Residual Waste Study

Air Quality Assessment

Greg Crooks, P.Eng.

Joint Waste Management Group (JWMG) - May 26, 2009

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AIR QUALITY ASSESSMENT
Methodology

- The Air Quality Assessment completed as part of the Environmental Assessment (EA) included:
  - Development of emissions inventories for point and mobile sources from the Facility;
  - Ambient Air Monitoring to assess current concentrations of chemicals in the air at Clarington 01;
  - Dispersion and deposition modeling of the Facility emissions; and,
  - Comparison of predicted results to provincial or federal regulatory standards, objectives and guidelines.

AIR QUALITY ASSESSMENT
Facility Emissions

- Data used to estimate emissions from the Facility were taken from three primary data sources:
  - Guarantees provided by Covanta. Guarantees are the maximum emissions level of a particular contaminant allowed to be emitted from the Facility.
  - Stack testing of one or more of the vendor's existing facilities which use similar technologies and are representative of emissions from the proposed facility.
  - Literature data sources for other facilities including U.S. EPA emissions factors and published emissions data from other facilities.

AIR QUALITY ASSESSMENT
Existing Air Quality

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- Ambient air monitoring was conducted in the vicinity of the Site to measure the following key indicators of ambient air quality:
  - Criteria Air Contaminants (SO_2, NO_x, CO, Ozone, and $PM_{2.5}$)
  - Total Suspended Particulate (TSP) matter and metals;
  - Polycyclic Aromatic Hydrocarbons (PAHs); and,
  - Dioxins and Furans.

Courtice Road Monitoring Station

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AIR QUALITY ASSESSMENT
Air Dispersion Modelling
Study Area

- The Study Area for the air quality dispersion modelling was comprised of a 40 km by 30 km domain. This size domain was chosen to ensure that not only the maximum ground level concentrations due the Facility would be assessed, but also lower concentration levels at greater distances from the Facility. See figure on next slide.

AIR QUALITY ASSESSMENT
Air Dispersion Modelling
Study Area

DURHAM REGION | York Region

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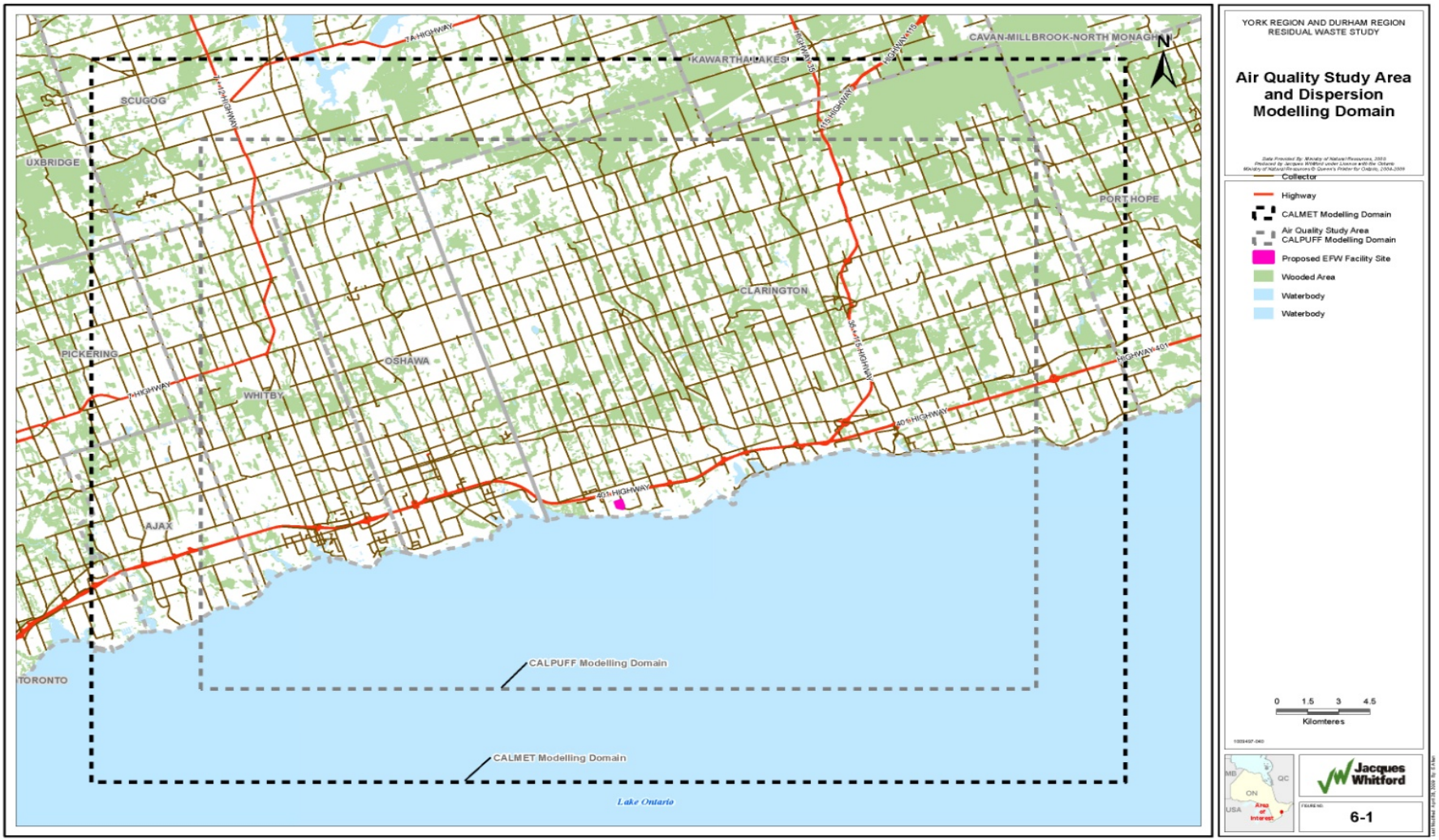

