Nothing Compares
NORTH CAROLINA

Trichloroethylene (TCE)

Short-Term Inhalation Action Levels

Jim Bateson, Superfund Section Chief, Div. of Waste Management

Sandy Mort, PhD, Environmental Toxicologist
NC Department of Environmental Quality
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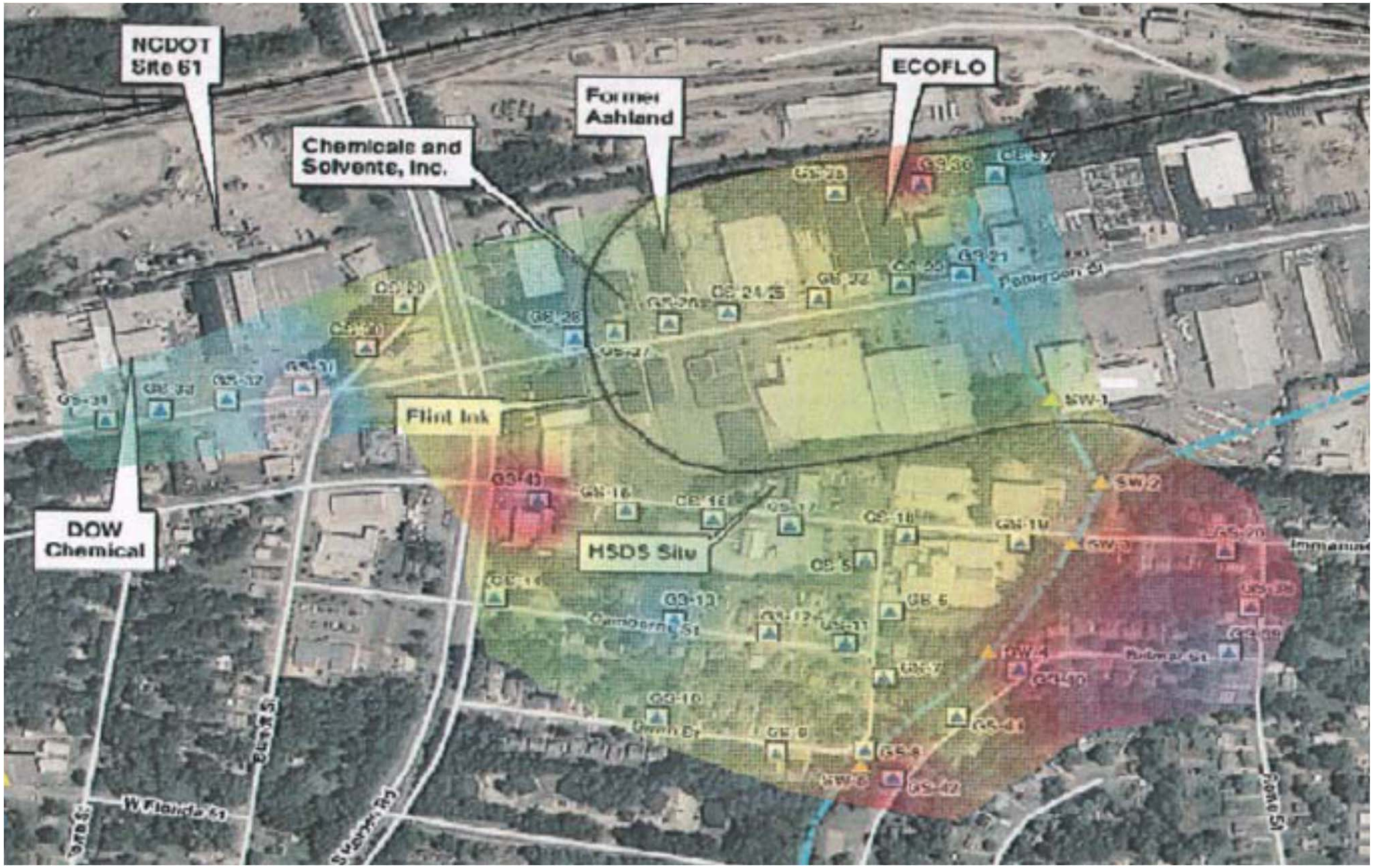
Vapor Intrusion -

