Canada-United States-Ontario-Michigan
Border Transportation Partnership

Draft
Air Quality
Work Plan

March 2006
Version 2

PREFACE

The Canada - U.S. – Ontario - Michigan Border Transportation Partnership (The Partnership) is composed of the Federal Highway Administration and Transport Canada representing the federal levels of government, and the Ontario Ministry of Transportation and the Michigan Department of Transportation representing the provincial/state level. The purpose of the Partnership is to improve the movement of people, goods, and services across the United States and Canadian border within the region of Southeast Michigan and Southwestern Ontario.

This international transportation improvement project will require approvals from governments on both sides of the border. The Partnership has developed a coordinated process that will enable the joint selection of a recommended river crossing location that meets the requirements of *Ontario Environmental Assessment Act* (OEA), *Canadian Environmental Assessment Act* (CEAA), and *National Environmental Policy Act* (NEPA).

The goal of the partnership is to:

- obtain government approval for a new or expanded crossing with connections to the provincial highway system in Ontario and the interstate freeway system in Michigan, including provisions for processing plazas to improve traffic and trade movements at the Windsor-Detroit border;
- completion of comprehensive engineering to support approvals, property acquisition, design and construction; and,
- submit environmental assessment documents to request approval by December 2007.

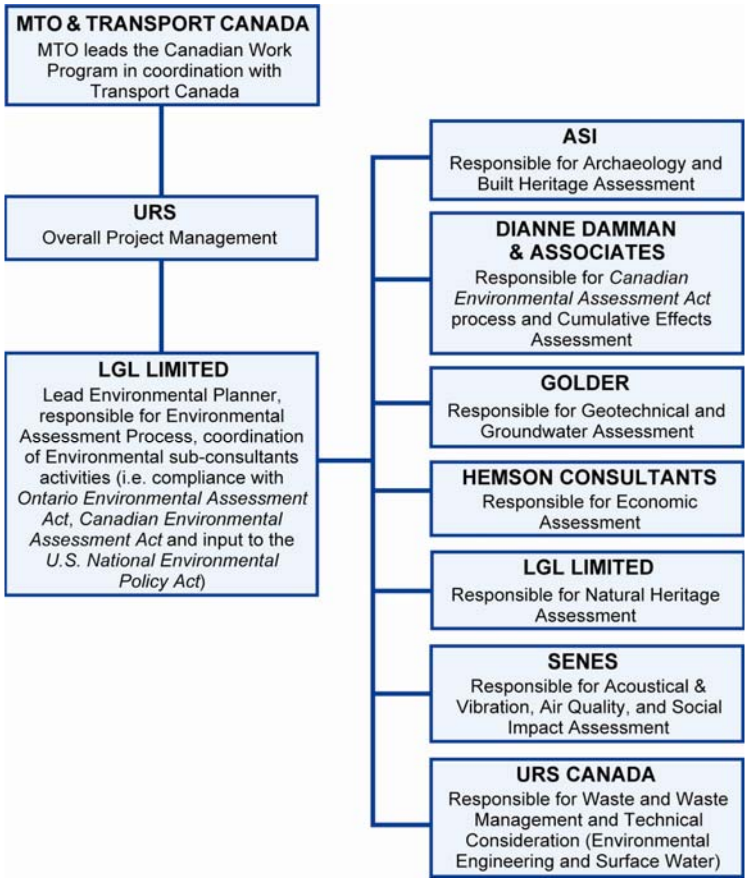
The Partnership completed a *Planning/Need and Feasibility Study* (P/NF) in January 2004 to address cross-border transportation demands for a 30-year planning period. Included in the documentation for that study was an Environmental Overview Report which provided an inventory of the existing condition in a Focused Analysis Area. Subsequently, in accordance with the *Ontario Environmental Assessment Act,* MTO prepared and submitted in May 2004 an environmental assessment Terms of Reference to the Ontario Ministry of the Environment for review and approval. The Terms of Reference was approved by the Ontario Minister of the Environment on September 17, 2004. The Terms of Reference outlines the framework that MTO and Transport Canada will follow in completing the Detroit River International Crossing Environmental Assessment (DRIC EA).

The Ontario Ministry of Transportation (MTO) is leading the Canadian work program in coordination with Transport Canada. The Michigan, Department of Transportation (MDOT), in coordination with the Federal Highways Administration (FHWA), is leading the U.S. work program.

The partnership is moving forward with technical and environmental work leading to the selection of a new or expanded border crossing, to address cross-border transportation demands for a 30-year planning period.

As an initial step in the DRIC EA process and to build upon the work completed in-depth secondary source data collection has been conducted. This work has been focused within the Preliminary Analysis Area (PAA) identified in the Environmental Overview Report, (as Amended January 2005). The noted data collection effort has been documented in a series of Working Papers. Working Papers have been prepared for the following topics: social impact assessment; economic assessment; archaeological resources; cultural resources; natural heritage; acoustics and vibration; air quality; waste and waste management; and technical considerations. The Working Papers are presented within the Environmental Overview Report (June 2005).

The Canadian Study Team and their tasks are presented below.



The purpose of the Working Papers is to document the secondary source data collection by: describing the data collection/sources used; providing an overview of study area conditions; identifying significance/sensitivity of features in the study area; and, identifying gaps in study area data and developing Work Plans to fill identified data gaps.

