U.S. EPA "State of VI Science" Workshop

Reducing Vapor Intrusion Uncertainties** by **More Frequent Simple Measurements** & **Community Involvement

Welcome & Key Definitions

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**Personal Perspective & Presentation – Does not represent Agency policy*
See: http://epa.gov/oswer/vaporintrusion

30th Annual International Conference on Soil, Water, Energy, and Air, A Virtual Conference, March 22nd, 2021

engineers | scientists | innovators

Presentation archived at https://iavi.rti.org/

Welcome
Sponsors, Title, Website, & Exposures

- **EPA's ORCR (RCRA)** & **ORD** – sponsored the analyses & presentations to:
- **Reduce Vapor Intrusion Uncertainties** (sampling; *v. difficult*) by:
  - **More <u>Frequent</u> Simple Measurements** (**I**ndicators, **T**racers & **S**urrogates (**ITS**))
  - &
  - **Community Involvement** (empowered by making their own measurements)
- This continues 23 years of work (1999) see: iavi website for previous work
- Objective is <u>not</u> endless studies – but <u>Ending</u> VI exposures
- Theme: Environmental Justice - *Min. Opportunities for Injustice* (exposures)

A RCRA perspective on VI risk Definitions: **(Res.)** Indoor Air **Concentrations = Exposure**

- Exposure Factors – for Groundwater Ingestion
  - While we all agree people drink 2 liters a day of 100% contaminated water, for ingestion risk calculations
  - Very few people do
- But almost all (living) persons breath regularly every day (~20,000 liters)
- And a very high percentage (~90%) of that is of indoor air
- Likely the majority of the time, is in One building, e.g., your home
  - or Workplace for some middle-aged healthy & non-pregnant (in the pre-Covid 19 days)
- If that air is contaminated (e.g., from VI) you have few options to avoid it
- Op-ed: Without verifiable-restrictions on future inhalation; Indoor air concentrations are equivalent to exposure; for **Equitable** regulatory decisions

A RCRA regulator's perspective on **Chronic** Risks & Distributions of Indoor Conc.

- Health Outcomes are gen. associated with Exposure/Dose metrics
- **Some** Outcomes like adult **Cancers** are associated w **Chronic** exposures:
  - are understood to the result of **long-term continuous/repeated exposures** where each of these exposures have a random-like chance of initiating, promoting and progressing disease towards adverse health effects,
    - e.g., radiation alpha particles strike sensitive lung tissue penetrating a cell membrane
    - Apoptosis or DNA repair mechanisms usually 'takes care of' the cell – but repair errors?
  - These 'chronic' diseases are generally associated with the long-term average level of exposures over many years/decades
  - Thus, these outcomes are most frequently seen in **adults**, of advanced age
  - The distribution metrics of most concern are the **Average**-mean's (**95UCL**)

A RCRA regulator's perspective on **Short-term Risk** & Distributions of Indoor Conc.

- **Other** health effects are **only-caused** during **short** windows of **time**:
- **One example** are ('in utero') **fetal-developmental** effects:
  - These are understood to be result of exposure/contamination interfering with the biology of cellular replication, specialization, & development into a 'child'
  - Thus, the exposures of concern are during (or prior to*) the specific window of times when these biological processes/developments take place
  - For these types of '**short-term**' outcomes/diseases, the exposures of concern:
  - are generally associated with the length of the window of susceptibility
    - e.g., Heart forms in ~21 days, & individual valves __ day(s)?
  - The resulting health defects are most frequently seen in (surviving) **children**
  - The distribution metrics of most concern are the '**RME**' **~95th%ile** of 1 day-avg.**

*For exposure to the mother, that is 'available' to the developing fetus, at the 'wrong' time

