MONDAY, MAY 5, 2025

Innovations in Assessment of Long-term Exposures to Outdoor Air Pollution

SESSION CHAIRS

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SPEAKERS

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Scientific and Policy Background

- The burden of disease from air pollution is predominantly associated with chronic (long-term) exposure.
- Challenges exist in measuring and modelling long-term exposure to many pollutants of concern (e.g., NO_2, BC, UFP).
- A lack of robust, scalable methods for long-term exposure assessment hinder our ability to conduct causal epidemiologic research.
- Emergent techniques (mobile monitoring, low-cost sensors, machine learning) show promise for improving the state-of-the art.

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RFA 19-1: Applying Novel Approaches to Improve Long-Term Exposure Assessment of Outdoor Air Pollution for Health Studies

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Objectives of RFA 19-1:

1. Develop improved methods to determine long-term human exposure to outdoor air pollutants.
   - Focus on pollutants with high spatial and temporal variability.
   - Encourage the use of novel techniques (sensors, mobile monitoring, location tracking, machine learning, etc.).
2. Quantify exposure measurement error (relevant to health studies).
3. Evaluate the potential impact of exposure measurement error on effect estimates in health studies.

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Timeline and Awards

- 2019: RFA Issued, 41 applications received, 5 awarded.
- 2020: Project initiations (3-year durations), through the COVID-19 pandemic.
- Lianne Sheppard: *"Optimizing Exposure Assessment for Inference about Air Pollution Effects with Application to Cognitive Function"*
- Scott Weichenthal: *"Comparing the estimated health impacts of long-term exposure to traffic-related air pollution using fixed-site, mobile, and deep learning models"*
- Klea Katsouyanni: *"Investigating the Consequences of Measurement Error of Gradually More Sophisticated Long-Term Personal Exposure Models in Assessing Health Effects: The London Study (MELONS)"*
- Gerard Hoek: *"Comparison of long-term air pollution exposure assessment based on mobile monitoring, low-cost sensors, dispersion modelling and routine monitoring-based models (CLAIRE)"*
- Kees de Hoogh: *"Accounting for mobility in air pollution exposure estimates in studies on long-term health effects (MOBI-AIR)"*

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Principal Investigator	Location	Sample Size	Main Air Pollutants	Monitoring Data	Exposure Assessment
Scott Weichenthal, *McGill University*	Montreal & Toronto, CA	1.5 million	BC, UFP	Mobile	LUR, machine learning models
Lianne Sheppard, *University of Washington*	Seattle, USA	5,400	NO_2, $PM_{2.5}$, UFP	Mobile, outdoor low-cost sensors	Universal kriging, spatiotemporal, machine-learning models
Klea Katsouyanni, *Imperial College, London*	London, UK	62,000	BC, NO_2, O_3, $PM_{2.5}$	Personal measurements, regulatory monitors	LUR, dispersion, machine learning, hybrid models
Gerard Hoek, *Utrecht University*	Netherlands	10 million	BC, NO_2, BC, $PM_{2.5}$, UFP	Mobile, outdoor low-cost sensors, regulatory monitors	LUR, dispersion, machine-learning, hybrid models
Kees de Hoogh, *Swiss TPH*	Netherlands, Switzerland	3.5 million	NO_2, $PM_{2.5}$	Personal measurements, location tracking	Agent-based, LUR, machine-learning models