In conjunction with the Working Papers, a Work Plan for each discipline has been prepared to structure the filling of identified data gaps. They provide:

- a schedule and order of events for the subject under investigation by phase;
- a rationale for further data collection methodologies;
- data sources;
- methods of assessment, criteria, indicators and measures; and,
- details on the integration of each work plan with the work plans of other disciplines.

The Work Plans have been developed based on current knowledge of existing conditions within the PAA and therefore, should be considered to be living documents which will be subject to agency and public review. The partnership is aware that the assessment and evaluation of alternatives at all phases will require applying the requirements of three pieces of legislation, the OEA, CEAA, and NEPA. Therefore, in preparing the Work Plans, the partnership has sought to integrate the most rigorous requirements from each piece of legislation.

Air Quality Work Plan

List of Tables

List of Figures

1. INTRODUCTION

1.1 Planning/Need and Feasibility Study – Existing Environmental Conditions

The Partnership jointly commissioned a Planning/Need and Feasibility Study (P/NF) (Canada-US-Ontario-Michigan Border Transportation Partnership 2004), which identified a long-term strategy to address the safe and efficient movement of people and goods between southeast Michigan and southwest Ontario. Although conducted in a manner consistent with the environmental study processes in both countries, the P/NF Study was not completed within the formal environmental study framework. The findings of the P/NF Study, however, serve as an important basis for governments to move forward in the development and improvement of cross border transportation services, including proceeding with the environmental study processes in the U.S. and Canada for major transportation improvements at the Detroit River International Crossing.

A consultation component was incorporated into the P/NF Study process. Canadian and U.S. government departments, ministries and agencies, local municipalities, First Nations groups, private sector stakeholders in border transportation issues, as well as the general public were engaged in the course of the study. Throughout the P/NF Study, the Partnership affirmed that the findings of the P/NF Study may be used to initiate environmental studies in accordance with the requirements of the U.S. *National Environment Policy Act* (NEPA), *Canadian Environmental Assessment Act* (CEAA) and *Ontario Environmental Assessment Act* (OEAA). This step would be followed by completion of the appropriate environmental impact/assessment studies, design of the approved improvements and ultimately, construction.

During preparation of the P/NF Study, background papers were prepared to establish existing conditions within the Preliminary Analysis Area (PAA). The PAA is roughly bounded by 9th Concession Road in the Town of Lakeshore, County Road 18 in the Town of Amherstburg on its southern extent and by the Detroit River on its western and northern extent. An Environmental Overview Working Paper (Canada-US-Ontario-Michigan Border Transportation Partnership 2005) was prepared to document environmental constraints which may preclude or otherwise constrain the generation of feasible transportation alternatives. The information contained in the Environmental Overview Working Paper was gathered from readily available secondary sources. Air quality issues identified in the Environmental Overview Working Paper included: ambient air quality criteria; air quality improvement and information programs, the Canada/U.S. Bi-national Agreement; and existing air pollutant concentrations. A summary of the information contained in the Environmental Overview Working Paper is presented below.

1.1.1 Air Quality Standards, Criteria and Guidelines

There are a number of standards, criteria and guidelines that are used to assess air quality. These are presented in the following subsections.

1.1.1.1 Canada Wide Standards for PM and Ozone (O_3)

In 1998, the federal and provincial environment ministers (exception Quebec) signed the Canada-Wide Accord on Environmental Harmonization, in which they agreed to develop Canada-Wide Standards (CWS) for certain air quality pollutants that threaten environmental and human health. For example, the recommended CWS for $PM_{2.5}$ is 30 µg/m^3 averaged over 24 hours, to be achieved by 2010. The recommended CWS for O_3 is 65 ppb averaged over 8hours, also to be achieved by 2010. Each jurisdiction is responsible for developing implementation plans outlining comprehensive actions to meet the standards for PM and ozone by the 2010 target date. Like the other jurisdictions in the CWS program, Ontario plans to produce a five-year progress report on the standards in 2006, with annual reporting beginning in 2011.

1.1.1.2 Ambient Air Quality Criteria - Ontario Regulation 337 of the Ontario Environmental Protection Act

The province of Ontario has established desirable ambient air quality criteria of contaminants for a specific period of time under the Environmental Protection Act. Ontario's ambient air quality criteria are summarized in Table 1.

TABLE 1: ONTARIO AMBIENT AIR QUALITY CRITERIA

Pollutant	Ambient Air Quality Criterion
Carbon Monoxide (CO)	
1-hour Average	30 ppm
8-hour Average	13 ppm
Nitrogen Dioxide (NO_2)	
1-hour Average	0.2 ppm
24-hour Average	0.13 ppm
Ozone (O_3)	
1-hour Average	0.08 ppm
Lead (Pb)	
24-hour Average	2.0 µg/m^3
Particulate Matter	
PM_{10} 24-hour Average	50 µg/m^3
$PM_{2.5}$ 24-hour Average	30 µg/m^3
Sulphur Dioxide (SO_2)	
1-hour Average	0.25 ppm
24-hour Average	0.10 ppm
1-year Average	0.02 ppm

1.1.2 Ontario's Air Quality Improvement and Information Programs

1.1.2.1 Drive Clean

The Ontario Drive Clean Program, implemented in 1999, is a mandatory vehicle emissions inspection and maintenance program, designed to cut smog-causing emissions from vehicles (especially NOx and VOCs). The program requires that light-duty cars, trucks, and vans have an emissions test every two years for registration renewal. The program applies to vehicles that are more than three model years old and fewer than 20 model years old and requires a pass or conditional pass for vehicle registration renewal.

