

US EPA ARCHIVE DOCUMENT

# MNRiskS

## (Minnesota Risk Screening)

A COMPREHENSIVE, MULTI- PATHWAY,  
MULTI-SOURCE, AIR POLLUTION RISK  
MODELING SYSTEM

*Risk Analysis*

DOI: 10.1111/j.1539-6924.2011.01640.x

### **Validation of a Novel Air Toxic Risk Model with Air Monitoring**

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# MNRiskS Components

## 1. Emissions inventory

- 203 pollutants
- Point, non-point (area), and mobile sources

## 2. Air dispersion & deposition modeling

- AERMOD

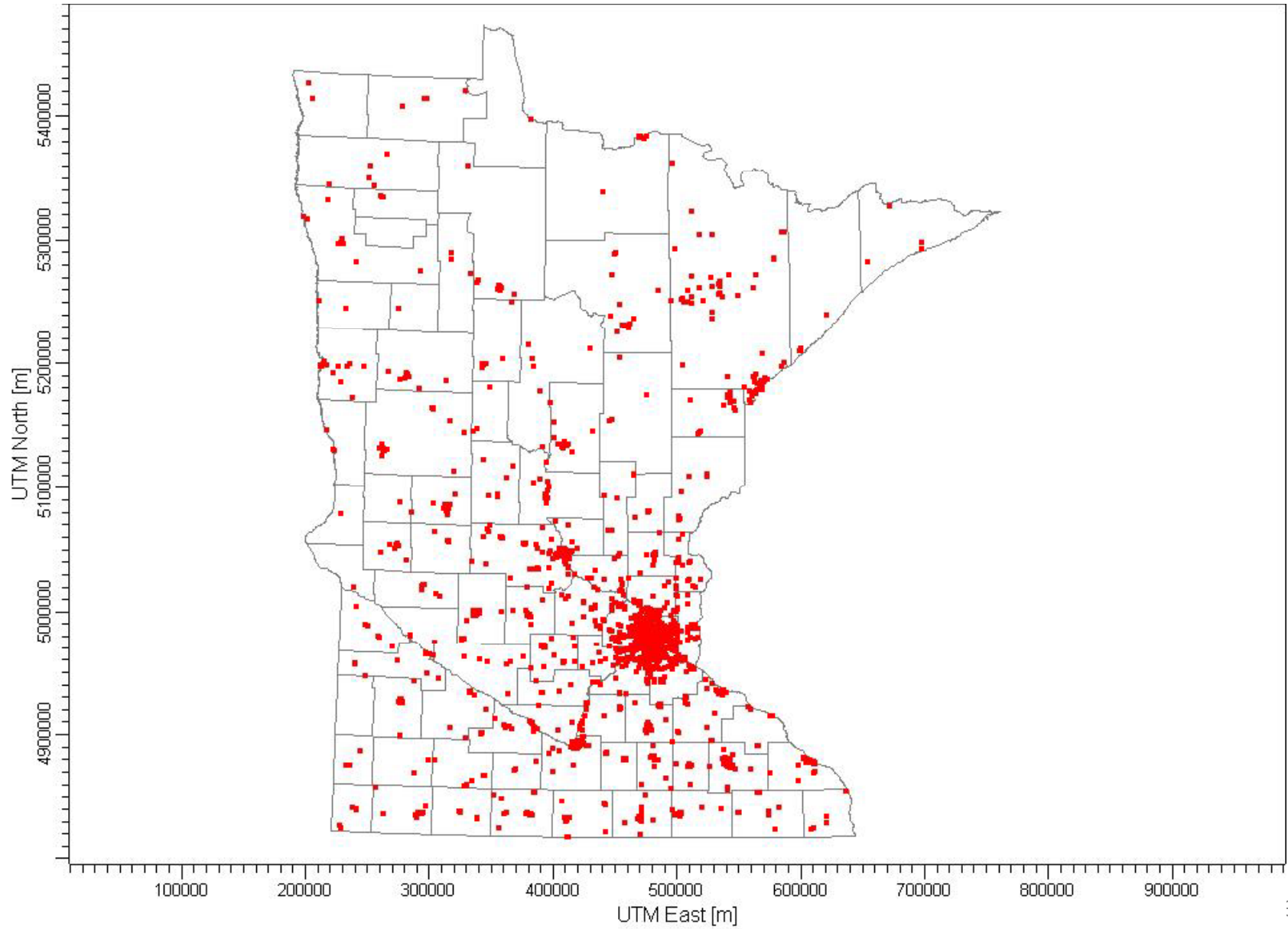
## 3. Fate, transport & biota modeling

- Water, soil, plants, animals, humans

