Minutes
Coordination Committee
Monday, June 8, 2026, 3:00 – 5:00 pm
Microsoft Teams

Present:
Rama Goparaju – ESI (Presenter), Alan Lynch – Arcadis (Presenter), Ali Shirook, ESI, Barry Duffey-Citizen, Chyler Sewell -Green Venture Dr. Charles Hostovsky-McMaster, Daniel McCulloch, George Mckibbon - McKibbon Wakefield, Philana Dollin-HC, Natalie Stacey-MECP, Lucas Neil – Stantec, Sara Mroue-ESI, Shelley Rogers, City of Hamilton, Stacey Currie, City of Hamilton, Stephen Burt- MECP, Susan Chapman- Citizen STAND for Stoney Creek, Trevor Imhoff, City of Hamilton, Tim Hung-MECP, Zobia Jawed-Chair, Zoe Davis-ECCC

1. **Land Acknowledgement**

The City of Hamilton is situated upon the traditional territories of the Erie, Neutral, Huron-Wendat, Haudenosaunee and Mississaugas. This land is covered by the Dish With One Spoon Wampum Belt Covenant, which was an agreement between the Haudenosaunee and Anishinaabek to share and care for the resources around the Great Lakes. We further acknowledge that this land is covered by the Between the Lakes Purchase, 1792, between the Crown and the Mississaugas of the Credit First Nation.

Today, the City of Hamilton is home to many Indigenous people from across Turtle Island (North America) and we recognize that we must do more to learn about the rich history of this land so that we can better understand our roles as residents, neighbours, partners and caretakers (source).

2. **Approval of March 9, 2026 meeting minutes – approved with 10 votes**

Presentations:

3. **(20 minutes) Rama Goparaju (ESI) and Alan Lynch (Arcadis) ESI –**

- **Tracking Institutional Emissions: A Data-Driven Path to Net Zero (Rama Goparaju) See presentation below**

How did the monitoring compare to Federal and/or Provincial Ambient Air Quality Standards? They did validate against MECP stations in Hamilton. PM 2.5 showed nearly identical trends. Ozone was moderately strong correlated. The others were not very well correlated. Again, there's location influence as well, but we did make sure to validate our data against the MECP and it is in a section within the report that we'd submitted. Suggested to show graphs what ESI is monitoring as it relates to the AAQC thresholds. Followed up from ESI that they think all of these will be found in the report. Rama just didn't want to provide actual numbers on the presentation but rather provided trends and kind of what we found in general, but not providing the actual data.

- ***Advancing Odour and Emissions Investigations: From Complaints to Plume Intelligence (Alan Lynch) See presentation below***

Where was the case study landfill? It is confidential at the moment, and they cannot disclose it at the moment. Airspace is not owned. There are restrictions on airspace and regulatory requirements on that, but it enables you to assess a potential source for emissions without having to enter the property where those emissions may be occurring. So it enables you to understand what may be being emitted from that source. It enables you to access possible conditions without having to enter or go to the owner of that site by having mounted equipment on drones. The drone monitoring enables you to gain knowledge which you normally wouldn't be able to do.

Discussion Items:

4. **Dust and Particulate Matter group updates, (5 mins) Shelley**

    - Continuing to work on the PDF for industrial fires and messaging for wood burning and wood smoke. Hoping to hear more from the in-person meeting to figure out more about the direction on how the group should go. They are scheduled to meet next Monday. The information could be ready for the Clean Air Hamilton website soon.

5. **Public Outreach and Education group updates, (5 mins) Zobia**

    - The group will begin to meet within the month or so now that we are post the in-person meeting. The group will reconvene and make sure that the direction aligns with some of the things discussed in the in-person meeting.

6. **Zobia delegated the 2022-2023 CAH report to council. (5 mins) Zobia**

    - It was well received and lots of questions. A few of the Councillors want to have a discussion about Clean Air Hamilton and how they can provide support post upcoming Municipal Election.

7. **Upwind Downwind May 26th conference. Last day for post conference survey is June 9th. (5 mins) Stacey**

    - Approximately 50 in person, 7 online.
    - Was their any community participation? Perhaps offer a limited number of tickets free to the public in case any barriers so that more can attend.
    - Great venue, Great food, Great presentations!
    - Longer lead-time in marketing and promotion would help with ticket sales and attract more vendors.
    - Encourage people to use public transit. Possible free transport to the conference.

8. **Community Experiences: an opportunity for anyone to share local air quality experiences, All (10 minutes)**

    - **Stoney Creek residents suing GFL over odour at local landfill**

- Article surrounding the experiences of the Stoney Creek community. 4th consecutive summer that TRS exceedances and items have not been resolved. Mentioned that some residents have lived there since 1996 and complaints were less than 10 per year and now, they exceed 1000s. Thanked Stephen Burt and MECP for providing support. Said if any questions they can reach out to Susan for more information.

9. Roundtable Updates: an opportunity for everyone to share with CAH participants events or updates that relate to CAH and that you are engaged in, All (10 minutes)

- Office of the climate change initiatives – Director moving forward on the Climate Change Reserve 2026 funded projects at GIC on June 17th. They also have partnership with economic development related to a clean tech manufacturing strategy for the City of Hamilton that economic development will be moving forward to GIC June 17th. Annual climate change progress report, which is tentatively scheduled for July 29th. That's where our office provides updates on Hamilton's community and corporate greenhouse gas emissions inventory, as well as our progress on overall implementation of Hamilton's climate action strategy.
- Does anyone know what type of air pollution issues you can get from an AI data work centre? It is in regard to the large number of emergency generators that are on site as they are diesel generators.

