soils and agriculture

3) *Human Health*

- Develop a list of priority pollutants
- Prepare a user friendly review of health issues for the public
- Prepare a formal risk assessment for priority pollutants

4) Land Use/Transportation

- Develop estimates of a baseline air pollutant emission inventory for transportation sources
- Estimate the impacts of changes to transportation patterns, transportation technologies and land use patterns on the release of pollutants into the air (and the resulting impacts on H-W)
- Identify and comment on major issues relating to transportation and land use that have an impact on H-W. Assess policies and programs that have an impact on air quality.
- Identify areas of research that are required to better understand the impacts of transportation and land use patterns on air quality in H-W.