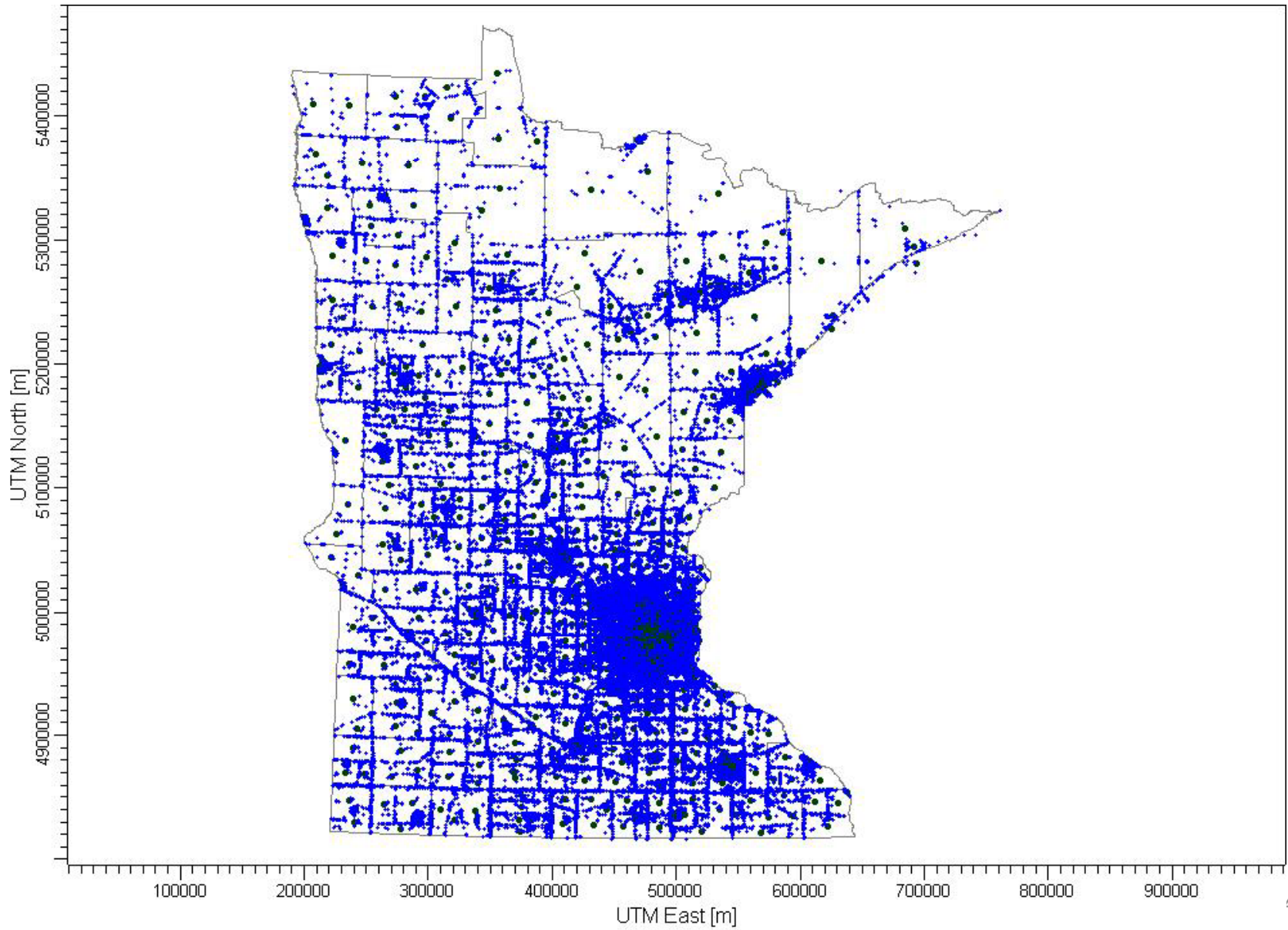
## 4. Risk Estimation

- Multiple pathways (per IRAP/HHRAP)
- residents, farmers, fishers, adults, children
- Toxicity values: MN Health Dept, IRIS, CalEPA, HEAST

# Point Sources



# 57,866 Receptors



## Latest Updates (MNRisks 2005)

- ❑ 2005 emissions inventory
- ❑ AERMOD dispersion model
- ❑ Secondary PM<sub>2.5</sub>, acrolein, formaldehyde, and acetaldehyde
- ❑ Improved spatial resolution of onroad mobile sources
- ❑ More dense coverage (57,866 receptors) including centroid receptors
- ❑ Improved assessment and detailed reporting of source subcategories