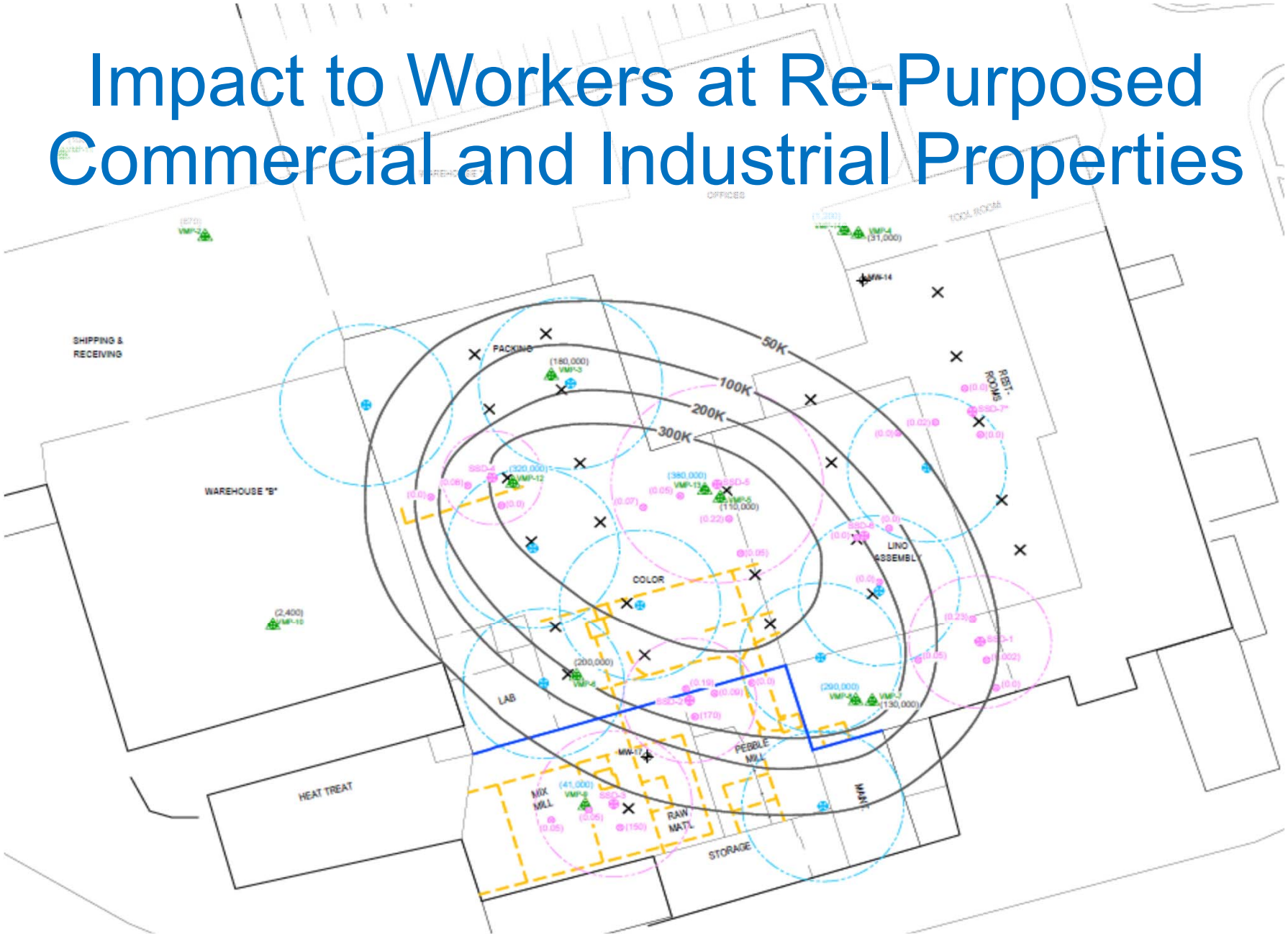
Subsurface contaminant migration to indoor air

TCE-Groundwater → TCE-Soil Space → TCE-Indoor Air

VI Impact to Nearby Residents



Impact to Workers at Re-Purposed Commercial and Industrial Properties



Assessing VI Risks is Tough

- **High Spatial and Temporal Variability:**
  - Complex pathways through soil and the buildings themselves
  - Ambient temperature, wind, and barometric pressure variation
  - HVAC behavior; daily use of doors and windows
  - Orders of magnitude differences are not uncommon

- **Sampling and Analysis Challenges:**
  - Difficult to draw vapor from the right space, steadily over 8/24 hours
  - Laboratory reproducibility problematic at low regulatory levels
  - High cost per sample
  - Passive sampling devices useful in some cases, as a supplement.