10. Reminder for the summer we will be cancelling the August meeting

Next meeting

July 13, 2026 **3:00-5:00pm** **Microsoft Teams**

TRACKING INSTITUTIONAL EMISSIONS

A Data-Driven Path to Net Zero

Campus-Scale Air Quality Monitoring and Source Attribution Study

City of Hamilton | Project Reference: RFP C5-05-25

Rama Goparaju
VP, Solution Architecture & Delivery
Ecosystem Informatics Inc.

Project led by:

McMASTER INSTITUTE FOR TRANSPORTATION & LOGISTICS

esi ecosystem informatics inc.

Project Collaboration Partners

McMaster University

Hamilton

About Ecosystem Informatics Inc.(ESI)

ESI is an Canadian environmental technology company specializing in advanced air monitoring and environmental intelligence with a fully integrated, end-to-end platform for environmental measurement and management.

01 **HARDWARE + DATA**

Rugged multi-sensor units combined with cloud analytics and alerting.

02 **AI-DRIVEN CALIBRATION**

Patented self-calibration keeps sensors accurate across changing field conditions.

03 **STATIONARY + MOBILE**

Adaptable to ground vehicles and aerial platforms via movement-correction algorithms.

04 **ACTIONABLE INTELLIGENCE**

Supports compliance, risk mitigation, and proactive operational and environmental management.

Acknowledgements

Thank you to our McMaster University partners and collaborators for their support throughout the study:

- **Mario Barricelli**

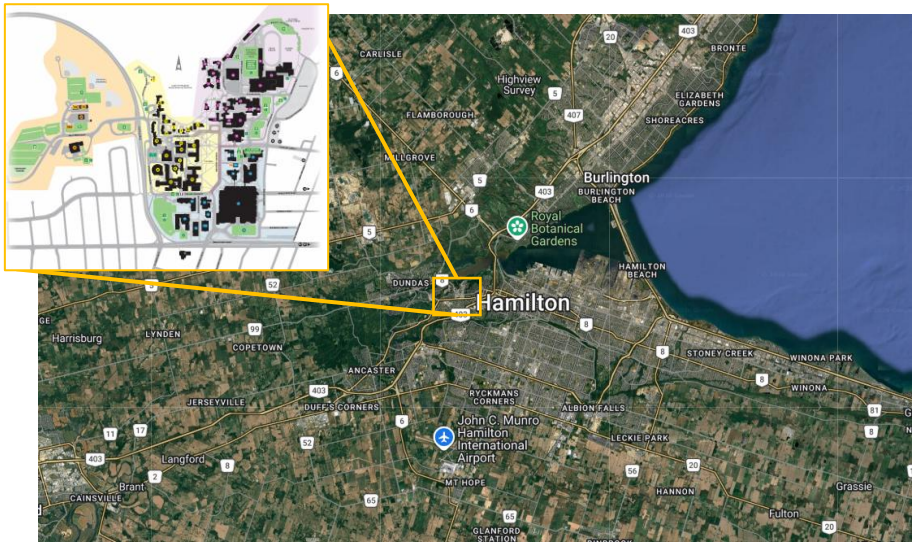
  Parking Services IT Manager
- **Dave Cano, MEB, M.E.Sc., CEM, PMP, CMVP, LEED® Green Associate**

  Director, Sustainability
- **Bob Shaw**

  Manager of Electrical Operations, Maintenance, Facility Services
- **Dr. Elkafi Hassini**

  Professor, Associate Dean, Research, and Purolator Research Chair in Sustainable Logistics and Supply Chain Management, DeGroote School of Business

Project Context



Hamilton & McMaster University

- Historically industrial urban center with diverse emission sources
- McMaster: high daily population turnover (students, staff, visitors)
- Proximity to Highway 403 and key arterial roadways
- Integrated with Westdale and Ainslie Wood communities
- Both city and university have Net Zero commitments

The Need

Move beyond generalized emissions estimates toward measured, location-specific insights reflecting real-world conditions.

Study Objectives

01

Characterize Air Quality

Map spatial and temporal air quality variations across the McMaster campus environment.

02

Identify Emission Hotspots

Locate areas of elevated pollutants linked to mobility, congestion, service activity, and operations.

03

Assess Temporal Patterns

Understand how air quality changes by time of day, traffic intensity, and campus activity patterns.

04

Support Evidence-Based Action

Inform campus planning, mobility strategies, operational improvements, and Net Zero initiatives.

Monitoring Design

Hybrid monitoring design: combined fixed and mobile air quality monitoring.

Study area: McMaster University campus and surrounding road/campus activity zones.

Parameters measured: CO, CO_2, NO_2, O_3, SO_2, $PM_{2.5}$, temperature, humidity, and pressure.