# Source Categories

## **Point Sources**

- large stationary sources

## **Mobile Sources**

- On-road
- Non-road

## **Area (Non-point) Sources**

- smaller stationary sources *inventoried collectively*

## Area & Mobile Source Subcategories

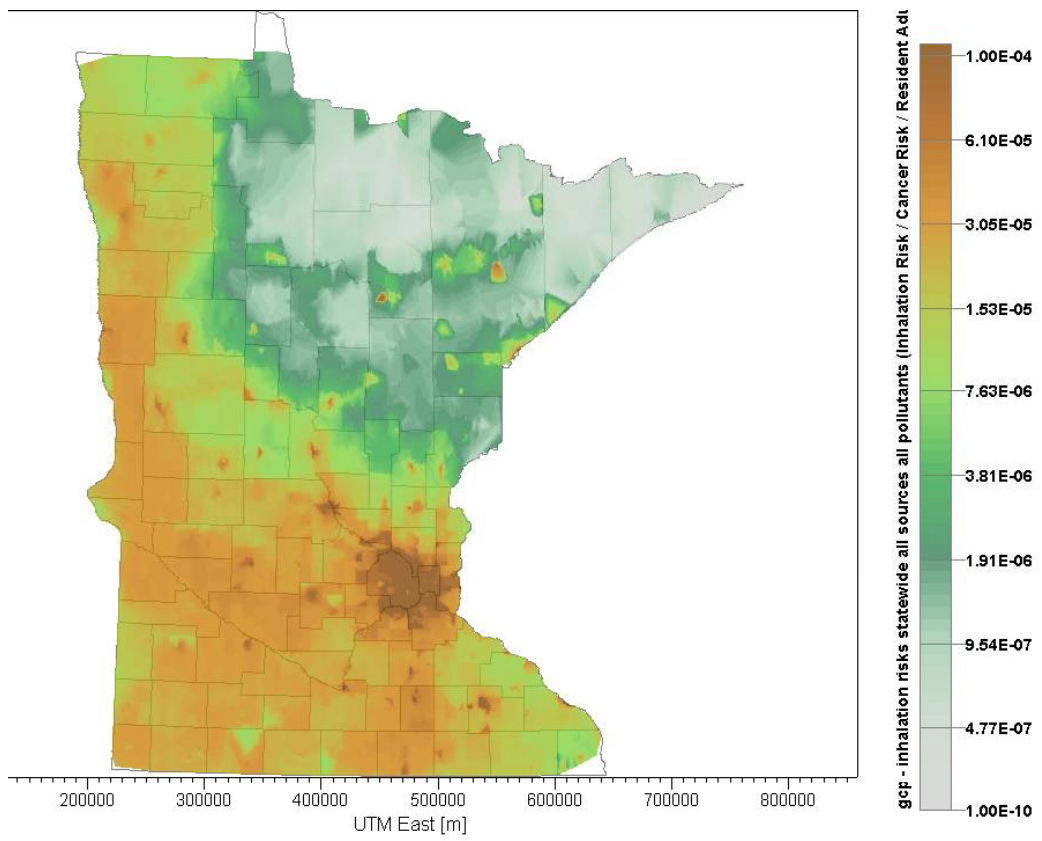
On-Road Mobile Sources	Area (nonpoint) Sources	Area (nonpoint) Sources (cont'd)
<p><b>Cars</b> <b>Buses</b> <b>Trucks</b></p>	<p><b>Agricultural Field Burning</b> <b>Agricultural Pesticide Use</b> <b>Agricultural Production - Animal Waste</b> <b>Agricultural Production - Fertilizer Application</b></p>	<p><b>Industrial Processes: Construction</b> <b>Industrial Surface Coating</b> <b>Mineral Processes: SIC 32</b> <b>Paved Roads</b> <b>Petroleum Bulk</b></p>
<p><b>Non-Road Mobile Sources</b></p>	<p><b>Agriculture Production - Crops, Tilling</b> <b>Animal Cremation</b> <b>Asphalt Paving</b> <b>Auto body Refinishing</b></p>	<p><b>Stations/Terminals: Breathing</b> <b>Refrigeration</b> <b>Residential Fossil Fuel Combustion</b> <b>Residential Wood Burning</b> <b>Solvent Cleaning</b></p>
<p><b>Lawn &amp; Garden Equipment</b> <b>Off Road Vehicles (e.g., ATVs)</b> <b>Snowmobiles</b> <b>Boats</b> <b>Planes</b> <b>Trains</b> <b>Construction Equipment</b> <b>Farm Equipment</b></p>	<p><b>Commercial and Consumer Products Usage</b> <b>Commercial Cooking</b> <b>Domestic Animals - Waste Emissions</b> <b>Dry Cleaners</b> <b>Fluorescent Lamp Breakage</b> <b>Fluorescent Lamp Recycling</b> <b>Gasoline Service Stations</b> <b>Gasoline Trucks in Transit</b> <b>Grain Elevators</b> <b>Graphic Arts</b> <b>Hospital Sterilization</b> <b>Human Cremation</b> <b>Human Perspiration</b></p>	<p><b>Stationary Fuel Combustion, Commercial/Institutional</b> <b>Stationary Source Fuel Combustion, Industrial</b> <b>Structure Fires</b> <b>Surface Coatings - Architectural</b> <b>Swimming Pools</b> <b>Tank/Drum Cleaning</b> <b>Traffic Markings</b> <b>Unpaved Roads</b> <b>Waste Disposal, Open Burning</b> <b>Waste Incineration</b> <b>Wild Animals - Waste Emissions</b></p>