VI risk demands a growing share of resources for Federal, State, and County programs that address contaminated sites in North Carolina

Well over one-half of NC contaminated sites (ex. UST) have releases of TCE or PCE, which degrades to TCE

- Many sites are as yet not assessed
- Those already addressed from 2000 – 2012 assumed 33-year chronic exposure risk only

Short Term Exposure Risk Doubles the Challenge

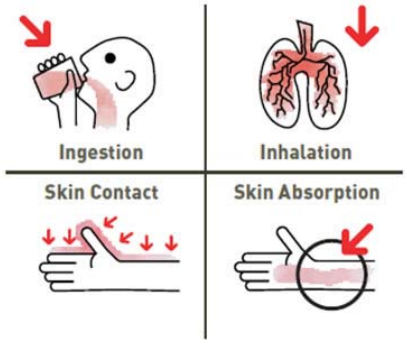
- Owners and regulators will rarely have enough data to make immediate decisions about full response actions.
- Risk communication with the potentially-at-risk population needs to take place as soon as possible
- Interim actions can limit exposures even before acquiring data sufficient to design permanent remedies

Consensus Among EPA and NC Programs is Essential

- Most Site Responses are Multi-Agency Responses
- Current EPA Region 4 Removal Management Levels (RMLs) of 2.1 (residential) and 8.8 $\mu g/m^3$ (occupational) represent a consensus among DWM, DHHS, and EPA toxicologists
- State and EPA Action Levels have varied nationally, but more recent policies are similar to the EPA Region 4 RMLs.

IRIS 2011 TCE Update -

- Carcinogenic to humans by all routes (inhalation, ingestion, dermal)
  - Tumor types –
    - Renal cell, non-Hodgkin's lymphoma, liver
    - Mutagenic mode-of-action for kidney tumors
      - Children
- Established toxicity values for non-cancer endpoints
  - Critical effects, inhalation –
    - Immune (Thymus weight)
    - Developmental – Fetal cardiac malformation

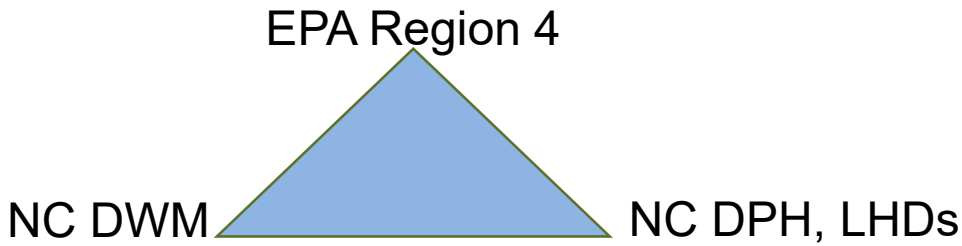


TCE Vapor Intrusion Indoor Air Action Levels

- Calculation of the AL -
  - 2.0 µg/m^3 RfC TCE
  - Default EPA/DEQ inhalation exposure parameters

- **VI Action Levels**
  - **Residential - 2.1 µg/m^3** TCE in indoor air
  - **Occupational – 8.8 µg/m^3** TCE in indoor air
  - ❖***TCE VI ALs are not listed on the VI screening level tables***

- EPA Region 4, NC DEQ, NC DPH & County Health Dept. consensus
  - Coordinated response, risk communication
- *Science Advisory Board* review proposal



The Sensitive Receptor -

What we know about TCE uptake -

- It is rapidly absorbed and distributed throughout the body
- It crosses the placenta

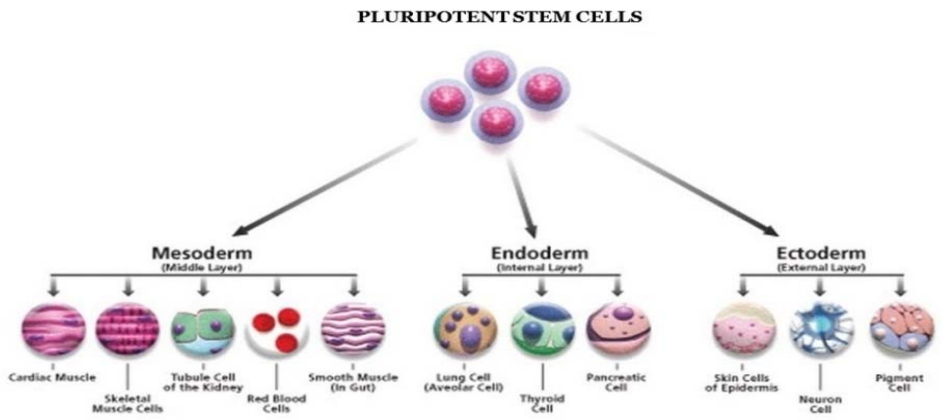
Sensitive (critical) effect – developmental, fetal cardiac malformation