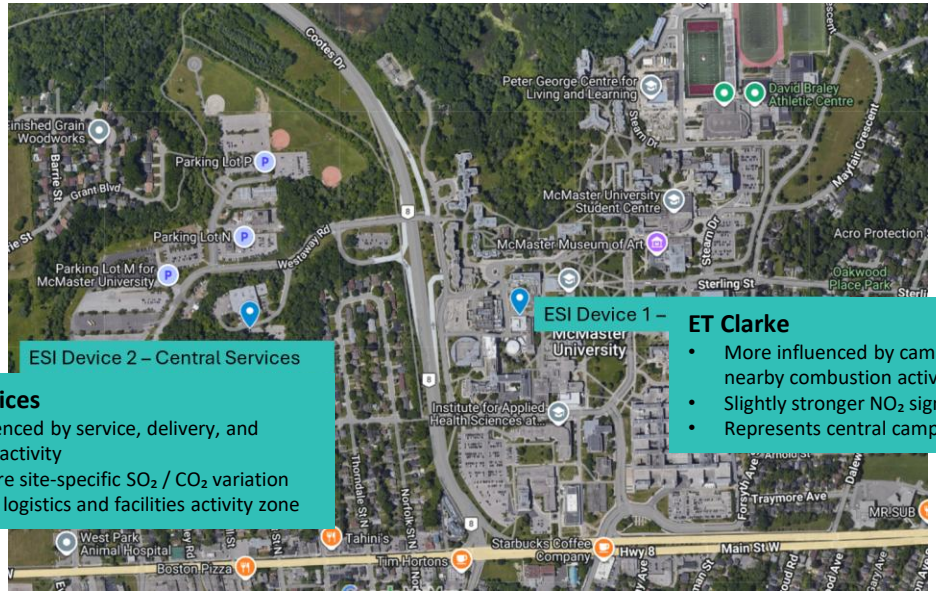
Monitoring Period: Feb-March 2026

Fixed monitoring: used to capture continuous baseline conditions and time-based trends.

- 2 fixed units deployed continuously
- ET Clarke Centre (high traffic)
- Central Services (logistics zone)

Key Findings – Fixed Monitoring

Similar overall trend → Different local influences → Different pollutant behaviour



Central Services

- More influenced by service, delivery, and operations activity
- Slightly more site-specific SO_2 / CO_2 variation
- Represents logistics and facilities activity zone

ET Clarke

- More influenced by campus traffic / nearby combustion activity
- Slightly stronger NO_2 signal
- Represents central campus activity zone

- Overall pollutant patterns were broadly similar across both locations.
- **$PM_{2.5}$ showed the strongest consistency** between the two sites.
- **CO and O_3 were also closely aligned**, suggesting stable monitoring performance.
- **NO_2 and SO_2 showed more site-specific variation**, likely due to localized traffic, combustion, or operational activity.

Key Findings – Fixed Monitoring – Diurnal Patterns

CO

Highest early morning, declining through day

Reduced traffic + increased atmospheric dispersion

NO_2

Stable through day, slight midday dip, evening rise

Traffic-influenced, localized emission sensitivity

$PM_{2.5}$

Clear midday peak, rising through morning

Daytime accumulation from mixed combustion sources

CO_2

Pronounced midday increase, esp. Central Services

Localized activity patterns and site-specific ventilation

Both monitoring locations show consistent diurnal trends, strongest for $PM_{2.5}$ and O_3

Key Findings – Fixed Monitoring - Weekday vs. Weekend Patterns

Campus activity had a clear influence on air quality patterns.

- **$PM_{2.5}$, CO, NO_2, and CO_2 were higher on weekdays** compared to weekends.
- Weekday increases likely reflect higher levels of commuting, campus traffic, service vehicles, deliveries, and operational activity.
- **Weekend reductions** suggest that lower campus activity was associated with improved ambient air quality for combustion-related pollutants.

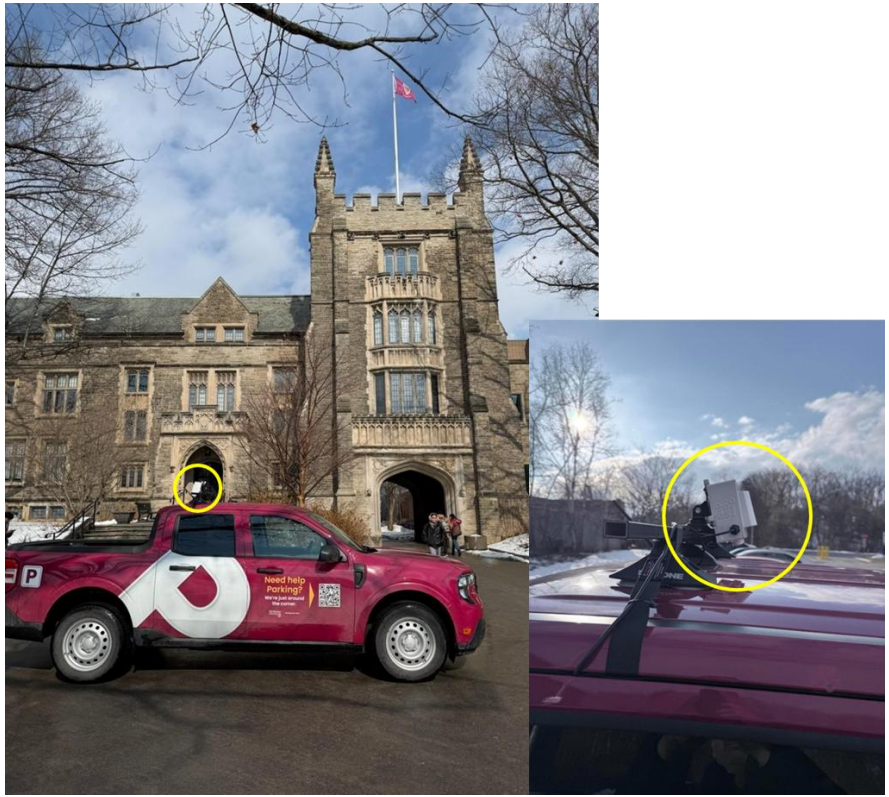
Key Findings

- CO, NO_2, CO_2, and $PM_{2.5}$ are consistently higher on weekdays (For example, over 35% reduction in $PM_{2.5}$ on weekends versus weekdays at both locations)
- SO_2 shows minor variation, higher at Central Services suggesting localized influence
- Clear activity-driven pattern confirms traffic as dominant emission source