The Smog Patrol, a unit of the Ontario Ministry of the Environment, patrols highways to identify excessively smoking vehicles, both those registered in Ontario and those from out-of-province. The vehicles are stopped, inspected, and may be escorted to a mobile test facility to have their emissions checked.

The Ontario Ministry of the Environment administers the Smog Alert program for localities in Ontario, including Windsor. Citizens can register to receive email smog alerts at the www.airqualityontario.com website. This website also includes Air Quality Indices for various localities updated hourly, based on the concentrations of six common air pollutants. As a part of Ontario Regulation 127/01 - "Airborne Contaminant Discharge - Monitoring and Reporting", the Ministry also administers the OnAIR program, which gives citizens access to reports on emissions from stationary sources in the province's industrial, commercial, institutional and municipal sectors. The OnAIR website is http://www.ene.gov.on.ca/environet /onair/splash.htm.

1.1.2.2 Ontario's Smog Plan

The Ontario Ministry of the Environment has set an Air Quality Target for Smog. This target is to achieve, by 2015, a 75 percent reduction in the number of times the 80 ppb one hour ozone criterion is exceeded. The base for calculating the reductions is the average number of exceedances in the years 1990 to 1994. The Ontario Smog Plan works towards this target. Ontario's Smog Plan is a partnership effort that sets regional and sectoral targets for emission reductions. A goal of the plan is to reduce emissions of NOx and VOCs by 45 percent from 1990 levels by the year 2015.

1.1.3 Canada/United States Bi-National Agreement

The governments of Canada and the United States have developed agreements to control air pollution and to improve air quality as they consider transboundary air pollution to be harmful to natural resources of vital environmental, cultural and economic importance, and to human health. The text of these agreements can be found in the following memoranda and the long range plans: the Memorandum of Intent Concerning Transboundary Air Pollution of 1980, the 1986 Joint Report of the Special Envoys on Acid Rain, as well as the ECE Convention on Long-Range Transboundary Air Pollution.

The general objective of the parties is to control transboundary air pollution between the two countries, and the purpose of these agreements is to establish practical and effective instruments to address shared concerns regarding transboundary air pollution. The two countries established a set of specific air quality objectives, which they undertook to achieve for emissions limitations or reductions of defined air pollutants. Two such pollutants are sulphur dioxide and nitrogen oxides.

1.1.3.1 Sulphur Dioxide

The agreement specified an annual emissions reduction in the seven easternmost provinces to 2.3 million tons per year by 1994 and the achievement of a sulphur dioxide emissions cap in the seven easternmost provinces at 2.3 million tons per year from 1995 through December 31, 1999. The agreement also specifies the achievement of a permanent national emissions cap of 3.2 million tons per year by 2000.

1.1.3.2 Nitrogen Oxides

The Canadian government mandated an interim reduction requirement by year 2000 of annual national emissions of nitrogen oxides from stationary sources by 100,000 tons below the year 2000 forecast level of 970,000 tons. Since then, new requirements in annual national emissions reduction have been implemented. The goal was to achieve these new requirements by 2000 and/or 2005. For mobile sources, the Canadian government has since implemented a more stringent control program for gasoline and diesel powered vehicles. In addition, the agreement establishes the rules and regulations for each government or party to follow for assessment, notification, and mitigation of proposed actions, activities and projects that, if carried out, would be likely to cause or affect significant transboundary air pollution. Further, the parties agree to establish and maintain a bilateral Air Quality Committee to assist in the implementation of the joint agreement.

The committee meets once a year and additionally at the request of either party to monitor progress and to refer to the International Joint Commission any unresolved dispute for negotiations.

1.1.4 Existing Air Pollutant Concentrations

The Ontario Ministry of the Environment and Environment Canada routinely collect data on air pollutant concentrations at various locations across Ontario and Canada. These have been compiled and are presented in detail in the DRIC Study Report entitled "Background Air Quality, April 2005".

1.2 Detroit River International Crossing – Terms of Reference

A Terms of Reference was submitted to the Ontario Ministry of the Environment for approval in May 2004. The Terms of Reference identifies the framework that the proponent must follow in completing an individual environmental assessment. The Terms of Reference received approval in September 2004.

The planning process that the Route Planning Study and Environmental Assessment Study will follow is outlined in the Terms of Reference and consists of four stages:

- Stage 1 – Define Study Area;
- Stage 2 – Illustrative Alternatives;
- Stage 3 – Practical Alternatives; and,
- Stage 4 – Concept Design Alternatives.

1.3 Air Quality Work Plan

The Air Quality Work Plan presents the approach and methodology for conducting the Air Quality Investigation for the Detroit River International Crossing Route Planning and Environmental Assessment Study. The proposed approach to completing the Air Quality Investigation is to increase the level of detail used to assess air quality features progressively as the geographical area of study is sequentially narrowed down. The proposed level of analysis, resolution, and type of data collection at each stage of the study is designed to maximize efficiency. The Air Quality Investigation is also designed to complement the work to be performed in the U.S. A summary of the Air Quality Investigation in relation to the study stages is presented in Table 1.