- *Cardiogenesis* = heart, vasculature system formation

Sensitive receptor = developing fetus during the 1st trimester

Exposure window of concern –

- 2-4 weeks prior to conception
- 1st trimester of pregnancy



The Critical TCE Exposure Window

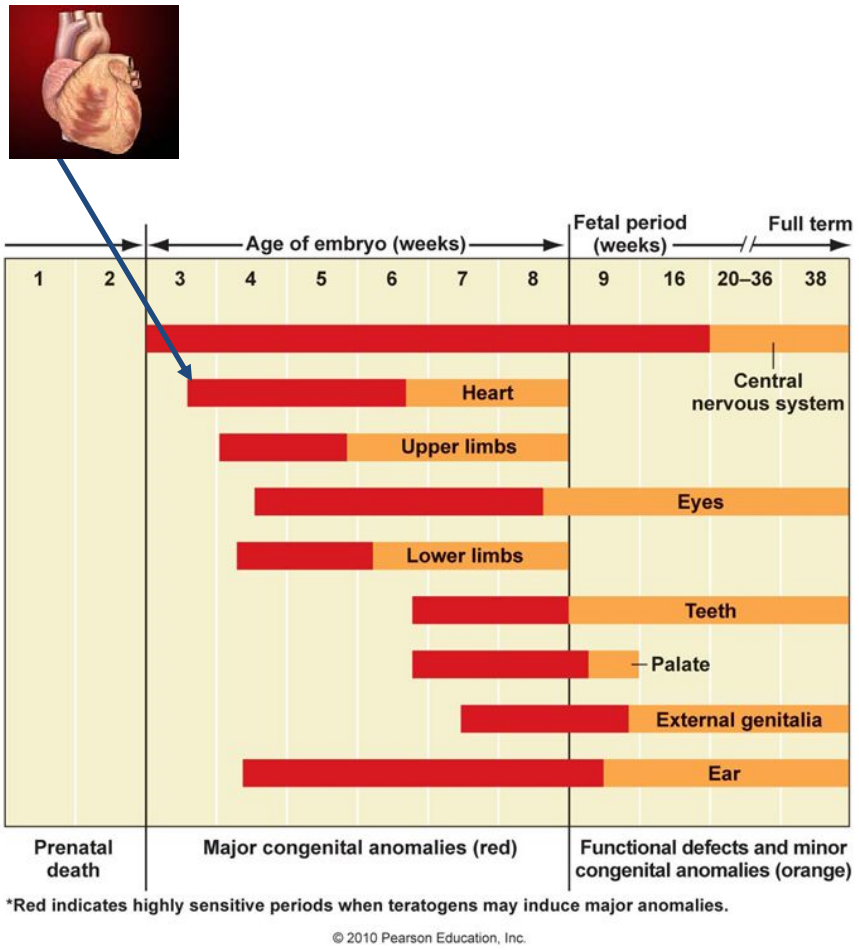
Developmental implications of TCE exposures in the 1st trimester –

- A period of rapid stem cell differentiation, migration
- Cardiac system one of earliest to develop
- Primary toxic insult response mechanisms not yet developed

** Result → a period of extreme vulnerability*

- Developmental effects with no apparent maternal toxicity
- Fetal risk increases with increased exposure frequency, duration and concentration

** Short-term exposure with long-term implications*



Department of Environmental Quality

TRICHLOROETHENE EXPOSURE LEVELS

Occupational Exposures Levels:

OSHA

- **PEL: 100 ppm**
- **STEL: 300 ppm for 5 min in any 2 hr period**

NIOSH

- **REL: 2 ppm (as anesthetic agent), 25 ppm over 10hr TWA**

ACGIH

- **50ppm over an 8 hr TWA**
- **STEL: 100 ppm**