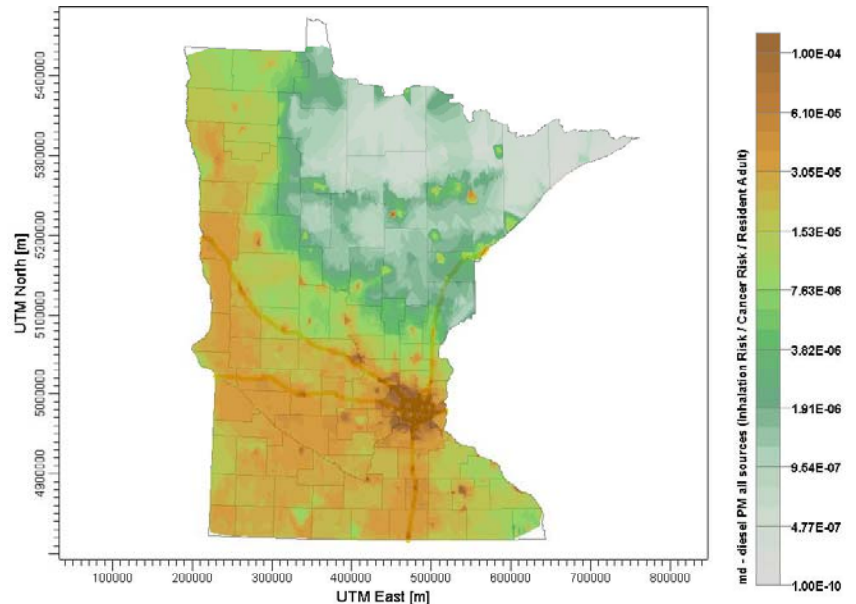
## Results can be evaluated by

- Pollutant
- Geographic region
- Source
  - Individual Source
  - Categories (mobile, area, point)
  - Subcategories & Industrial sectors
- Exposure pathway
- Receptor scenario