At each stage of the study process, similar tasks will occur. These tasks include:

Task 1 – Define Area of Investigation - Identify the study area for the purposes of investigating the potential effects of the project.

Task 2 – Data Collection - Identify the type, source, level of detail and methods to be used to obtain information.

Task 3 – Data Analysis - Identify how the information will be interpreted to determine the significance and sensitivity of changes to air quality.

Task 4 – Evaluate Alternatives - Identify the air quality criteria and indicators that will be used to compare alternatives.

Task 5 – Conduct Impact Assessment - Identify the range of potential environmental effects to be assessed.

Task 6 – Recommend Environmental Protection Measures - Identify the range of potential environmental protection measures to be assessed. Environmental protection measures typically include avoidance, minimization, mitigation, compensation and monitoring.

These tasks are summarized for each stage of the study process in Table 1.

TABLE 2. AIR QUALITY INVESTIGATION BY STUDY STAGE

Study Stage[1]	Level of Analysis	Task 1 Define Area of Investigation	Task 2 Data Collection	Task 3 Data Analysis	Task 4 Evaluate Alternatives	Task 5 Impact Assessment	Task 6 Environmental Protection Measures
Stage 1 – Define Study Area	Regional Investigation	Preliminary Analysis Area	• Secondary Source • Air Photo Interpretation • Historical Background Air Quality Measurements	Identify potentially significant areas of study for further analysis.	• Identify areas that may be presently impacted by poor air quality due to traffic congestion	Opportunities/ Constraints Analysis	• Mitigation through improved traffic flow
Stage 2 – Illustrative Alternatives	Regional Investigation	Illustrative Alternative Routes (X0 through X15)	• Traffic flows • Vehicle exhaust emissions (U.S. EPA MOBILE 6.2) • Surface roadway emissions (U.S. EPA AP-42)	All vehicle emissions will be estimated using output from MOBILE 6.2C model and/or U.S. EPA AP-42 emission factors. This data will be used in conjunction with the overall VKT and fleet composition for each Ilustrative Alternative to determine changes in the total mass of pollutants emitted.	• The change in total pollutant burden over baseline conditions will be used together with other criteria (such as the potential number of receptors located within a specified distance) to rank the IAs.	Opportunities/ Constraints Analysis	• Mitigation through improved traffic flow

TABLE 2. AIR QUALITY INVESTIGATION BY STUDY STAGE

Study Stage[1]	Level of Analysis	Task 1 Define Area of Investigation	Task 2 Data Collection	Task 3 Data Analysis	Task 4 Evaluate Alternatives	Task 5 Impact Assessment	Task 6 Environmental Protection Measures
Stage 3 – Practical Alternatives	Localized Investigation	Practical Alternative Routes	• Traffic flows • Vehicle exhaust emissions (U.S. EPA MOBILE 6.2) • Surface roadway emissions (U.S. EPA AP-42) • Meteorological data	Emission estimates will be used in conjunction with an industry recognized air dispersion model for roadways (such as CALQ3HCR) or an alternative acceptable dispersion model (such as as ISCST3)	• Analysis of Practical Alternatives will be undertaken for a limited set of pollutants (NOx and $PM_{2.5}$) for the baseline (existing) conditions and the future operational scenarios (e.g. 2015 & 2025). • Predicted concentrations will be discussed in reference to provincial and federal air quality guidelines, as available.	Generic Impacts Within Specified Distances from the Roadway	• Minimization • Generic mitigation approaches
Stage 4 – Analysis of Technically Preferred Alternative (TPA)	Localized Investigation	Technically Preferred Alternative Route	• Traffic flows • Vehicle exhaust emissions (U.S. EPA MOBILE 6.2) • Surface roadway emissions (U.S. EPA AP-42) • Meteorological data	Dispersion modeling will be undertaken for all pollutants, and the analyses will consider separate future cases for construction and operations. Maximum 24-hour and annual average emission scenarios will be developed.	• Analysis will be conducted using predicted impacts over a period of 5-years, and comparisons made of predicted annual average concentrations to relevant federal and provincial criteria and standards. • An assessment of worst-case maximum (1-hour and 24-hour) conditions will also be included for comparison to MOE AAQCs and National Ambient Air Quality Objectives. • Evaluation of odour impacts.	Conceptual Site-Specific Local Impacts	• Minimization • Conceptual site-specific mitigation, compensation and monitoring (if required)

1 Detail Design is not currently included in the Detroit River International Crossing Route Planning and Environmental Assessment Study

2. STAGE 1 – DEFINE STUDY AREA

A study area will be established to encompass the stated problems, opportunities and range of feasible alternatives. The study area will be generated based on a review of significant physical and environmental constraints that may preclude the development of feasible alternatives and the ability to provide continuous corridors of sufficient area to generate a range of linear transportation facility alternatives.

2.1 Task 1 – Define Area of Investigation

The area of investigation is the Preliminary Analysis Area identified in the amended Environmental Overview Document. In general, this includes all roads in the Windsor area and growth that is expected to occur in the area between 2004 and 2035.

2.2 Task 2 – Data Collection

The Air Quality analysis uses historical air quality data on common air pollutants such as particulate matter (Total Suspended Particulates – TSP, Particulate Matter less than 10 microns – PM_{10}, Particulate Matter less than 2.5 microns – $PM_{2.5}$), nitrogen oxides, carbon monoxide, and oxides of sulphur that are based upon actual measurements over many years in the Windsor area.