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AIR QUALITY ASSESSMENT
Model Prediction Locations

- Dispersion model predictions were made over a grid of 4415 receptors covering the entire study area, as well as at 391 sensitive receptors (e.g. hospitals, schools, nearby residences, parks, daycares, etc). See figures on next slides.

AIR QUALITY ASSESSMENT
Model Prediction Locations

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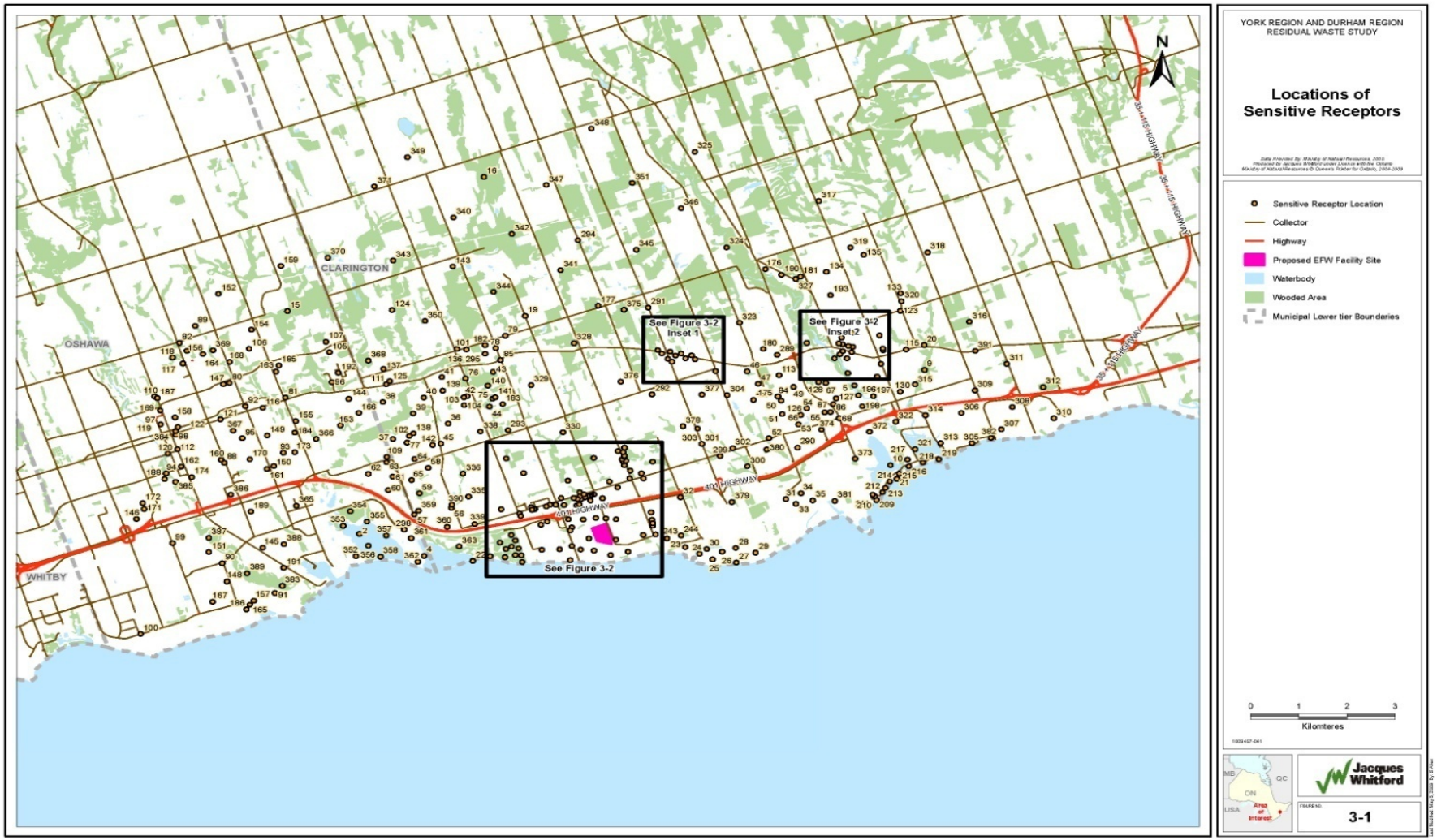