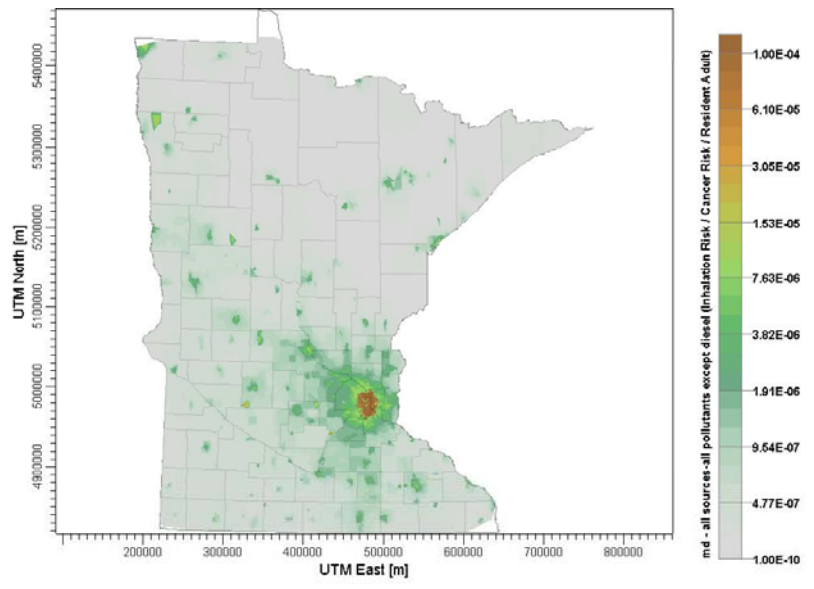
# Inhalation cancer risks – all sources



All pollutants

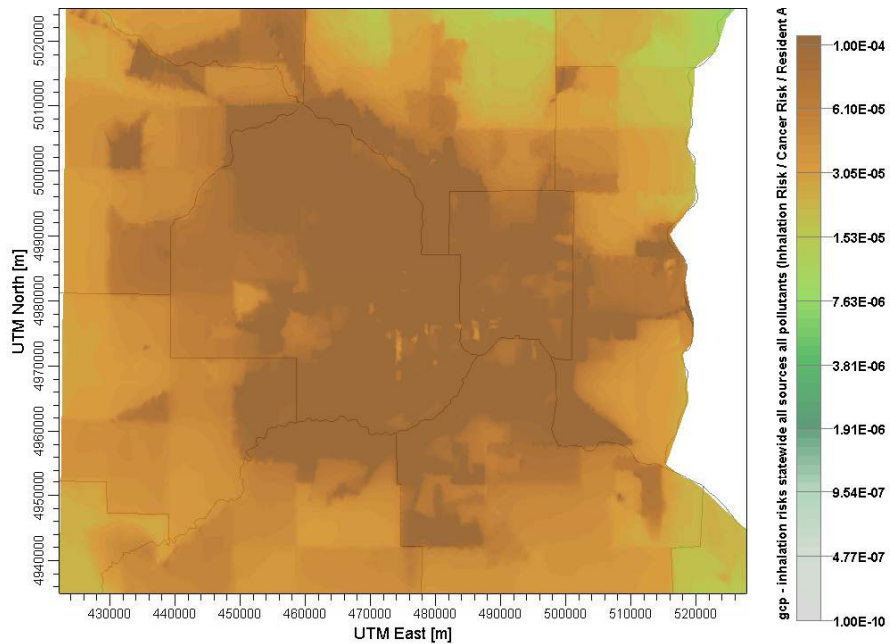


Diesel