Monitoring Design – Mobile Monitoring

Mobile monitoring: used to map spatial variation across campus and identify localized hotspots.

- 2 mobile units on fleet vehicles
- Georeferenced measurements across campus
- High-traffic corridors and service zones



Mobile Monitoring - Coverage

Spatial distribution of mobile data coverage

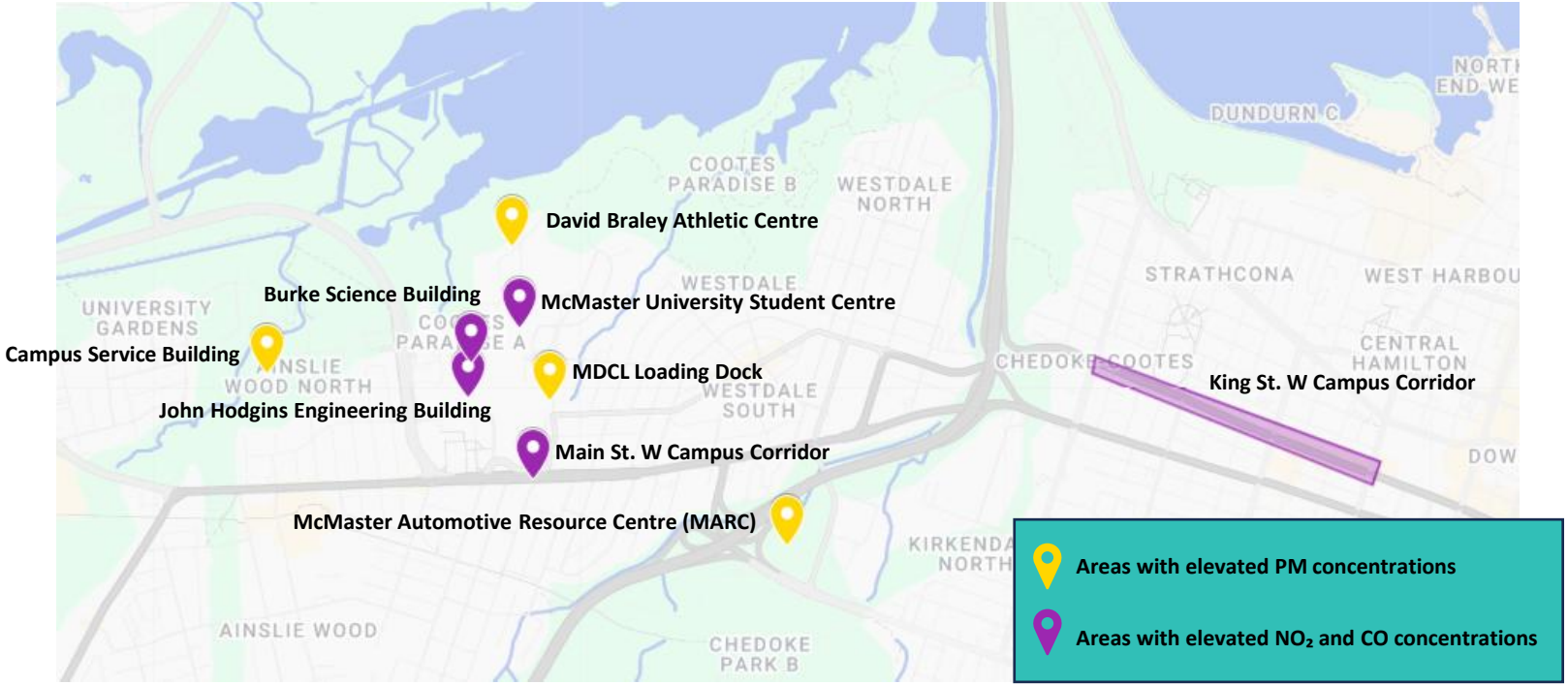
Mobile units were installed on McMaster campus vehicles, allowing data collection as vehicles travelled **in and around campus** during normal operations.

Spatial Aggregation Method

- Mobile data was grouped into H3 hexagonal grid cells
- Sparse cells were removed to improve reliability
- Pollutant concentrations were averaged within each cell
- Mobile results were normalized against fixed monitoring baselines

H3 hexagonal aggregation

Mobile Monitoring – Spatial Hotspots



Hotspots concentrate along King Street and around campus buildings with high traffic density (MUSC, JHE, BSB)

Interpretation & Ground-Truthing

Hotspot locations were reviewed with McMaster staff to better understand possible local drivers.