AIR QUALITY ASSESSMENT
Model Prediction Locations

DURHAM REGION

York Region

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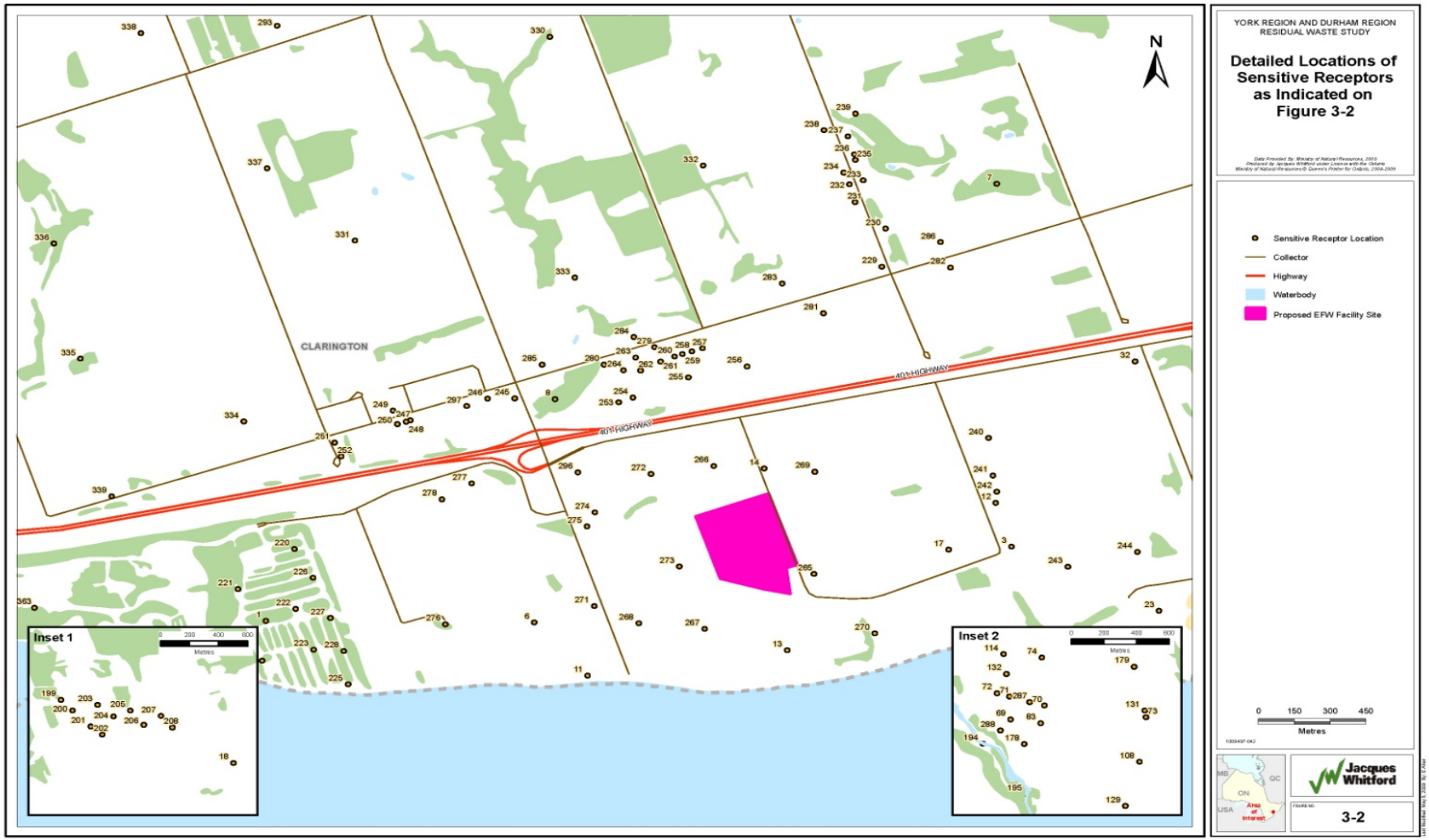

