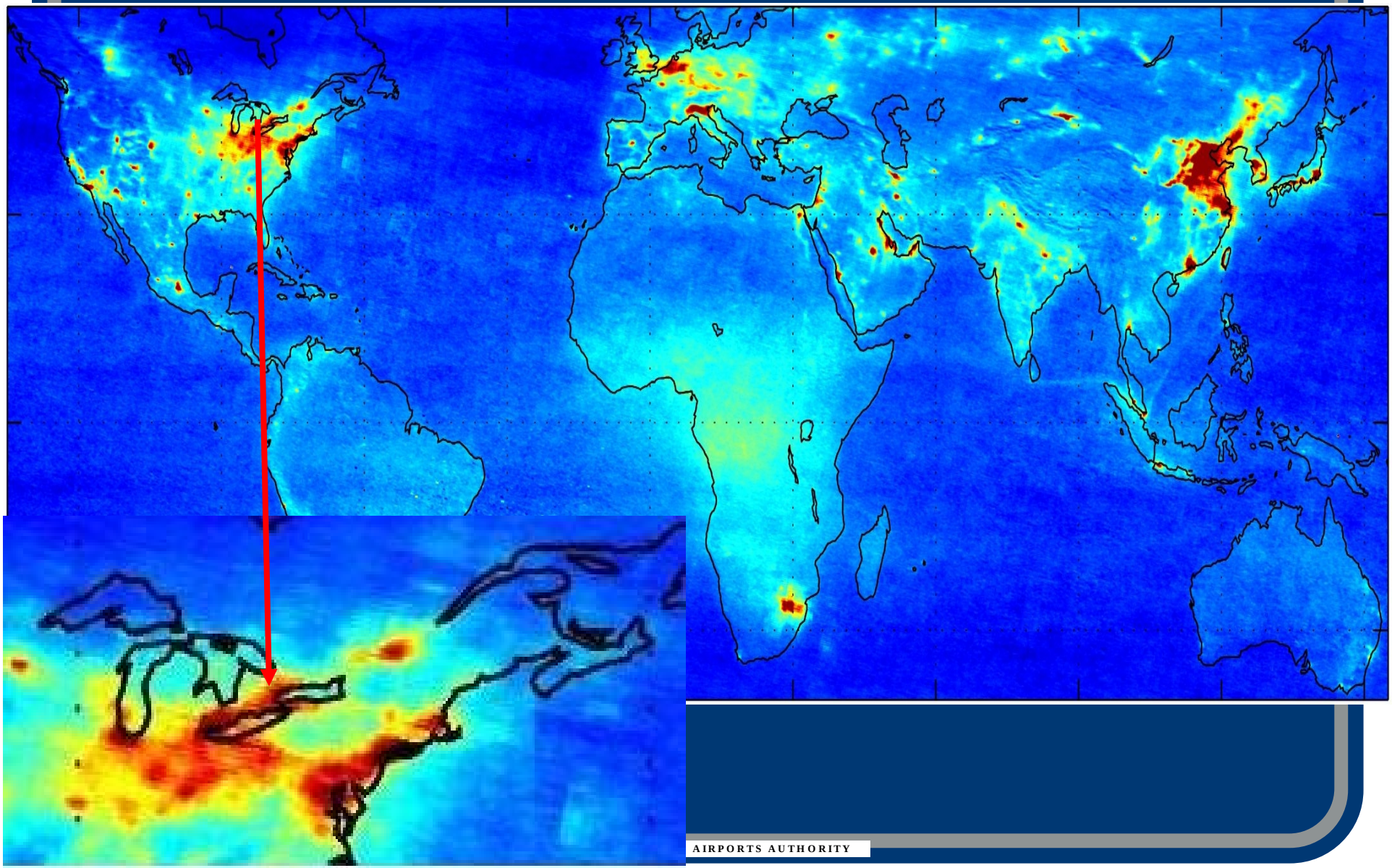
# Global $NO_x$ 2004 per Envisat



# Focusing Emission Reductions


## Results from Recent Air Quality Modeling, Monitoring and Health Risk Assessments

# Toronto Pearson International Airport

- 29.9 million passengers
- 5 runways
- 426,500 a/c movements per year
- $4.4 B Terminal Dev.