Campus context helped explain where elevated readings may align with:

- service routes and loading areas
- traffic and parking activity
- construction or maintenance work
- building operations and campus circulation

Primary: Vehicular Traffic

- King Street congestion, idling, and high vehicle density
- Campus buildings MUSC, JHE, BSB surroundings
- Elevated NO_2 and CO concentrations

Secondary: Stationary Combustion

- Central boiler plant near ET Clarke
- Consistently higher NO_2 at ET Clarke location beyond traffic alone
- Steadier background influence compared with traffic-driven variability

Localized: Construction & Operations

- $PM_{2.5}$ hotspots near MARC / active construction area
- Episodic but meaningful short-term impacts
- Central Services showed higher variability from logistics and service activity

Recommendations: Traffic & Infrastructure

Traffic Management

- Anti-idling enforcement in hotspot zones (King St, campus core)
- Traffic flow optimization at key intersections and campus access points
- Evaluate restricted or low-emission zones in high-density areas
- Traffic re-routing or access control during peak periods

Boiler & Infrastructure Optimization

- Assess boiler performance and emission efficiency
- Optimize operational schedules during reduced demand periods
- Evaluate emission reduction technologies or system upgrades
- Long-term transition strategies: electrification or hybrid heating

Recommendations: Monitoring & Planning

Construction & Dust Control

- Dust suppression measures: water application and physical barriers
- Monitor high-activity construction phases for peak emissions
- Align construction activities with favorable meteorological conditions

Monitoring Strategy

- Continue fixed monitoring for long-term trend tracking
- Periodic mobile campaigns to validate evolving hotspots
- Expand monitoring coverage to high-risk areas
- Integrate data into real-time dashboards and alert systems

Planning & Policy Integration

- Use hotspot findings to inform campus mobility, parking, and service-route planning
- Prioritize interventions in areas where campus activity overlaps with elevated pollutant patterns

Conclusion & Key Learnings

- **Fixed + mobile monitoring provides a fuller picture**
  Fixed units show how air quality changes over time, while mobile units show how it changes by location.
- **Campus air quality is highly local**
  Conditions can change across short distances depending on traffic, service activity, construction, and building operations.
- **Different pollutants point to different source types**
  NO_2 and CO helped identify traffic and combustion patterns, while $PM_{2.5}$ highlighted localized particulate sources.
- **Ground-truthing improves interpretation**
  Input from McMaster staff helped connect hotspot patterns to real campus operations.
- **The approach is scalable across institutions**
  The same fixed + mobile monitoring model can be applied to other campuses, hospitals, municipalities, and public institutions.
- **Monitoring supports action, not just reporting**
  The data can support mobility planning, operational changes, Net Zero strategies, and targeted emissions reduction.

This project showed that institutional emissions can be measured, mapped, and acted upon, and that the same approach has the potential to be scaled across other campuses and public-sector environments.

Thank You!

Queries and Feedback

Appendix

Data Validation vs. MECP Stations

ESI measurements compared against 3 MECP stations: Hamilton Downtown, Hamilton West, Hamilton Mountain

$PM_{2.5}$	Strong	Nearly identical temporal trends and magnitude across all stations
O_3	Moderate–Strong	Smooth photochemical patterns well-captured, consistent across sites
CO	Moderate	Stable trends with moderate fluctuations, early March peak well-captured
NO_2	Variable	Greater variability due to localized traffic influences and microenvironment
SO_2	Variable	Low ambient concentrations make comparisons sensitive to small differences

All measured concentrations remained well below Ontario 1-hour AAQC thresholds throughout the monitoring period

Advancing Odour and Emissions Investigation: From Complaints to Plume Intelligence

Dr. Shirook Ali
CEO/CTO,
Ecosystem Informatics Inc.

Alan Lynch
Senior Scientist,
Arcadis Environmental Solutions

Agenda

01 **Hamilton's Odour Challenge**
Context and community impact

02 **Facility Context**
Landfill, composting, wastewater, industrial

03 **The Monitoring Gap**
Why sampling and fixed stations fall short

04 **Drone-Based Air Monitoring**
H_2S, VOCs, plume delineation

05 **From Data to Action**
Modeling, verification, and next steps

The Odour Challenge

Odour complaints are often:

- intermittent
- location-specific
- wind-driven

Odour impacts can also involve multiple compounds, including:

- H_2S
- VOCs
- reduced sulphur compounds
- Ammonia
- composting emissions

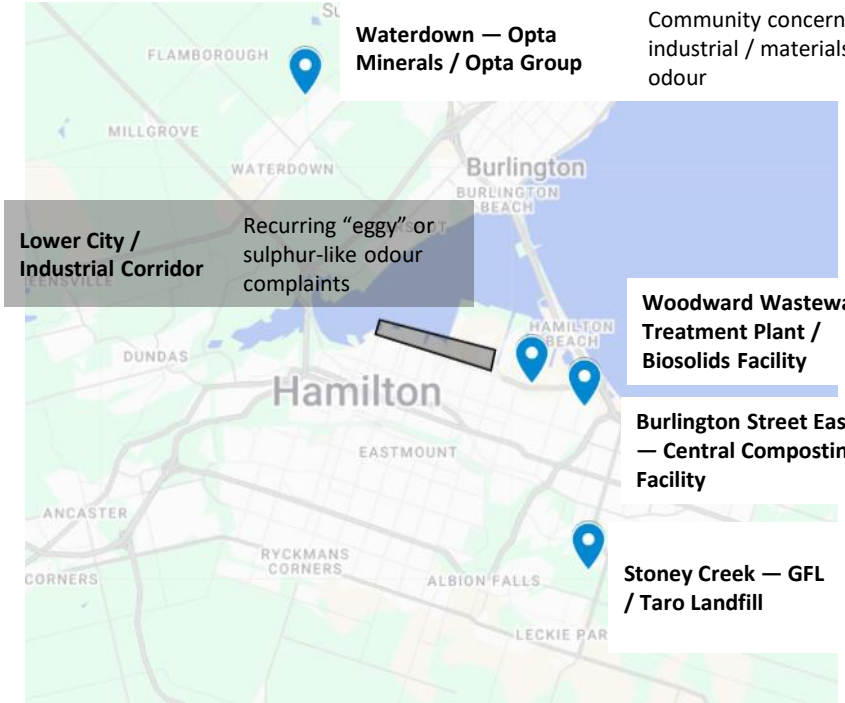
Based on the facility, there are other pollutants involved when odours are present:

- industrial process emissions
- Biosolids emissions
- Landfill gas (methane related)

A resident may experience a strong odour for a short period, while a nearby fixed monitor or periodic sampler may miss the event entirely. The human nose is typically more sensitive than monitoring equipment.

Odour is not always a constant concentration problem. It is often influenced by type of event, plume dimension, source strength, wind (direction/turbulence), and receptor perception problem.

Hamilton Context: Recurring Odour Concerns Across the Region



Waterdown — Opta Minerals / Opta Group

Community concern around industrial / materials-processing odour

Lower City / Industrial Corridor

Recurring "eggy" or sulphur-like odour complaints

Woodward Wastewater Treatment Plant / Biosolids Facility

Sewage and biosolids odours; complaints; MECP action-plan response

Burlington Street East — Central Composting Facility

Major compost odour issue, facility shutdown, and fine

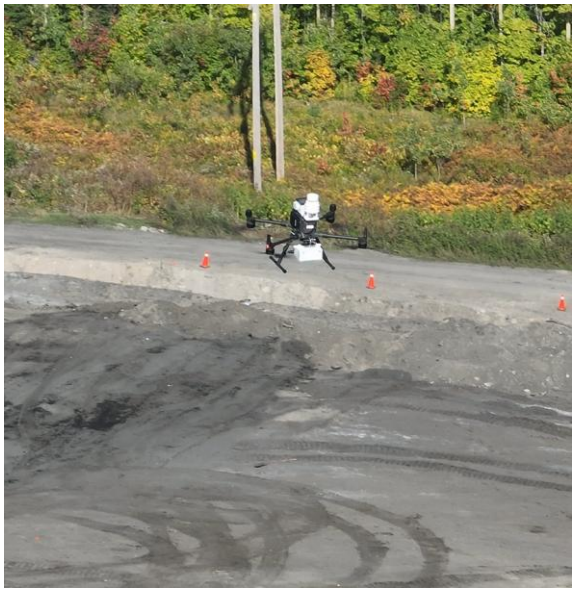
Stoney Creek — GFL / Taro Landfill

Rotten egg, sulphur, and landfill-type odours; resident complaints; health concerns; legal escalation; school siting concerns

These examples suggest a broader regional need for improved odour investigation methods that combine complaints, wind, source context, monitoring, and targeted follow-up.

Important Note: These examples should be understood as documented areas of public concern, not as a claim that any specific facility is responsible for every odour complaint.

The monitoring gap



Spatial Blind Spots

Sampling/Fixed monitors only measure conditions at one location. If the plume shifts with wind or source activity, the monitor may sit outside the impacted area or capture only part of the event.

Limited Coverage

Sampling /Ground-based monitoring can miss how far an odour or emission plume travels across neighbourhoods, receptors, or facility boundaries.

Vertical Gaps

Odour and gas plumes do not always stay at ground level. Depending on wind, temperature, source height, and gas behaviour, impacts may occur above or below fixed sensor height.

Reactive, Not Proactive

Complaint logs, inspections, and occasional sampling are useful, but often capture events after they occur. They may not show plume movement, source context, or where impacts may appear next.

A stronger odour investigation needs spatial, temporal, meteorological, and chemical context and not just isolated measurements.

What “plume intelligence” means

Where is the event strongest?