**https://www.epa.gov/risk/guidelines-developmental-toxicity-risk-assessment

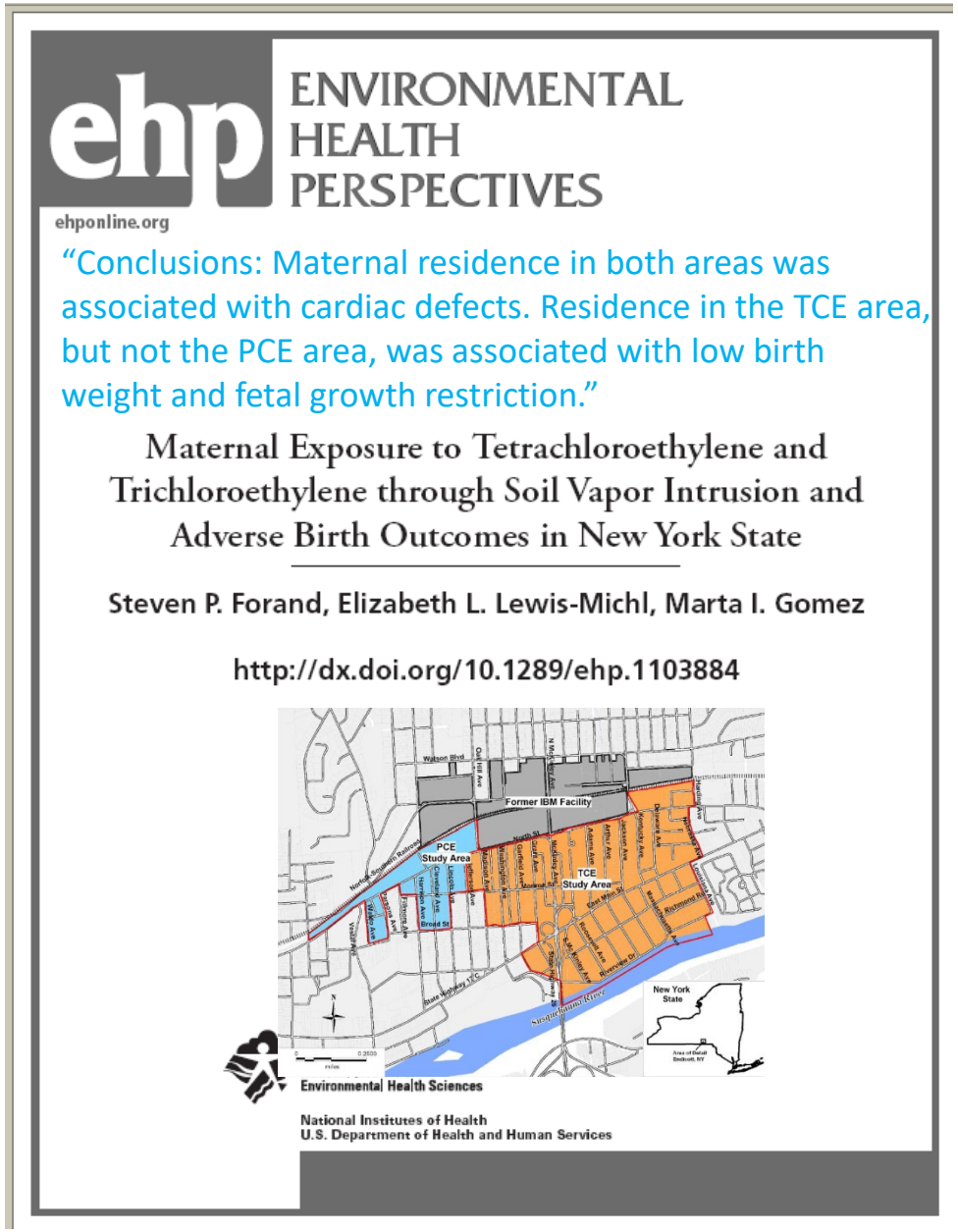
Endicott, NY

- TCE plume (70 block) area:
  - ~2615 residents, 1090 births (‘78-02)

248

~1/4 births

- 117 Small for gestational age
  - RR = **1.23** (95% CI = 1.03-1.48)
- 76 Low birth weight
  - RR = **1.36** (95% CI = 1.07-1.73)
- 37 Term low birth weight
  - RR = **1.68** (95% CI = 1.20-2.34)
- 15 Cardiac defects
  - RR = **2.15** (95% CI = 1.27-3.62)
- 3 Conotruncal* defects
  - RR = **4.91** (95% CI = 1.58-15.24)



* “abnormal formation of the outflow tracts of the heart”

(RR) Rate Ratios relative to the rest of NY state (excluding NYC) – elevated? (by many VI sites)

http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.1103884

Infrequent High Conc. **Peaks** can drive **both**!

- Two types of risk metrics for conc./exposure distributions:

- **Short-term**/sub-chronic effects
  - Reasonable Maximum Exposure (RME, between 90th & 98th percentile) EPA, 2015
  - We're using a central-estimate of the range of RME (**~95th%ile**)
  - Conc. averaged over the 'period of concern' for the outcome of concern, e.g.,
  - For short-term/sub-chronic effects, like Developmental, could be a low as **1 day****

- **Chronic** long-term risks (e.g., few days at OoM conc ~ simple majority of exposure)
  - 95th **U**pper **C**onfidence **L**imit on the Mean (average) – bare min. 3-7* samples (**variability**)
    - **95UCL** of mean (**average**) exposure concentration
  - Summary Note: **95UCL** can **~ 95th%ile** for small sample # w/ high variability

* https://www.nj.gov/dep/srp/guidance/rs/proucl.pdf

**https://www.epa.gov/risk/guidelines-developmental-toxicity-risk-assessment

Reducing Vapor Intrusion Uncertainties by More Frequent Simple Measurements and Community Involvement

Outline of EPA-RCRA Perspectives coming:

- Environmental Justice
    - Temporal & Spatial variability
- Citizen Scientist w/ simple (but powerful & freq.) **ITS** measurements
- Long-term ‘Monitoring’ (of <u>all</u> buildings ‘at risk’ for **VI**)
- ‘Soil Gas Safe Communities’
    - Thanks for ‘coming’