# Background

- 1990 Environmental Assessment for the Addition of 3 Runways
- Air Emissions not to Increase
- 1990s Emphasis on Criteria Pollutants
- 2000s Emphasis on VOC's and PM10/2.5
- Health Issues

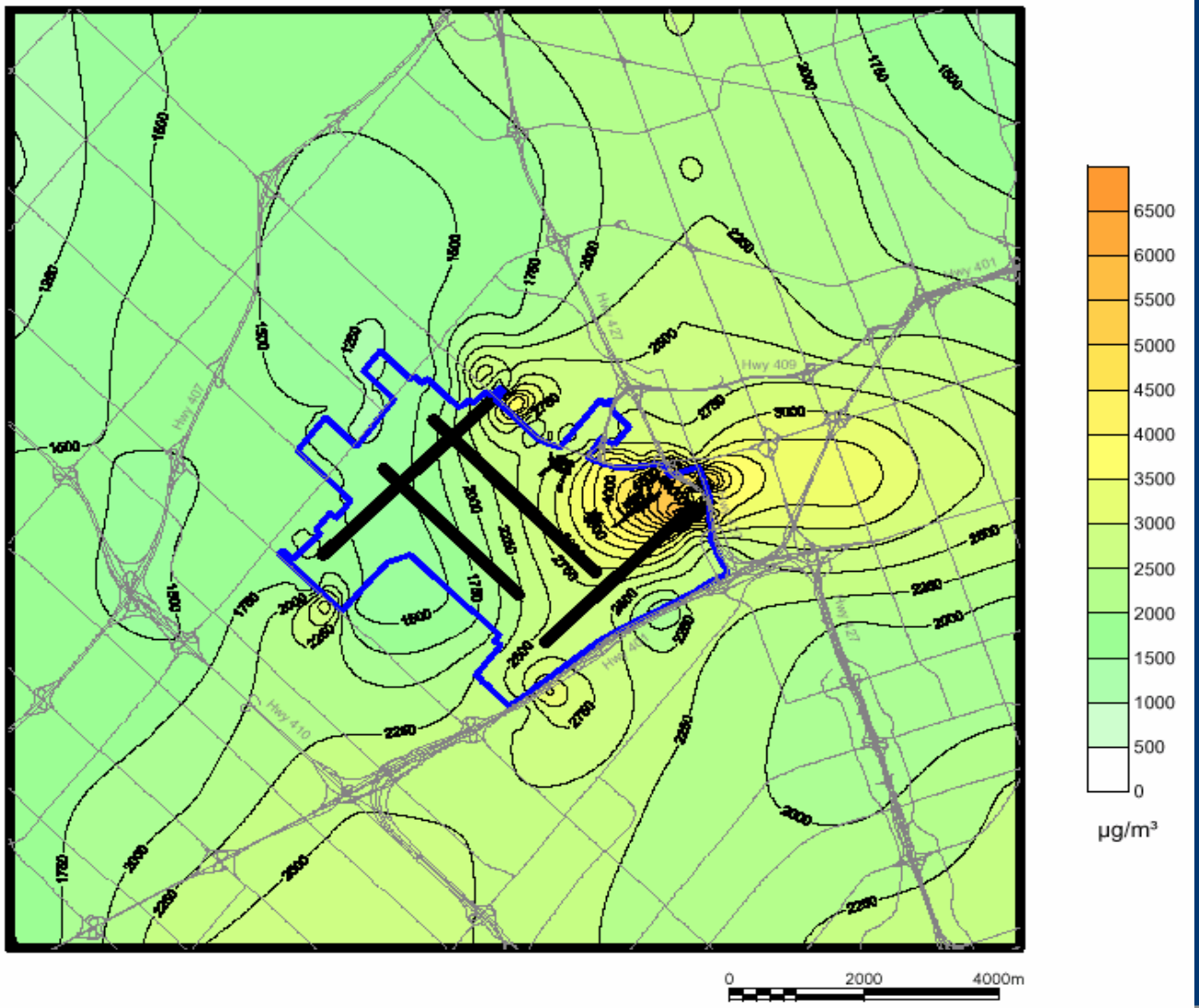
# Recent Toronto Studies

- Modeling and Health Risk Assessment – 2004
- One Year Ambient Air Quality Study – 2006 (Criteria Pollutants plus 160 OCs)
- Workplace Health and Safety – Baggage Stripping and Cargo Tunnels -2005/6

# Possible Problem – $NO_x$

- Dominant sources of $NO_x$ emissions were aircraft (airport) and industrial point sources (off-site). Overall results……..
- $NO_2$ predicted to exceed 1-h AAQC/AQO (all years) but none measured in 1999-2000 and 2005-2006 studies