Air photos will be used to visually assess the proximity of the air quality monitoring stations to major arteries and roadways, such as Huron Church Road, in the City of Windsor.

2.3 Task 3 – Data Analysis

The air quality measurements and the air photo mapping will be used to identify areas that are potentially currently impacted, in terms of air quality, in the City of Windsor, and/or areas that may benefit.

2.4 Task 4 – Evaluate Alternatives

No evaluation of alternatives will be performed at this stage. Criteria will be used to identify opportunities/constraints located in the area of investigation

2.5 Task 5 – Conduct Impact Assessment

No impact assessment will be performed at this stage. Instead, areas that are presently potentially impacted will be identified, with the intent of postulating future improvements due to enhancements in traffic flow.

2.6 Task 6 – Recommend Environmental Protection Measures

Environmental protection measures will not be addressed at this stage. Any projected improvements in traffic flow, combined with technological engine enhancements, will likely reduce vehicular air pollutant exhaust emissions.

2.7 Results

The Preliminary Analysis Area will be refined based on a review of opportunities and constraints to the development of a linear transportation facility, with respect to air quality. Illustrative alternatives will be generated and carried forward for further evaluation.

3. STAGE 2 – ILLUSTRATIVE ALTERNATIVES

Each of the Illustrative Alternatives (IAs) will be assessed in terms of the potential impacts in the vicinity of the proposed route. In order to assess the potential air quality impacts resulting from the IAs, a semi-quantitative analysis of each route alternative will be conducted. This will be done via an emissions burden analysis, whereby the total pollutant emissions will be calculated for various time frames (both current and future). This approach allows a comparison of the atmospheric burdens, and thus an assessment of the overall effect generated by the alternatives for a common geographic area.

3.1 Task 1 – Define Area of Investigation

The area of investigation encompasses the entire region, including all illustrative alternative routes, including X1 through X15. The illustrative alternative routes will be compared to the current baseline conditions, route X0.

3.2 Task 2 – Data Collection

A transportation model has been developed for the area. The current and projected future Vehicle Kilometres Travelled (VKT) for both Detroit and Windsor will be determined by the transportation consultant, and provided to SENES. The vehicle fleet mix will be examined and altered (as anticipated) in relation to reducing the emissions from vehicles as technology improves. Emission scenarios will be developed for past, present and future dates, to illustrate changes in emissions resulting from alternative route alignments, and improvements to traffic flow. These will include the following proposed milestone years: 2004 (to represent existing conditions), 2013 (completion), and 2023 (10 years post-construction). This will include a "do nothing" case for year 2023, with a potentially high level of future congestion. To a certain extent, this activity will be co-ordinated with the U.S. air consultant to enable consistency in the fleet mix assumed on the crossing. Particular attention will be paid to the fleet mix as well as particulate and VOC emissions from heavy border trucks.

Emissions from vehicle exhaust and roadway surfaces are typically estimated using U.S. EPA emission factors, which are mathematical representations of emissions, based on certain specific parameters. These equations were developed by the U.S. EPA, and are derived from measurements that have been made across North America. The required parameters include vehicle speed, vehicle weight, sulphur content of fuel, the vehicle fleet mix (e.g. the fraction of certain types of vehicles – cars, trucks, etc., and their ages), and the surface silt loading of roadways (e.g. the amount of fine material that is present on the surface of a paved road).

All of these have been incorporated into the U.S. EPA MOBILE6 emissions model, which produces estimates of vehicle exhaust emissions. The Canadian version of the model (latest version: MOBILE6.2C), which incorporates differences in fleet composition, fuel characteristics, etc, will be applied to the Canadian portion of the traffic, whereas the U.S.

version (MOBILE6.2) will be applied to the U.S. portion of the traffic. All other types of emission factors (such as those for surface roadway emissions) will be from the U.S. EPA compendium of emission factors known as AP-42.

All vehicle emissions will be estimated using output from the MOBILE 6.2/6.2C model and /or U.S. EPA AP-42 emission factors. This model will incorporate the expected traffic conditions on the IA routes, as developed by the project transportation team. Appropriate modifications to the emissions, due to specialized traffic conditions or technological advances will be made when warranted. Additional estimates will be required to estimate emissions of re-suspended road dust. Representative silt loadings are required for these assessments. If available, these will be determined from the literature. Alternately, surface silt sampling in the Windsor area may be necessary.

For each Illustrative Alternative, the pollutant burdens will be calculated for the following pollutants and precursors: carbon monoxide (CO), nitrogen oxides (NO_x), SO_2, CO_2, CH_4, particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$) (which includes Diesel Particulate Matter (DPM)), and volatile organic compounds (VOC). It will likewise be performed for the following air toxics: benzene, acetaldehyde, formaldehyde, 1,3-butadiene, acrolein, and polycyclic aromatic hydrocarbons (PAH). These contaminants were selected because they represent the greatest potential for off-site impacts due to tailpipe or roadway surfaces. All of the species listed above are emitted in vehicle exhaust. Fugitive dust, including fine particulate matter, such as PM_{10} and smaller is also emitted from roadway surfaces as vehicles travel over them.

Additionally, vehicle exhaust contains ozone precursor compounds such as NO_X and VOCs. Potential impacts due to ground level ozone (GLO) will be considered through an assessment of emissions changes in ozone precursors and their ratios, in relation to ambient ozone concentrations.