AIR QUALITY ASSESSMENT
Dispersion Modelling

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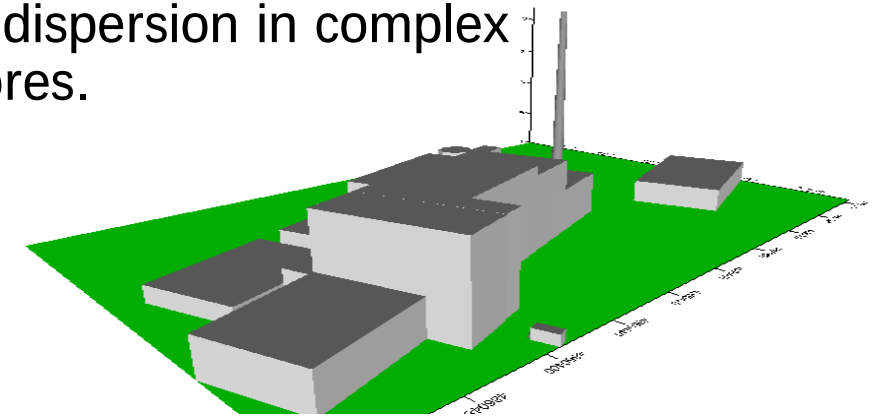
- A total of 90 potential contaminants of concern (CoPCs) were evaluated (including criteria air contaminants, dioxins and furans, PAHs, VOCs and metals).
- The U.S. EPA CALPUFF model was used for the dispersion modelling because of its ability to account for dispersion in complex environments such as near lake shores.
- The CALPUFF model accounts for atmospheric processes including building wake effects, changes in terrain, thermal internal boundary layer effects, secondary particulate formation and thermal inversions.



3-D View of Facility Data used to Account for Building Wake Effects

AIR QUALITY ASSESSMENT
Overview of Results

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- Comparison to Ambient Air Quality Criteria, Objectives, and Standards
  - Emissions from the Facility alone and in combination with existing air quality levels were assessed and compared to applicable provincial/federal criteria.
  - During normal operations, emissions from the Facility in combination with existing air quality levels are predicted to **meet all applicable provincial/federal air quality criteria** for all contaminants (continuous operation at maximum capacity).
  - During process upsets, (including start-up and shut-downs) emissions from the Facility in combination with existing air quality levels are predicted to **meet all applicable provincial/federal air quality criteria for all contaminants.**

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AIR QUALITY ASSESSMENT
Overview of Results

- Changes in Ground Level Ozone
  - Based on the magnitudes of the NO_x and VOC (ozone pre-cursor), emissions from the Facility relative to the existing emission levels in the region (1.4% and 0.5% respectively), changes in ground level ozone are expected to be minimal.
- Odour Detectability
  - Based on Covanta's proposed mitigation measures for odour control, including operating the Facility under negative pressure to avoid odour emissions leaving the buildings, there is not expected to be adverse off-property odour effects.

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Site Specific Human Health and Ecological Risk Assessment

Christopher Ollson, Ph.D.

Joint Waste Management Group (JWMG) - May 26, 2009

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Site Specific vs. Generic Risk Assessment

- There are significant differences between the generic and site specific risk assessments:

Generic Risk Assessment	Site Specific Risk Assessment
Generic Background/Baseline Data	Quantitative Analysis of Existing Conditions in the Assessment Area
Hypothetical Receptor Locations	Physical Receptor Locations Chosen from Within the Study Area
Generic EFW Emissions Data	Emissions Data from Comparable Facility Constructed by Preferred Vendor

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Risk Assessment Framework

Public Communication and Consultation

Problem Formulation

Are there Project-related chemicals in the environment that can adversely affect the health of people or ecological receptors? How do these chemicals come into contact with people or wildlife?

Toxicity Assessment

What amount of these chemicals is linked to environmental effects to human or ecological health?

Exposure Assessment

To what degree are people and ecological receptors exposed to these chemicals?

Risk Characterization

When predicted exposure levels are compared to exposure limits, is an increased risk predicted? If so, how do we reduce the identified risks?