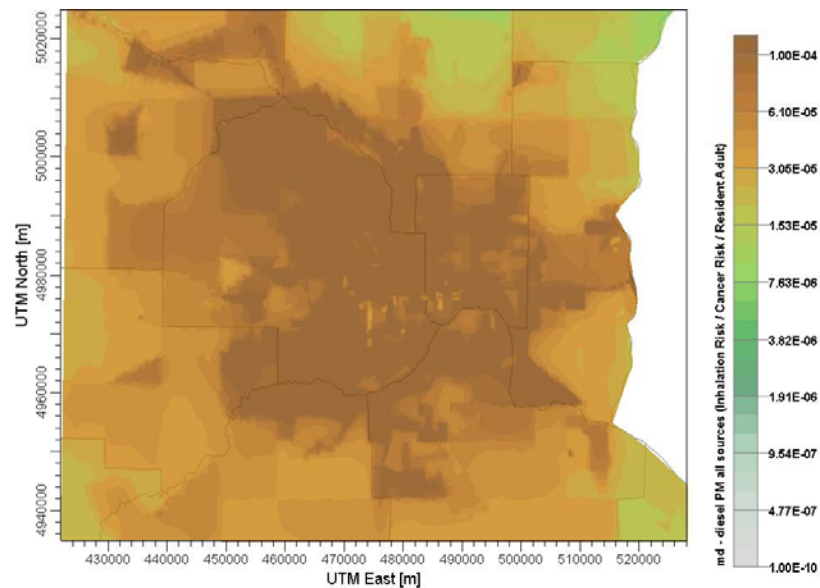


All pollutants *except* diesel,

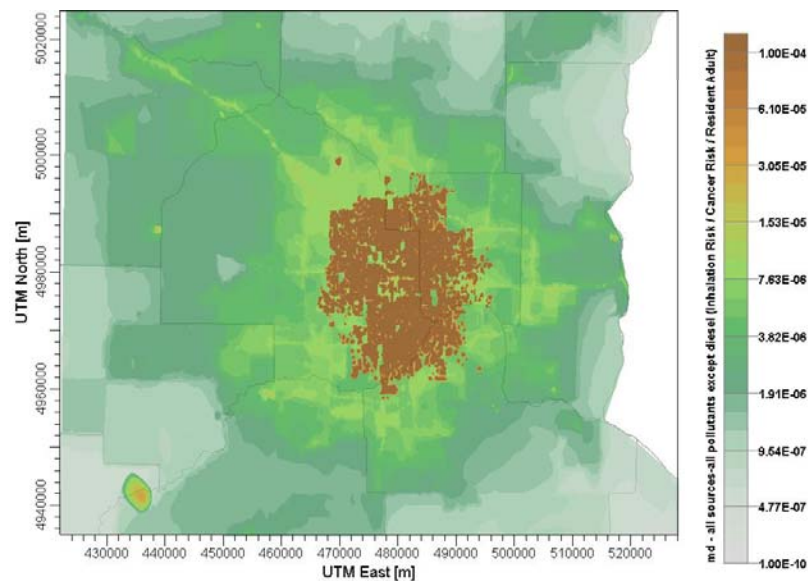
# Inhalation cancer risks – all sources Metro area