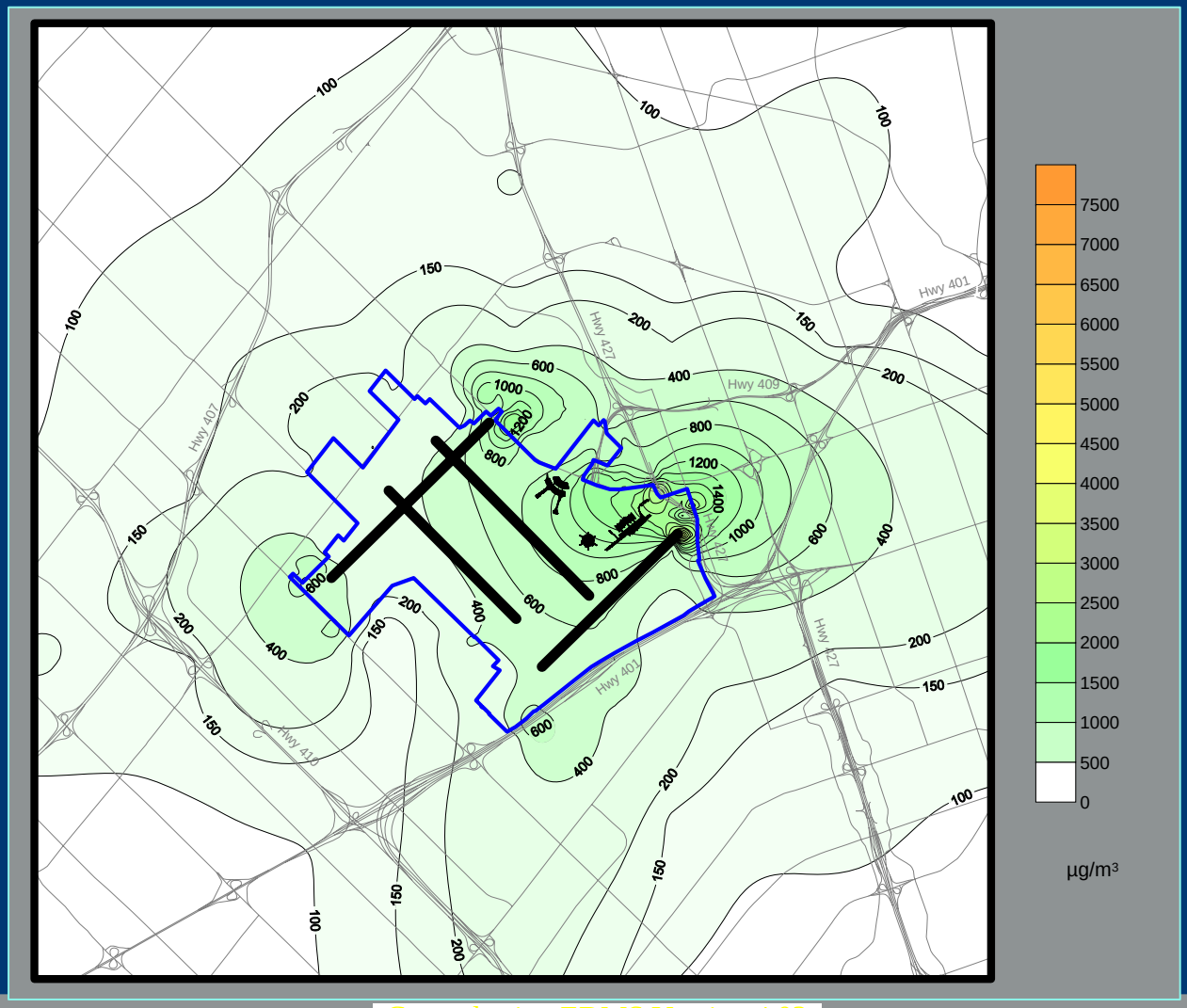
# Year 2000 Predicted Maximum 1-Hour $NO_X$ Concentration, Phase 3