Uncertainty Analysis/Validation of Data

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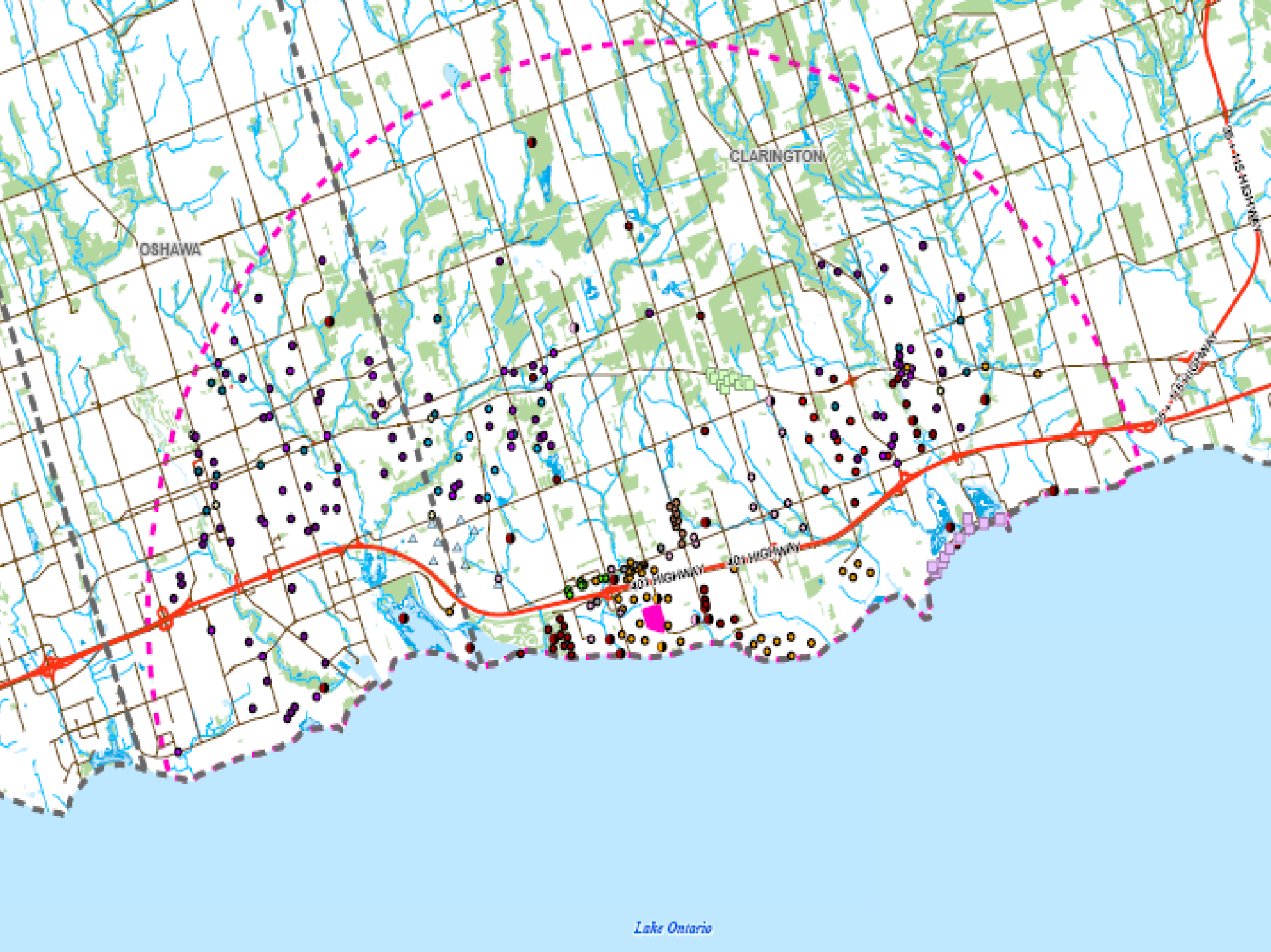
Risk Assessment Methodology

- The risk assessment followed a widely accepted risk assessment framework
  - Collected Baseline Data from various locations within the Local Assessment Area
  - Selected receptor locations based on public input, landuse, location etc.
  - Compiled a comprehensive list of Chemicals of Potential Concern that may be emitted from the facility


OSHAWA
CLARINGTON
401 HIGHWAY
401 HIGHWAY
Lake Ontario

Scenarios Evaluated in the Human Health and Ecological Risk Assessment

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Baseline Scenarios	• Baseline Case • Baseline Traffic Case
Construction Scenario	• Construction Case*
Operational Scenarios	• Project Alone Case • Project Case • Process Upset Case • Process Upset Project Case • Traffic Case • Future Case*
Decommissioning Scenario	• Decommissioning Case*

* These Cases were only evaluated qualitatively

Chemicals of Potential Concern

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Criteria Air Contaminants			Chlorinated Polycyclic Aromatics
Ammonia* Hydrogen Chloride (HCl)* Hydrogen Fluoride (HF)*	Nitrogen Dioxide (NO_2)* Particulate Matter ($PM_{2.5}$)* Particulate Matter (PM_{10})*	Sulphur Dioxide (SO_2)* Total Particulate Matter*	Total PCBs (as Aroclor 1254) 2,3,7,8-TCDD TEQ (dioxin/furan)

Metals	Chlorinated Monocyclic Aromatics	Polycyclic Aromatic Hydrocarbons	Volatile Organic Compounds
Antimony	1,2-Dichlorobenzene	Acenaphthylene	Acetaldehyde*
Arsenic	1,2,4-Trichlorobenzene	Acenaphthene	Benzene*
Barium	1,2,4,5-Tetrachlorobenzene	Anthracene	Biphenyl*
Beryllium	2,3,4,6-Tetrachlorophenol*	Benzo(a)anthracene	Bromodichloromethane*
Boron	2,4,6-Trichlorophenol*	Benzo(a)pyrene	Bromoform
Cadmium	2,4-Dichlorophenol*	Benzo(e)pyrene	Bromomethane*
Chromium (Total)	Pentachlorobenzene	Benzo(a)fluorene	Carbon Tetrachloride
Chromium (VI)	Hexachlorobenzene	Benzo(b)fluorene	Chloroform
Cobalt	Pentachlorophenol	Benzo(b)fluoranthene	Dichlorodifluoromethane*
Lead		Benzo(g,h,i)perylene	1,1-Dichloroethene*
Mercury (Inorganic)		Benzo(k)fluoranthene	Dichloromethane
Methyl Mercury		Chrysene	Ethylbenzene*
Nickel		Dibenzo(a,c)anthracene	Ethylene Dibromide*
Phosphorus		Dibenzo(a,h)anthracene	Formaldehyde*
Selenium		Fluoranthene	O-Terphenyl
Silver		Fluorene	Tetrachloroethylene*
Thallium		Indeno(1,2,3-cd)pyrene	Toluene*
Tin		1-Methylnaphthalene*	1,1,1-Trichloroethane
Vanadium		2-Methylnaphthalene*	1,1,2-Trichloroethylene*
Zinc		Naphthalene*	Trichlorofluoromethane
		Perylene	Vinyl Chloride*
* Inhalation Only		Phenanthrene	m-, p-, and o-Xylenes*
		Pyrene	