3.3 Task 3 – Data Analysis

The data will be used in conjunction with the fleet composition and overall VKT on each roadway link in Windsor, for each Illustrative Alternative to determine the mass of pollutants (daily and/or annual emission) emitted (e.g. the pollutant burden).

3.4 Task 4 – Evaluate Alternatives

The change in pollutant burden over baseline conditions for each IA will be used together with other criteria (such as the potential number of receptors located within a specified distance) to rank the IAs. The output from this task will be a comparison of the overall effect of alternative border crossing improvements.

3.5 Task 5 – Conduct Impact Assessment

Impact assessment will not specifically be carried out within the air quality assessment. Instead, potential changes to air quality and associated impacts will be assessed within the Social Impact Assessment, through a proximity analysis (i.e. assessment of the number of sensitive receptors (residences, schools, etc.) located within a specified distance from the roadway).

3.6 Task 6 – Recommend Environmental Protection Measures

Environmental protection measures will not be addressed at this stage. Any projected improvements in traffic flow, combined with technological engine enhancements, will likely reduce vehicular air pollutant exhaust emissions.

3.7 Results

The illustrative alternatives will be evaluated to determine whether there are any significant differences, positive or negative, between the individual Illustrative Alternatives, that would preclude, or specifically favour, further consideration in the study. A set of Practical Alternatives (PA) will be selected based on a comparative analysis of the full set of indicators and effects [e.g. natural environment (air quality, surface & groundwater quality), social environment, etc.]. Practical alternatives will be generated and carried forward for further evaluation.

4. STAGE 3 – PRACTICAL ALTERNATIVES

Practical alternatives represent the set of illustrative alternatives that, upon evaluation of impacts and benefits, are carried forward for further consideration. Practical alternatives are generated through more detailed design (although still at a preliminary level) to better identify property requirements, infrastructural implications, construction staging impacts and mitigation measures.

4.1 Task 1 – Define Area of Investigation

The area of investigation is practical routes, plazas, plaza extensions and crossings within the technically preferred illustrative alternative(s). This area is known as the Area of Continued Analysis (ACA) and is illustrated in Figure 1.

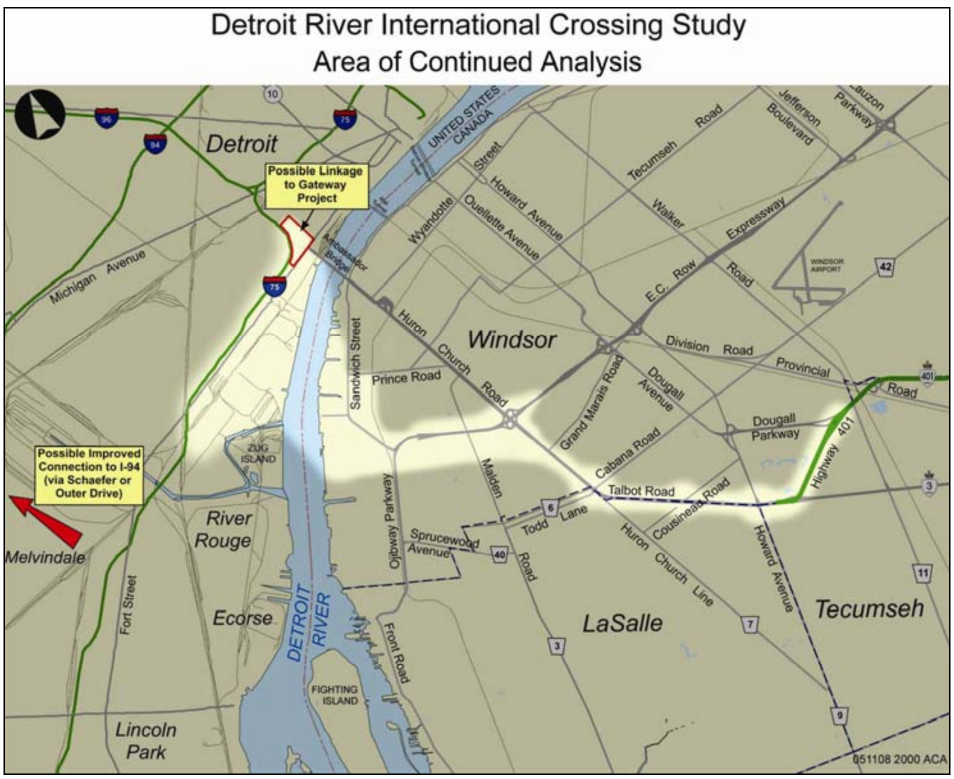


FIGURE 1. KEY PLAN OF THE AREA OF CONTINUED ANALYSIS.

4.2 Task 2 – Data Collection

The emissions estimates generated through the evaluation of the Illustrative Alternatives will be used in this stage of the analysis, and modified as necessary based on any projected changes to predicted traffic volumes. Information on vehicle queuing and idling at intersections and customs plazas will also be collected and incorporated into the analysis.

Local meteorological data is required, in conjunction with an approved air dispersion model, to assess the dispersion of the contaminants emitted from the roadway. Meteorological data is one of the most important inputs into an air dispersion model. Once a pollutant is emitted into the atmosphere from a source, the meteorological characteristics in an area govern where a pollutant will end up, in addition to the resulting predicted air concentrations.