Created using LDM3 Version 4.03

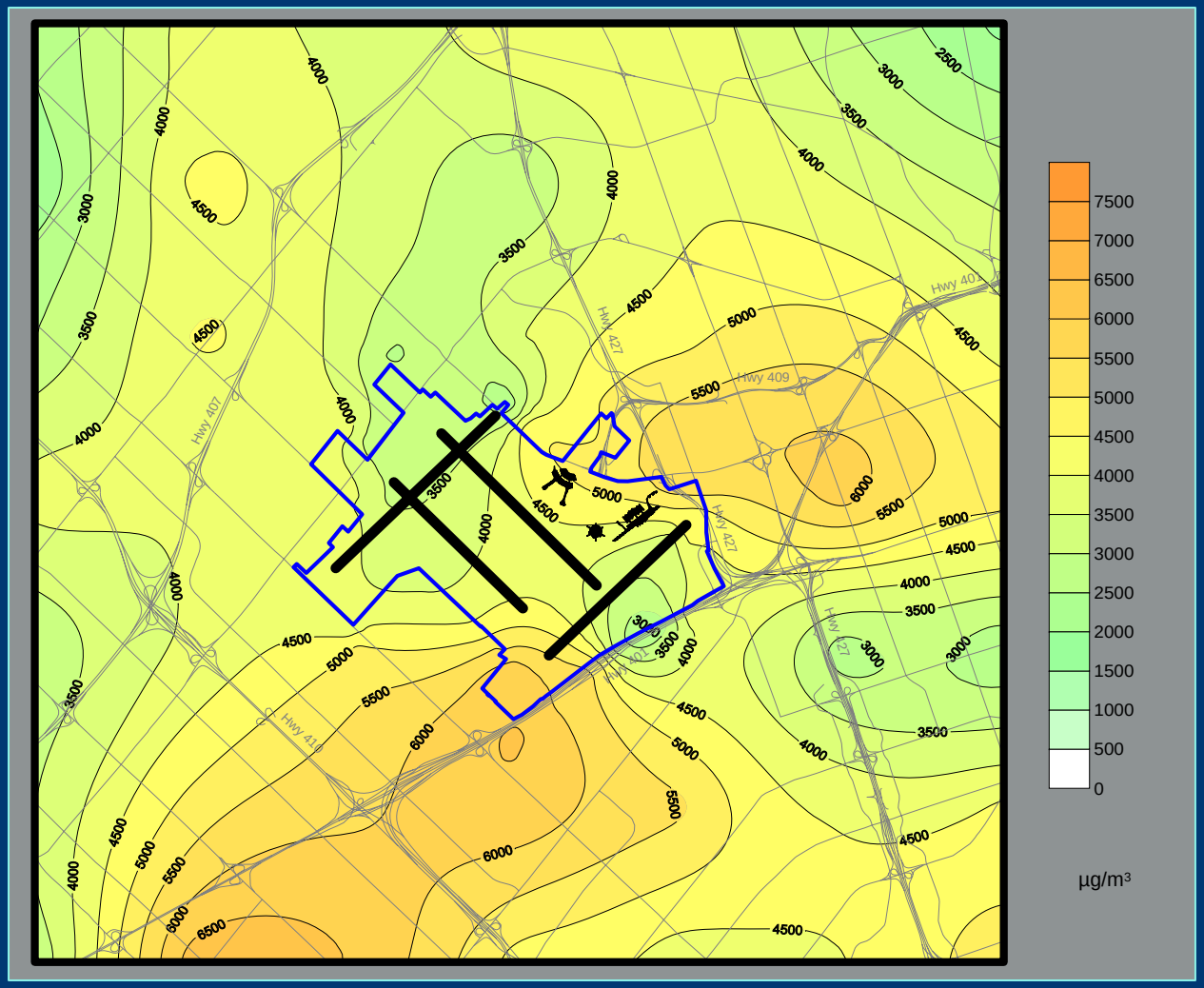
# Airport Emissions 1-Hour VOC





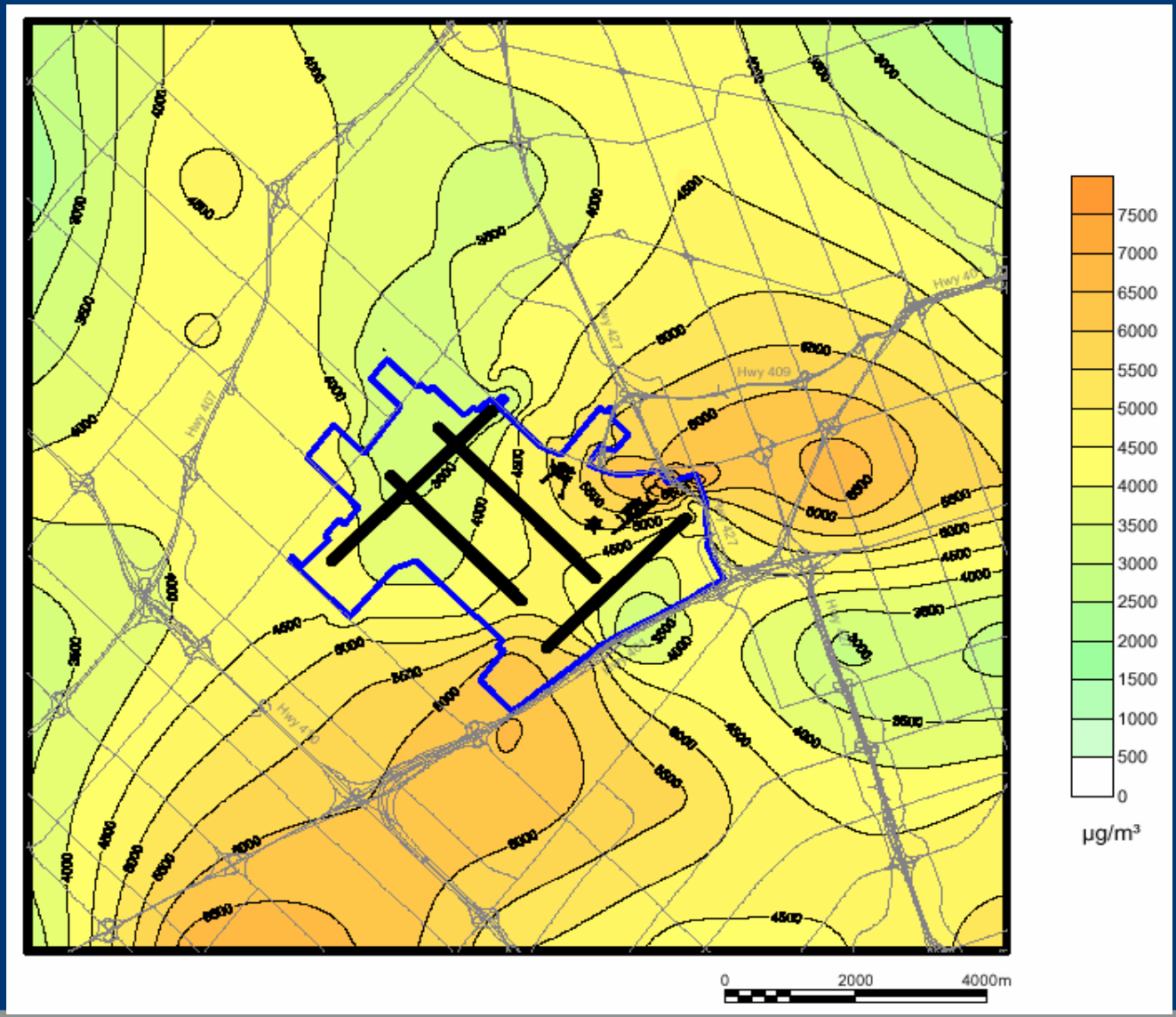

Created using EDMS Version 4.03

# Off-site Emissions 1-Hour VOC




Created using LDM3 Version 4.03

# On and Off-site Emissions
# 1-Hour VOC Concentration





Created using LDM3 Version 4.03

# AQ Study Results

- The maximum predicted 1-hour and annual NOx concentrations are expected to remain unchanged for future years, relative to base conditions.
- There are no predicted health risks associated with any of the other criteria pollutants examined

# Results: Long-Term Impacts Airport Emissions

## Carbonyl Compounds

- **Results for Carbonyl Compounds**
  - **(15 compounds including Formaldehyde, Acetaldehyde, Acrolein, etc.)**
  - **It was determined that at these concentrations, no measurable adverse health effects would result at any chosen residential location, using the most sensitive receptor chosen (a female child).**

**-Marginal Acrolein exceedance.**

# Results: Long-Term Impacts, Airport Emissions VOC/PAH

- **Phase 1 predicted Cancer Risks and Exposure Ratios for VOC and PAH Concentrations**
  - **None of the short-term or long-term air concentrations of VOCs or PAHs predicted for airport sources exceeded health (toxicity) criteria**
    - **All Exposure Ratios (ERs) for non-cancer endpoints were less than a value of one (1) at the location of maximum off-site concentration and seven off-site receptors**
    - **All the Cancer Risk Levels (CRLs) were less than one-in-a-million at the location of maximum off-site concentration and the seven off-site receptors.**

# Monitoring Results

# Monitoring 2005-2006

- 14 months of data
- Criteria Pollutants
- 52 Canister Samples tested for 165 Separate Organic Compounds Sampled every 6 days