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Results of the Human Health Risk Assessment

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Human Health Assessments

- The risks to human receptors were evaluated in two ways:
  - **Inhalation Assessment**: The risks associated with inhaling EFW air emissions
    - 309 receptor locations were evaluated for the inhalation assessment
  - **Multi-Pathway Assessment:** The risks associated with exposure to EFW emissions through dermal contact or ingestion of exposed media
    - Dermal contact with soil, dust
    - Ingestion of produce, agricultural products, fish and wild game as well as incidental ingestion of surface water while swimming
    - 132 receptor locations were evaluated

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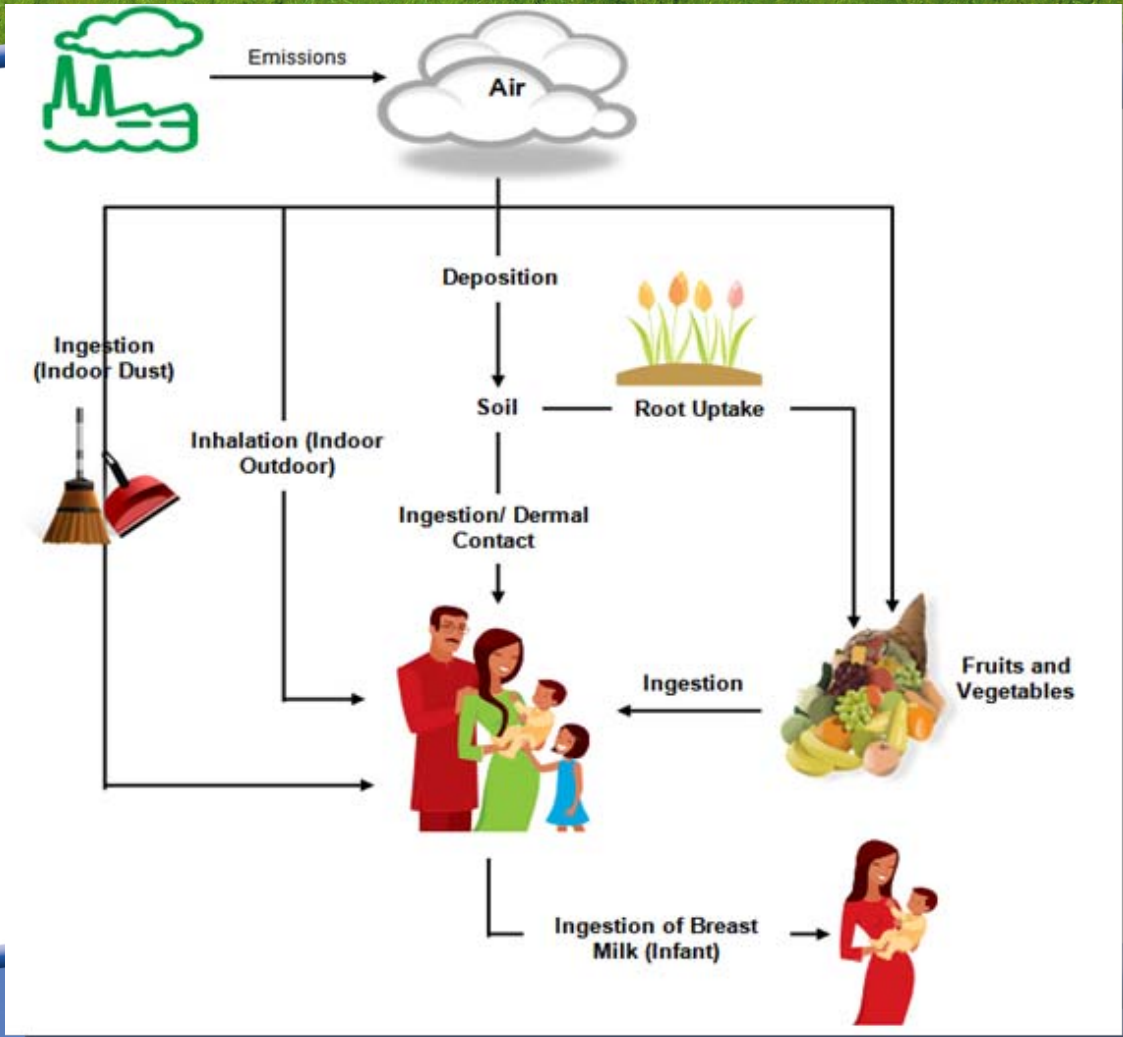
Exposure Pathway used for a Local Resident



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Results of the Inhalation Assessment

- Results indicate that no acute (1-hour or 24-hour) or chronic (annual) risk estimates at the maximum ground level concentration exceeded the regulatory benchmark for all Project Scenarios

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Results of the Human Health Multi-Pathway Risk Assessment

- The results of the multi-pathway assessment indicate that exposure to Facility-related air emissions will result in no adverse health effects to human receptors living or visiting the LRASA.