All pollutants



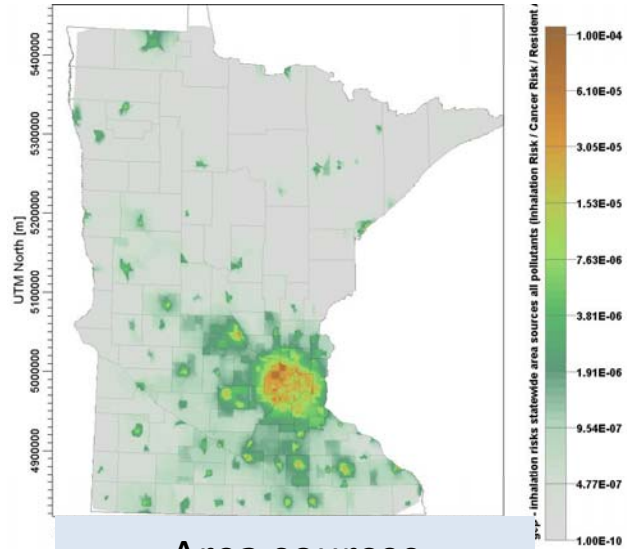
Diesel



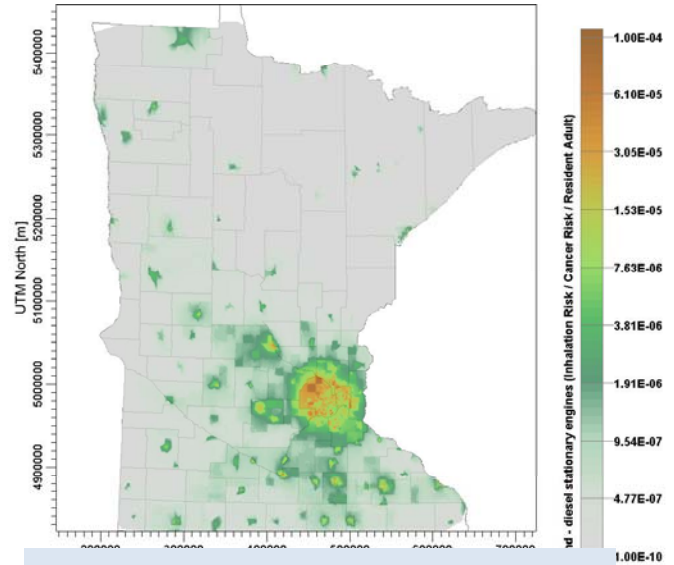
All pollutants *except* diesel,

# Area Sources

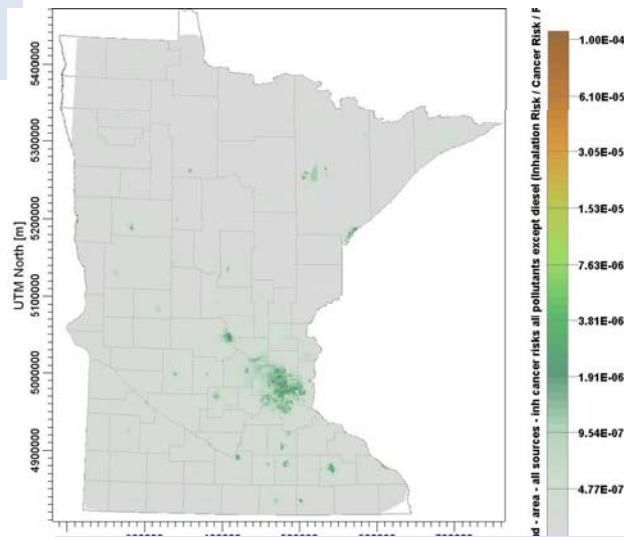
## Estimated Inhalation Cancer Risks



Area sources  
all pollutants



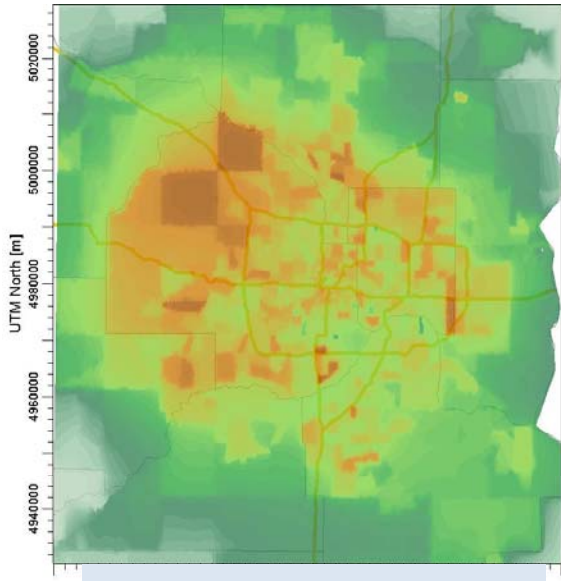
Stationary diesel engines  
Industrial &  