A 5-year meteorological data file from the Windsor Airport, suitable for modelling the impacts from transportation systems, will be prepared and submitted to the MOE for review. This data will be used in all the modelling work for this project. The surface data will most likely be from the Environment Canada (Meteorological Services Canada – MSC) station located at the Windsor Airport. The conditions at this station are representative of the Windsor area in general, and thus the data is appropriate for the dispersion modelling that will be completed for this project. The upper air data will likely be from the station located in Flint, MI, which is the closest station to the Windsor area. Upper air characteristics are a regional parameter, and thus this station is representative of the characteristics in the Windsor area.

Hourly meteorological data are required for detailed dispersion modelling, including: mixing height, temperature, cloud cover, cloud opacity, wind speed and wind direction. Upper air measurements are required for calculating hourly mixing heights. Using upper air observations (twice daily), morning and afternoon mixing heights are calculated and, based on these, hourly mixing heights are estimated using the U.S. EPA's regulatory meteorological pre-processor PCRAMMET.

Since the resulting impacts will be primarily aimed at making comparisons, the same meteorological dataset will be used for all Alternatives so as to remove any meteorological bias from the decision-making. This is a valid approach because the air quality analysis required by the MOE is normally based on a worst-case type of analysis driven by a specific combination of meteorological parameters. Using a 5-year dataset best allows that unique combination to be found. Should one or more areas of a particular corridor have marked topography, the team will assess any implications of this on the final results through a site-specific model run.

4.3 Task 3 – Data Analysis

Dispersion modelling is commonly used to predict atmospheric concentrations of pollutants at specific receptors downwind of the source of pollutants over specific averaging times (i.e. annual, daily, hourly). The process involves using a computer program to mimic the way the atmosphere disperses pollutants. Successful modelling requires specific attention to the inputs and a rigorous quality assurance program.

An atmospheric dispersion model takes emissions from a source; estimates how high into the atmosphere they will go, how widely they will spread and how far they will travel based on hourly meteorological data; and outputs the pattern of concentrations that will occur downwind for various averaging times.

An industry recognized air dispersion model for roadways (such as the CALQ3HCR Model, which was specifically designed by the U.S. Environmental Protection Agency (EPA) to analyze both intersections with line-ups of idling traffic as well as free-flowing traffic), or an alternative acceptable dispersion model (such as ISCST3, AERMOD, or CALPUFF) will be used to predict air quality impacts at sensitive receptors located along each of the PAs. The most appropriate model will be chosen in consultation with EC, MOE as well as City of Windsor's Air Quality peer reviewer(s).

The highest predicted traffic flow scenario will be used to develop the maximum credible air pollutant emission scenarios for input to the model using the emission factors generated using MOBILE6.2C. Each corridor will be modelled separately and impacts determined along it.

Representative background concentrations must be added to the model-predicted particulate concentrations to get an accurate representation of the air quality surrounding the PAs. This is particularly important in the Windsor area, which is currently affected by transboundary pollution, and high existing traffic levels. Also, since Ambient Air Quality Criteria (AAQCs) as well as National Ambient Air Quality Objectives (NAAQO) are based on total rather than incremental ambient concentrations, representative background components must be added to the model-predicted concentrations for comparison to MOE AAQCs.

Ambient concentrations of various airborne pollutants are routinely collected by Environment Canada (EC) and the Ontario Ministry of the Environment at several stations in the Windsor area. The most recent 5-years of data from these stations (1999-2003), in addition to data from other focussed air quality studies in Windsor have been summarized in a supplementary working paper completed for this study (Background Report – Air Quality, SENES 2005). This data is deemed representative of the current air quality conditions and pollutant concentrations in the Windsor area. As such, this report will be used to determine appropriate short and long-term background concentrations of each pollutant species, which will then be added to the modeled concentrations, and no additional air sampling will be completed in this regard. To be conservative, the 90th percentile of measurements will be used as ambient background concentrations for various pollutants of concern. This built in conservatism also accounts for the localized impact of nearby sources (e.g. large industries and other roadways).

Since the objective of the Practical Alternatives analysis is a comparison of the projected impacts between the different alternatives, it is appropriate to conduct this phase of the analysis for a more limited set of pollutants. The selected pollutants are NO_x and $PM_{2.5}$, which represent the key indicators of impacts from gaseous and particulate species, respectively. It should be noted that all pollutants outlined in Section 3.2 will be included in the assessment of the Technically Preferred Alternative (TPA).

4.4 Task 4 – Evaluate Alternatives

Maximum model predicted concentrations of NO_x and $PM_{2.5}$ will be produced at sensitive receptor locations (i.e. residences, schools, etc) within specified distances from the roadway. The model predicted concentrations will be discussed in reference to provincial (MOE Ambient Air Quality Criteria (AAQC)) and federal (Canada-wide Standards and EC

National Ambient Air Quality Objectives) guidelines, as available. For those contaminants where the maximum concentrations are predicted to exceed the criteria, frequency of exceedance analyses will also be carried out.

4.5 Task 5 – Conduct Impact Assessment

The output of this task will be a table presenting peak and average concentrations at sensitive receptors within specified distances from the roadway in the Study Area, as well as the number of times an air quality standard is predicted to be exceeded within each of the zones, for both NO_x and $PM_{2.5}$. In addition, a detailed analysis of any local hot spots will also be completed, as necessary.