# Monitoring Results

- Airport observations Correlate well with Local Air Quality Monitoring Station
- Criteria Pollutants within Guidelines with the Exception of Ozone
- Apron Site was the Dirtiest
- All Organic Compounds (checked) with the Exception of Acetaldehyde were Less than those used in the Previous Modeling Results (HHRA)

# Health and Safety Monitoring

- **Baggage Stripping Road-High CO Levels**

# Summary of Air Sampling Data at T1 for Area and Personal

| Location | VOCs (ppm) | | | CO (ppm) | | | $NO_2$ (ppm) | | | Particulates ($mg/m^3$) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Avg. | Min. | Max | Avg. | Min. | Max | Avg. | Min. | Max. | Avg. |
| CF1 | **0.0** | **0.0** | **0.0** | **0.0** | **4** | **0.14** | **0.0** | **0.3** | **0.0** | - | - | - |
| CF2 | **0.0** | **0.0** | **0.0** | **0.0** | **9** | **0.21** | **0.0** | **0.1** | **0.0** | - | - | - |
| CF3A | **0.0** | **0.0** | **0.0** | **0.0** | **29** | **1.19** | **0.0** | **0.6** | **0.05** | - | - | - |
| CF6 | - | **0.5** | **0.2** | **0.0** | **14** | **0.74** | **0.0** | **0.5** | **0.0** | - | - | - |
| CF7 | **0.0** | **13.2** | **0.7** | **0.0** | **45** | **1.5** | **0.0** | **0.4** | **0.04** | - | - | - |
| CF9 | **0.0** | **0.0** | **0.0** | **0.0** | **22** | **0.97** | **0.0** | **0.0** | **0.0** | - | - | - |
| OSS-1 | **0.0** | **0.0** | **0.0** | **0.0** | **13** | **0.94** | **0.0** | **0.2** | **0.0** | - | - | - |
| OSS-2 | - | **0.0** | **0.0** | **0.0** | **11** | **0.54** | **0.0** | **0.2** | **0.0** | - | - | - |
| OSS1/OSS4 | **0.0** | **0.0** | **0.0** | **0.0** | **22** | **0.88** | **0.0** | **0.2** | **0.0** | - | - | - |
| BC 3 | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.6** | **0.0** | - | - | - |
| Rudy | - | - | - | **0.0** | **38.0** | **0.0** | - | - | - | **0.003** | **0.929** | **0.078** |
| Nelson | - | - | - | **0.0** | **37** | **0.0** | - | - | - | **0.005** | **0.382** | **0.035** |
| Mark | - | - | - | **0.0** | **5.0** | **0.0** | - | - | - | **0.000** | **3.734** | **0.091** |
| Justin | - | - | - | **0.0** | **34.0** | **0.0** | - | - | - | **0.000** | **36.89** | **0.162** |
| Andrew | - | - | - | **0.0** | **663** | **1.12** | - | - | - | **0.006** | **0.615** | **0.055** |
| Sandra | - | - | - | **0.0** | **17.3** | **1.47** | - | - | - | **0.006** | **0.351** | **0.03** |

# Problem Area – Terminal Apron

## Pollutants of Concern:

- CO
- Acetaldehyde is 4X Modeled

# Aldehydes & Ketones

## Perth/Ruskin

| Carbonyl | Jet Emission: Range % Idle-Taxi | Diesel: Ranking | |
|---|---|---|---|
| **Formaldehyde** | 37-70% | **1** (LD =45%, HD = 26%) | **Combined LD = 63-75% HD = 50%** |
| **Acetaldehyde** | 9-41% | **2** | |
| **Acetone** | 4-45% | **3** | |
| **Acrolein** | 3.7-16% | **11** | |
| **Propanal** | 1.4-7.5% | **13** | |
| **Crotonaldehyde** | 0.7-5.1% | **4** | |

# Airside Emission Sources

- Aircraft
- GSE
  - Luggage
  - Cargo
  - Fuel
  - De-icing
  - Water
  - Heating/Cooling
  - Electric Power
- Airfield Maintenance

# Conclusion

# Thank You

# Conditioned Clean Air

**Replacing APU with power and A/C at the gate has saved Air Canada $300K in fuel costs at YUL**

**It would save environment + $1 million at YYZ!**

# Co-generation Plant

# 10 Years of Emission Reductions

- Airside
- Efficiency
- Private Vehicles
- Ground Side Vehicles
- Fixed Sources