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Results of the Human Health Multi-Pathway Risk Assessment

- The only exceedences of regulatory benchmarks were from existing conditions in the Baseline Case.
- These risks were not unexpected as any urban area in Ontario would produce similar results. Although some risk was expected from existing conditions, additional exceedences were seen in the Baseline Case that were directly related to
  - 1) the use of laboratory method detection limits as environmental media concentrations, and
  - 2) conservative receptor characteristics used to represent toddler receptor consumption patterns of homegrown produce and agricultural products.

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Results of the Ecological Risk Assessment

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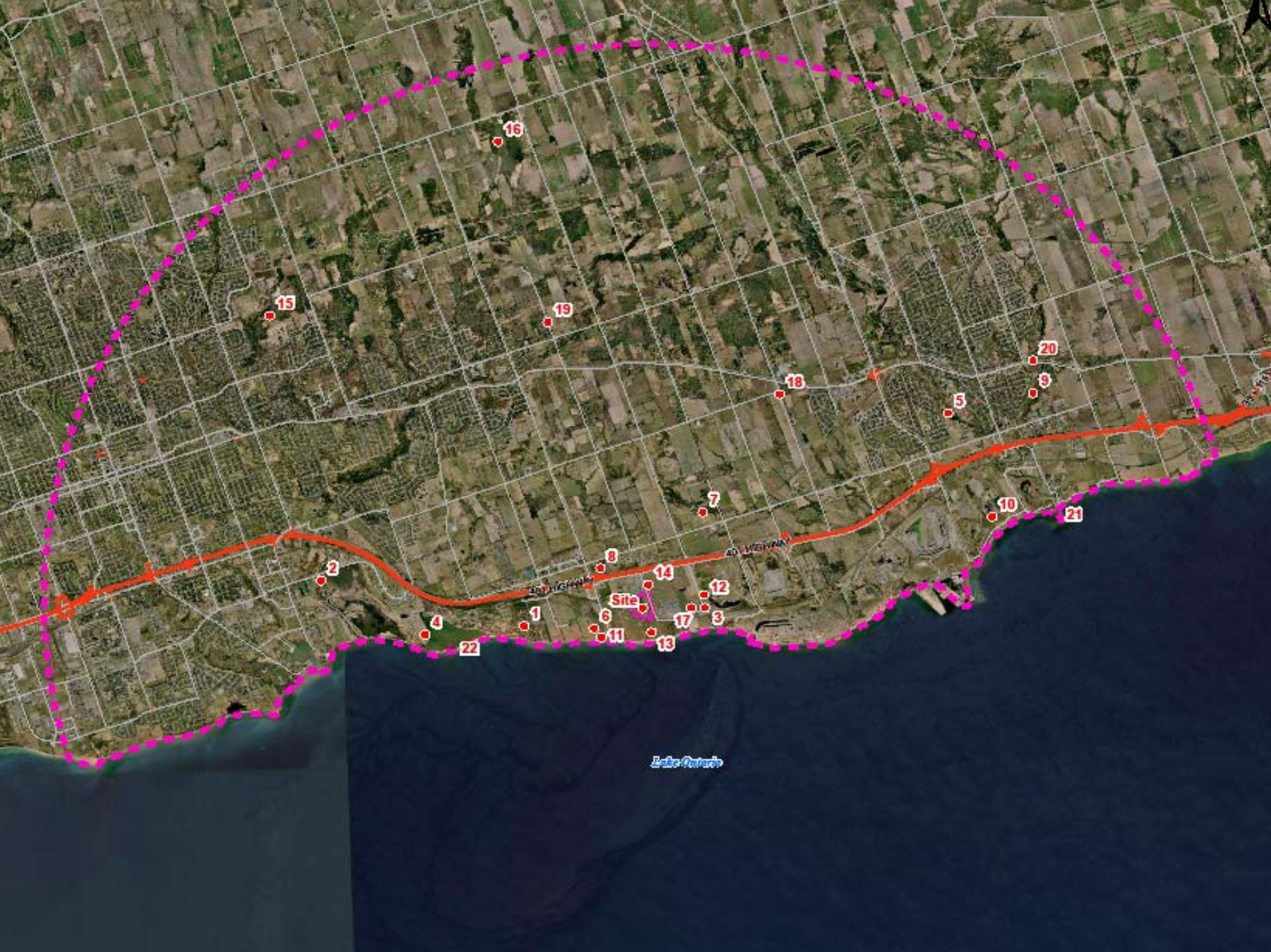
Ecological Risk Assessment Methodology