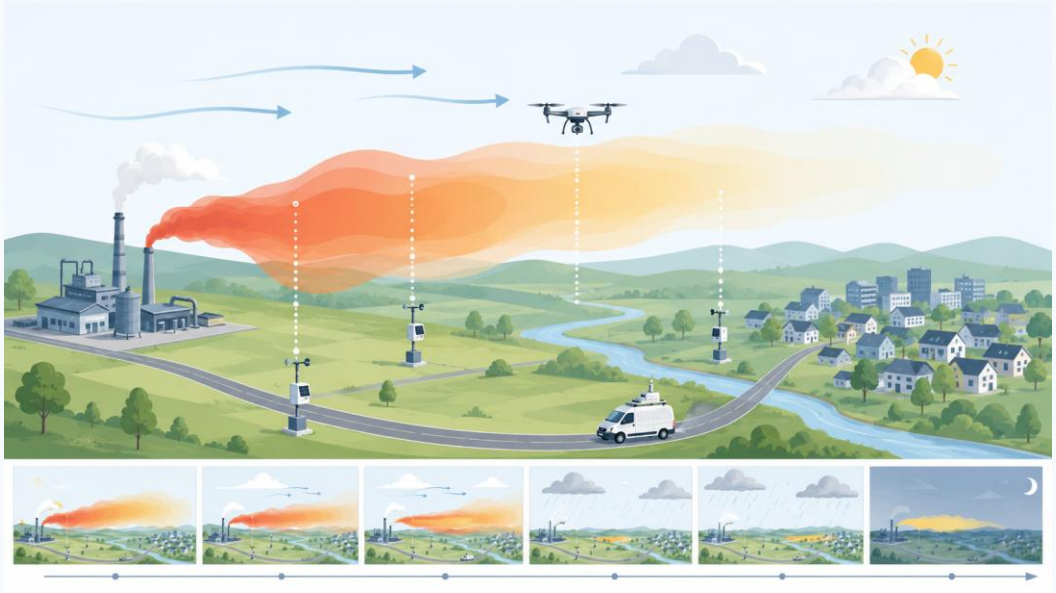
Identifies concentration hotspots or likely plume centreline

Where should follow-up occur?

Guides targeted sampling, inspections, or fixed monitor placement

Is it changing over time?

Tracks concentration shifts during operations or weather changes



How is it moving?

Uses wind direction, wind speed, and terrain/context

Does it align with known source areas?

Compares events with site locations, operations, and wind patterns

Who may be affected?

Identifies downwind receptors, neighbourhoods, schools, or facilities

Is it ground-level or elevated?

Helps understand vertical plume behaviour

Plume intelligence does not replace sampling or regulatory investigation. It helps make those efforts more targeted, timely, and evidence-based.

Role of Drones in Odour and Emissions Investigations

Flux Plane Mapping

Builds a vertical “cross-section” of the plume to calculate the total mass of parameters transported downwind within the air mass.

Vertical Plume Profiling

Shows whether the odour or gas is staying near ground level, rising, or mixing/heterogenous at different heights.

Upwind / Downwind Comparison

Separates background conditions from potential source influence by comparing air before and after it passes a suspected source area.

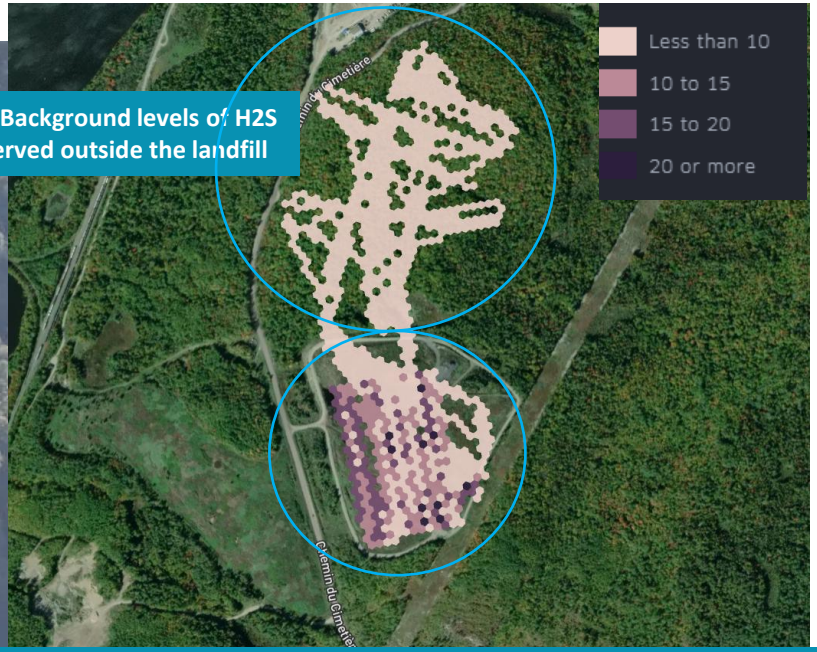
Targeting Follow-Up Sampling

Results help determine where fixed monitors, canisters, lab sampling, or inspections should be focused so supplemental assessment is not guesswork.

Drones do not replace fixed monitors or lab sampling. The results focus investigations by demonstrating plume dynamics (transport/dispersion), and focus ground-based assessment.