4.6 Task 6 – Recommend Environmental Protection Measures

If preliminary modelling indicates that a limit is exceeded, various mitigation measures will be suggested and applied in order to eliminate impacts or reduce them to acceptable levels. Such mitigation measures might include, but not be limited to:

- road sweeping and washing;
- modifications to alignments;
- passive controls along the route alignment (plantings etc.); and
- speed controls.

A discussion of the potential control efficiencies of each measure will also be included.

4.7 Results

Upon completion of the analysis, an overall qualitative assessment will be completed. The task will describe the results in terms of the advantages and disadvantages of route alternatives, trade-offs that can be made, the relationships to sensitive receptors, and overall predicted degradation or improvement to local air quality.

The practical alternatives will be scored and evaluated to select a technically preferred practical alternative (TPA).

5. STAGE 4 – ANALYSIS OF THE TECHNICALLY PREFERRED ALTERNATIVE

Concept design alternatives represent the set of practical alternatives that, upon evaluation of impacts and benefits, are carried forward for further consideration. Concept design includes the consideration and development of specific engineering and environmental issues to further understand very particular implications of the recommended alternative. The level of engineering detail is sufficient to develop environmental protection measures in consultation with the appropriate agencies and to secure environmental assessment approvals.

5.1 Task 1 – Define Area of Investigation

The area of investigation is concept design routes, plazas, plaza extensions and crossings within the technically preferred practical alternative(s) of the ACA.

5.2 Task 2 – Data Collection

Air Quality information collected previously for the Technically Preferred Alternative including traffic flow, vehicular emission rates, surface road emission rates, and meteorological data will be used for this stage of the project. In addition, the predicted concentrations from the previous phase of the project will be used as an early determinant of any required mitigation strategies that should be incorporated.

5.3 Task 3 – Data Analysis

Detailed dispersion modelling will be undertaken for all pollutants presented earlier in Section 3.2, in addition to all operational phases (i.e. 2015, 2025, 2035). The analyses will also consider separate future cases for construction and operations. Using the same U.S. EPA emission factors as discussed previously in Section 3.2, and the corridor construction techniques to be applied, maximum 24-hour and annual average emission scenarios will be developed to represent periods when the highest levels of pollutants will be emitted. These emission rates will be input to the dispersion model to predict the maximum downwind concentrations at ground level and elevated receptors (as necessary) along the TPA.

The main air related impacts from construction activities include the generation of dust emissions through material handling operations and vehicle travel on unpaved surfaces in addition to exhaust emissions from heavy construction equipment. Generally, these nuisance impacts are of short duration and can be reduced through the use of good construction management and mitigative practices such as seeding or treating (watering) open spaces, setting speed limits for heavy equipment, using dust suppression materials, etc. As such, construction phase nuisance impacts are not regulated. Not withstanding, an assessment of the construction-phase emissions will be included in the study to ensure that any short-term nuisance effects are minimized. In addition, where possible, effects due to traffic disruption (i.e. increased idle times and queuing) will also be assessed.

This phase will also include an assessment of odour impacts. Odour will be addressed through the use of emission of Odour Units (OU) determined either from the literature, or based on odour thresholds of modeled contaminants. Aldehydes (formaldehyde, acetaldehyde and acrolein) are believed to be the primary source of odour in exhaust. Since these pollutants will be assessed in the study (as outlined earlier in Section 2.1), it will be possible to determine odour emission rates.

The analysis will be conducted using predicted impacts over a period of 5-years (e.g. using 5 years of meteorological data), and comparisons made of predicted annual average concentrations to relevant federal and provincial criteria and standards. An assessment of worst-case maximum (1-hour and 24-hour) conditions will also be included for comparison to MOE Ambient Air Quality Criteria (AAQCs) and National Ambient Air Quality Objectives (NAAQO) for the respective averaging periods.

5.4 Task 4 – Evaluate Alternatives

The operational (post-construction/completion) phase for the TPA will be assessed in a similar manner to that described for the Practical Alternatives, for all study pollutants, and all milestone years. The model predicted concentrations will be compared to provincial (MOE Ambient Air Quality Criteria (AAQC)) and federal (Canada-wide Standards and EC National Ambient Air Quality Objectives) guidelines, as available. For receptors where an air quality standard or criterion is predicted to be exceeded, an analysis of the frequency of exceedance will be completed.

5.5 Task 5 – Conduct Impact Assessment

The model predicted concentrations and frequency analysis will be used to develop impact zones at increasing distances from the roadway. The impact zone(s) will then be applied along each concept alternative to determine the maximum potential impact level for the technically preferred alternative route(s).

5.6 Task 6 – Recommend Environmental Protection Measures

Appropriate mitigation measures, such as those presented above in Section 4.6, will also be discussed in relation to reducing the potential for air quality impacts during construction and implementation stages of the technically preferred alternative. In particular, where standards or guidelines are predicted to be exceeded, the effectiveness of particular options will be assessed in regards to eliminating or reducing the number of these excursions. If necessary, additional dispersion modelling will be undertaken to determine the frequency and magnitude of residual impacts, after the application of mitigation measures.

5.7 Results

The concept design alternatives will be evaluated to select a technically preferred concept design alternative(s). Detail design is not included in the current scope of work for the Detroit River International Crossing Route Planning and Environmental Assessment Study.