- The ecological risk assessment followed a recognized framework incorporating guidance from various sources including:
  - Ontario Regulation 153/04 Record of Site Condition Regulation, Part XV.1 of the Environmental Protection Act: Guidance Protocol (MOE, 2004);
  - A Framework for Ecological Risk Assessment (General Guidance) (CCME, 1996);
  - Guidelines for Ecological Risk Assessment (US EPA, 1998); and
  - US EPA Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (US EPA, 1999)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Selection of Valued Ecological Components (VECs)

- Selection of VECs included consideration of wildlife species that were:
  - Indigenous to the area;
  - Most likely to receive the greatest exposure to contaminant releases due to their habitat and home range;
  - Representative of various levels in the food web (*e.g.*, carnivore, herbivore, omnivore); and
  - Of cultural or economic significance (*e.g.*, wild game valued for hunting, fish important to the fisheries industry).

Ecological Receptors Considered in this Assessment: Mammals

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Muskrat

Eastern Cottontail Rabbit

Masked Shrew

Meadow Vole

Mink

Red Fox

White-tailed Deer

Ecological Receptors Considered in this Assessment: Birds

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American Robin

Belted Kingfisher

Great Blue Heron

Mallard Duck

Red-tailed Hawk

Wild Turkey

Ecological Receptors Considered in this Assessment: Community Receptors

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Freshwater Receptors

Benthic Invertebrates

Terrestrial Plants

Terrestrial Invertebrates

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Exposure Pathways

- For terrestrial wildlife receptors (*i.e.*, birds, mammals, plants, soil invertebrates), exposure may occur through the following routes:
  - Direct contact with soils
  - Inhalation
  - Ingestion of soil, sediment, and water
  - Ingestion of plants or prey species that have accumulated chemicals from the soil, and other media
- For freshwater receptors (*i.e.*, fish, benthic invertebrates), exposure may occur through the following routes:
  - Ingestion of sediment
  - Ingestion of aquatic prey
  - Contact with sediment
  - Ingestion/contact with surface water

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Results of the Ecological Risk Assessment

- The only exceedences of regulatory benchmarks were from existing conditions in the Baseline Case in freshwater aquatic system for a limited number of chemicals.
- No undue risk was predicted for ecological receptor for any of the Project-related scenarios modeled.
- No undue risk was predicted for any Species at Risk that would be found within the area.

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Ecological Risk Assessment Conclusions

- The use of laboratory detection limits as estimated concentrations was considered a conservative and protective measure in the ecological risk assessment and for the most part resulted in Baseline Case risks to aquatic receptors.

- It is important to note the reported Ecological Hazard Quotient values are expected to be generally similar to other background areas in Ontario.

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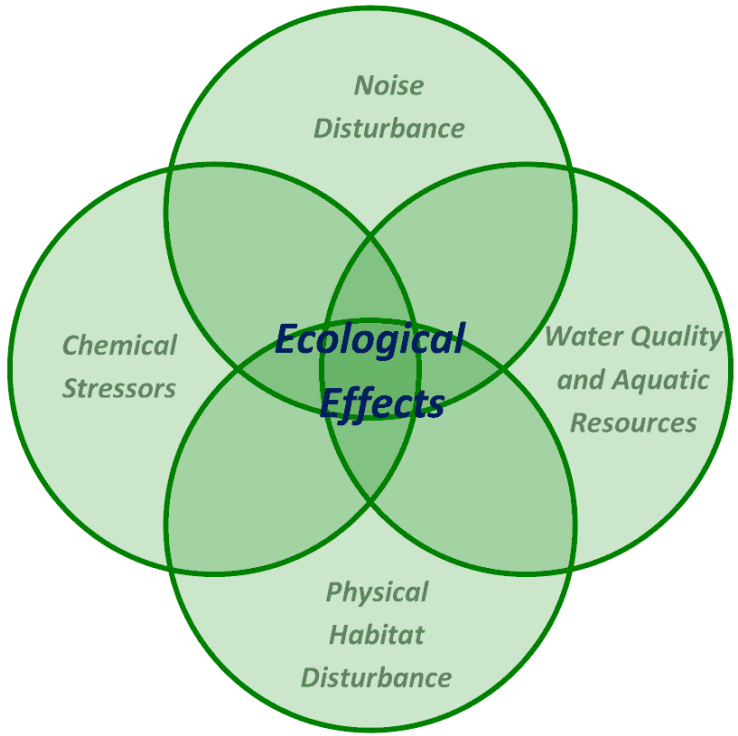
Ecological Risk Assessment Conclusions

- The combination of chemical (Project emissions of COPC) and non-chemical stressors (noise, habitat alteration, water resources), are not expected to have an effect on ecological receptors in the Local Risk Assessment Study Area.



Conclusion

- The site-specific risk assessment determined that the proposed Covanta facility operating at 140,000 tonnes of MSW/year could be safely operated at the Clarington 01 site without undue risk to either people or the environment.