Detroit River
INTERNATIONAL CROSSING
S T U D Y

Changes to Air Quality

Identifying how the Detroit River International Crossing (DRIC) study may change air quality is an important consideration in the DRIC Environmental Assessment.

Air quality effects of the Practical Alternatives are currently being assessed using a combination of existing air monitoring data and air dispersion modelling. Air dispersion modelling must be used to assess the impacts of future changes, such as implementation of the alternatives, and changes in fuels, vehicle technologies and traffic volumes. The predictive air quality model being used is specifically designed to assess impacts from roads and highways. The model incorporates the differences between moving vehicles, and queued vehicles that are idling, as well as differences in roads that are at-grade, depressed, tunnelled or elevated on bridges.

Existing concentrations of gaseous pollutants in Windsor such as SO_2, CO and VOCs (such as acrolein) were assessed as part of the assessment of Illustrative Alternatives and found to be well below Ontario Ministry of the Environment (MOE) Ambient Air Quality Criteria (AAQCs) under future traffic conditions. The two indicator pollutants selected for this phase of the analysis to represent one gaseous compound and one particulate compound are Particulate Matter less than 2.5 microns ($PM_{2.5}$) and Nitrogen Oxides (NO_x). Changes in the total predicted concentrations of these two air pollutants were examined for each alternative in relation to one another.

The results presented herein are discussed as a "work in progress" since generation of results and analysis are still ongoing.

How the Analysis was Done

The analysis was completed using the following approach:

- determine background concentrations
- compile data on existing $PM_{2.5}$ and NO_x concentrations
- input traffic data for existing and future conditions, including access road, plaza and crossing alternatives
- calculate pollutant emissions from the highway corridor for existing and future conditions, and
- use air dispersion model (CAL3QHCR) with meteorological data from Windsor Airport to determine future air pollutant concentrations in the vicinity of the corridor (essentially all of west Windsor) and at sensitive receptor locations (such as schools).

Data on the existing air pollutant concentrations in the Windsor area was obtained from the two MOE air monitoring stations located on College Street and on University Avenue. The highest 24-hour 90th percentile $PM_{2.5}$ and NO_x concentrations measured at these stations in the past four years were conservatively selected as the interim background concentrations, which were added to all model predicted results. Data from the two new DRIC air monitoring stations will be used to refine the background concentrations.

Traffic data was provided by IBI Group for all main roads in the corridor for existing, baseline conditions (2006) and the future "do nothing" case (2035), as well as for each access road, plaza and crossing alternative in 2035.

Emission rates from these vehicles were input into the U.S. Environmental Protection Agency CAL3QHCR roadway dispersion model, which is accepted for use in Ontario by the MOE. The model was run using meteorological data from Windsor Airport, to determine predicted air pollutant concentrations at points on a grid that covered west Windsor, in addition to specific sensitive receptor locations and receptors used in the Social Impact Assessment (SIA), such as schools and places of worship.

Results to Date

Although this phase of the study focused on $PM_{2.5}$ and NO_x specifically, additional pollutants will be examined when assessing the technically and environmentally preferred alternative.

Presently, road based transportation sources are responsible for approximately 45% of the total NO_x emissions in the Windsor airshed. Emissions from the Huron Church Road corridor contribute approximately 2% of the total NO_x emissions to the Windsor airshed. Improvements in technologies and fuels will combine to reduce the emissions from transportation sources. Based on the regulated and anticipated changes in both Canada and the U.S., preliminary estimates indicate that annual emissions of NO_x from road related transportation sources in Windsor will be reduced from approximately 4000 tonnes in 2004 to 500 tonnes in 2035. Based on these projected decreases, road transportation related sources will likely comprise a much smaller fraction of the total emissions. For example, if emissions from all other sources remain the same, transportation related sources in Windsor will comprise less than 10% of the total regional NO_x emissions, even considering future growth in traffic volumes.

Fine particulate matter ($PM_{2.5}$) emissions from road based transportation sources are comprised of two contributing fractions. The first is tailpipe emissions resulting from fuel combustion. The second, and higher fraction, is from road dust, which is generated from the resuspension of surface material and debris, tire and brake wear, and roadway abrasion. Since total road emissions of $PM_{2.5}$ are predominantly comprised of road dust, $PM_{2.5}$ emissions will increase as traffic increases in the Highway 3/Huron Church Road corridor. However, the tailpipe fraction of $PM_{2.5}$ emissions is currently a maximum of 30% of the total road based $PM_{2.5}$ emissions in Windsor. In future, tailpipe emissions of $PM_{2.5}$ will be reduced to less than 10% of the total $PM_{2.5}$ emissions through providing a continuous freeway for international traffic (avoids braking, idling and acceleration at traffic signals) between the present terminus of Highway 401 and the new border crossing and improvements in fuels and vehicle technologies.

Preliminary Assessment of Alternatives

Access Road Alternatives

Service Road Configurations

Preliminary modelling of air quality impacts of the Practical Alternatives indicates that between Alternatives 1 (one-way service roads) and 2 (parallel 2-way service raods), there is very little difference in the predicted changes to $PM_{2.5}$ and NO_x concentrations.

Route Alignments Between St. Clair College and Howard Avenue

Two route alignment options were studied for the area between St. Clair College and Howard Avenue. Option 1 considers a widening of the present roadway corridor more to the north (Windsor) side of Highway 3, whereas Option 2 considers a widening of the corridor more to the south (LaSalle) side of Highway 3.