Drone Data Collection

Sitewide scans

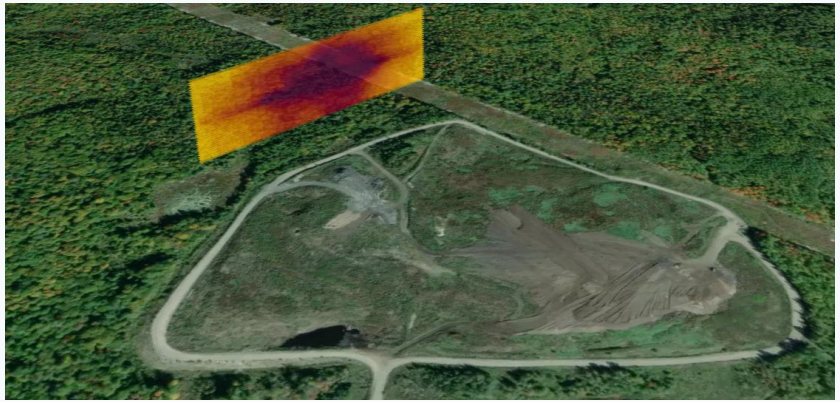


Only Background levels of H2S observed outside the landfill

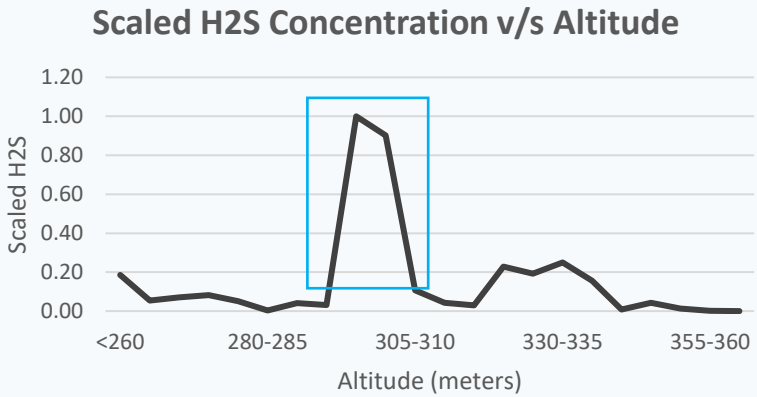
Drone-based monitoring can reveal the spatial pattern of an odour or gas signal across a site, rather than relying on a single fixed point. The stronger signal appears concentrated in the lower / southern portion

Drone Based Emissions Analysis in Practice

Vertical Flux Plane Mapping

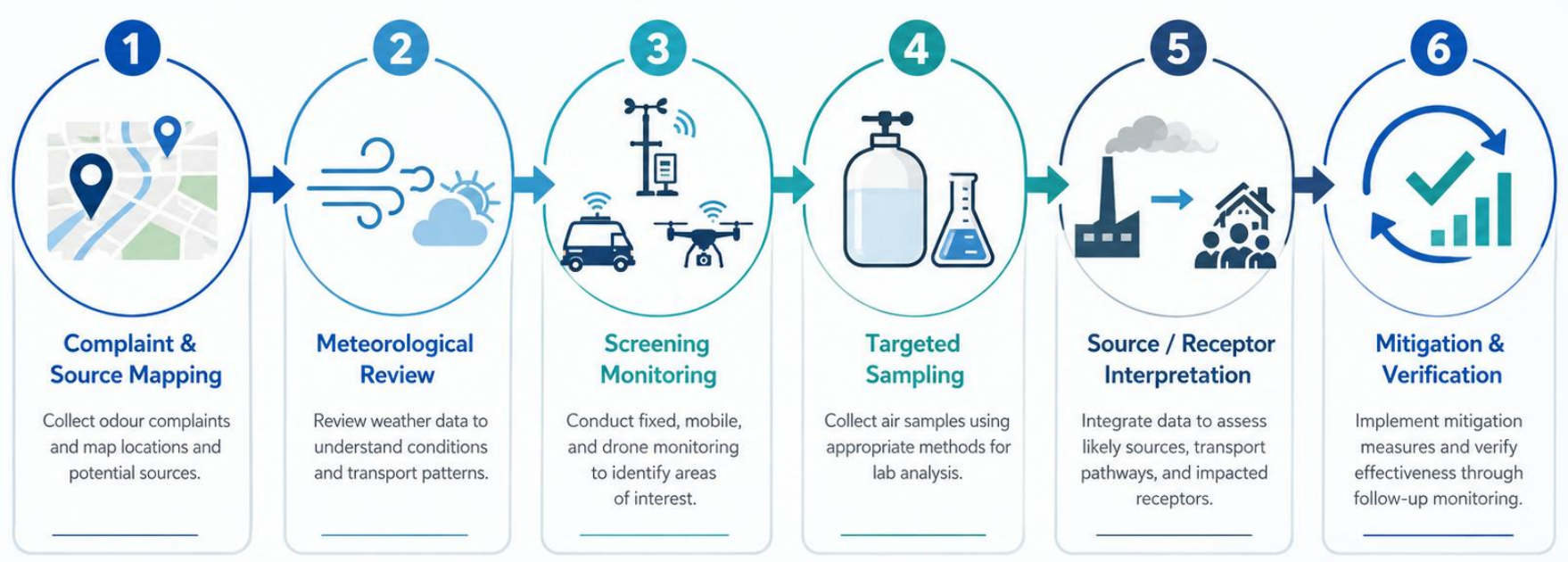


Vertical Profile of H2S



Clear indication that the H_2S signal was not evenly distributed with altitude. The strongest response appeared in a narrow elevated band, highlighting the value of drone-based vertical profiling to demonstrate plume dispersion.

Suggested Investigation Framework



Moving from Complaints to Evidence-Based Investigation

Odour complaints are an important signal, but they are only the starting point. To better understand odour and emissions events, investigations need to connect:

- **Where people report impacts**
- with **when events occur**,
- with **meteorological conditions (wind, precipitation)**
- with **how the plume may migrate**,
- with **the height of the plume and how this may be affected by downwind meteorology**,
- and **where follow-up sampling or monitoring should focus**.

The goal is not to replace existing investigation methods, but to add a tool that provides more detailed spatial, temporal, and chemical context, and how this changes with meteorological conditions.
A layered evidence approach can help Hamilton move from isolated odour complaints toward a clearer understanding of plume behaviour, source/receptor pathways, and more effective follow-up investigation.

Thank You!

Queries and Feedback time