The preliminary air dispersion modelling results indicate that there is a slight difference in the change in $PM_{2.5}$ and NO_xconcentrations between Option 1 and Option 2 at receptors located within 50 m (164 ft) of the right-of-way (ROW) between St. Clair College and Howard Avenue. Receptors located to the north of the proposed ROW experience slightly higher predicted concentrations with the Option 1 alignment versus the Option 2 alignment. This difference is primarily due to the change in the proximity of these receptors to the proposed ROW.

Right-of-Way Elevation (i.e. at-grade vs. depressed vs. tunnelled)

Preliminary modelling of air quality impacts of the Practical Alternatives indicates that within 50 – 100 m (164 – 328 ft) from the ROW there are differences between the alternatives. For example, within 100 m (328 ft) from the ROW, depressed sections show slightly lower predicted concentrations of $PM_{2.5}$ and NO_x than at-grade sections. Beyond 100 m (328 ft), there is no discernible difference between at-grade and depressed alternatives.

Depressed alternatives result in a reduction in $PM_{2.5}$ concentrations in the vicinity of the ROW, in comparison to at-grade alternatives. NO_x concentrations are also reduced with depressed alternatives in comparison to at-grade alternatives in the vicinity of the ROW.

The tunnel alternative results in lower concentrations of $PM_{2.5}$ relative to at-grade and depressed alternatives in the vicinity of the ROW.

The tunnel alternative with a ventilation building results in slight decreases in the maximum predicted 1-hour NO_x concentration in the vicinity of the ROW, relative to at-grade and depressed options. However, slight increases in the maximum predicted 1 hour NO_x concentrations are indicated over a broader area in comparison to the at-grade and depressed options. This reflects the dispersion characteristics of the exhaust stacks at the ventilation buildings.

Tunnel Ventilation Options

Four different options for tunnel ventilation are being assessed. These are as follows:

- Option 1A – Two ventilation buildings each located approximately one third away from the main tunnel entrance/exits
- Option 1B – Two ventilation buildings each located at the main tunnel entrance/exits
- Option 1C – A single ventilation building located approximately half-way between the tunnel main entrance/exits
- Option 2 – Jet fans placed on the tunnel ceiling throughout the tunnel with pollutants being exhausted out the portals instead of ventilation buildings

The preliminary results of the atmospheric dispersion modelling assessment indicate that of the four tunnel ventilation options studied, Option 2 (i.e. using jet fans to ventilate the tunnel through the portals instead of a vent building) is least preferable as it produces the highest concentrations in $PM_{2.5}$ and NO_x at the receptors relative to the other three ventilation options. Also, the jet fans tunnel alternative resulted in higher predicted 1 hour maximum NO_x concentrations in comparison to the at-grade and depressed options, for all of the sensitive and SIA receptors examined.

Of the three ventilation building options assessed, each showed similar slight changes in NO_x and $PM_{2.5}$ concentrations, relative to each other. In general, Option 1B indicated slightly higher concentrations for both $PM_{2.5}$ and NO_x at many of the sensitive and SIA receptors examined.

Plaza Alternatives

Four plaza alternatives are currently being studied (Plazas A, B, B1 & C). The preliminary results indicate that each of the four plaza alternatives studied results in increases in the predicted maximum $PM_{2.5}$ and NO_x concentrations in the vicinity of each of them. The effects of Plazas B, B1 and C are predominantly seen in the area to the west of Ojibway Parkway/E.C. Row Expressway interchange at non-sensitive receptors. In Sandwich Towne, there is no discernible difference in the maximum predicted concentrations between Plaza B and Plaza C.

The effects of Plaza A are seen primarily in the immediate vicinity of the plaza footprint. However, there is no discernible difference in maximum predicted $PM_{2.5}$ and NO_x concentrations between Plaza A and Plaza B alternatives in this area. This is likely due to the effects of the connecting road that leads to Plaza B.

Crossing Alternatives

Three bridge crossing alternatives are currently being studied. Preliminary atmospheric dispersion modeling indicates that each of the three crossing alternatives results in increases in the predicted $PM_{2.5}$ and NO_x concentrations in the vicinity of the crossings and the connecting route between each plaza and bridge. Changes in the predicted concentrations of $PM_{2.5}$ and NO_x resulting from Crossings A and B are primarily seen in the area to the west of Ojibway Parkway/E.C. Row Expressway interchange at non-sensitive receptors. In Sandwich Towne, there is no discernible difference in the predicted maximum $PM_{2.5}$ and NO_x concentrations from these crossing alternatives.

However, Crossing C (including the connection to the crossing from the plaza sites) shows slight increases in the predicted maximum $PM_{2.5}$ and NO_x concentrations in Sandwich Towne.

Remaining Activities

Modelling of the changes in air quality is ongoing. Further analysis of the data is required to assess all of the potential changes to air quality, to assess specific impacts or benefits related to individual alternatives. The results presented in this document are preliminary, and are subject to change.

Additional activities to be completed are as follows:

- additional analysis of alternatives, including modelling of interim future years (2015 and 2025)
- further refinement of traffic data, emissions and final QA/QC of results
- assessment of refinements to alternatives.

These tasks will be completed in the following months, such that all analysis will be completed and the results finalized in 2007.