Commercial/Institutional



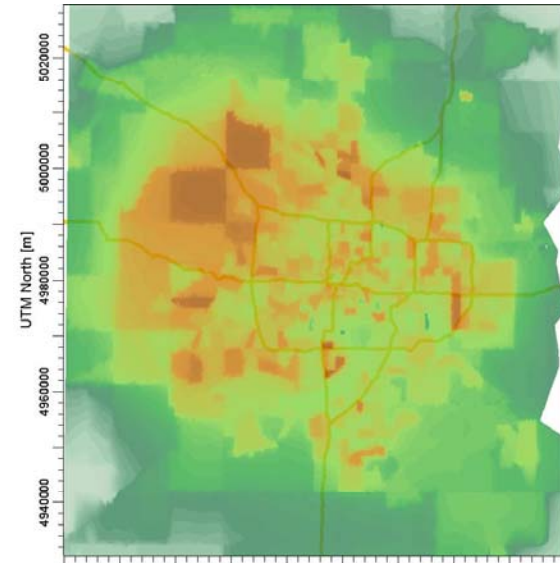
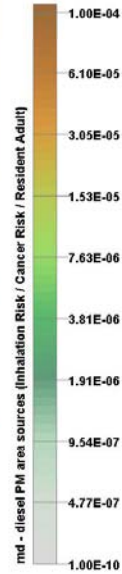
Area sources  
all pollutants *except* diesel

# Area Sources

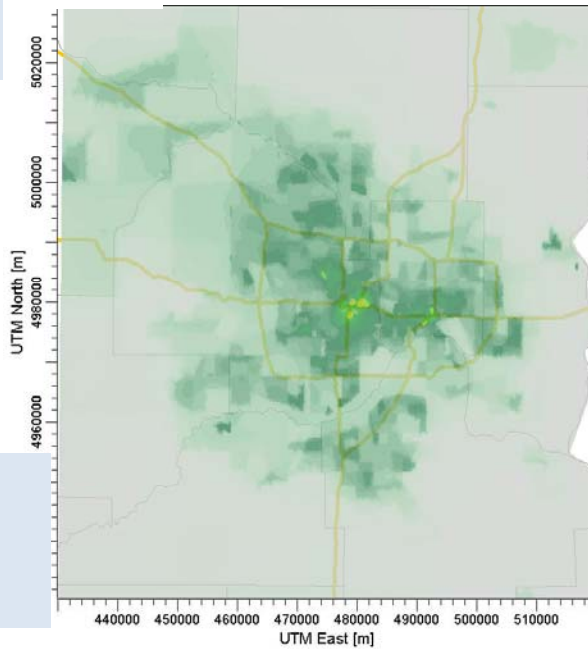
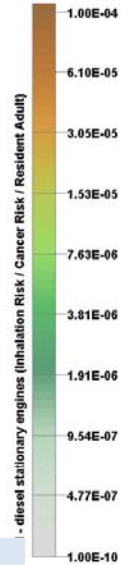
## Estimated Inhalation Cancer Risks – metro



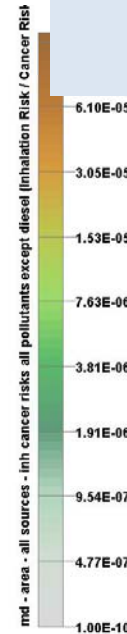
Area Source Total  
All pollutants

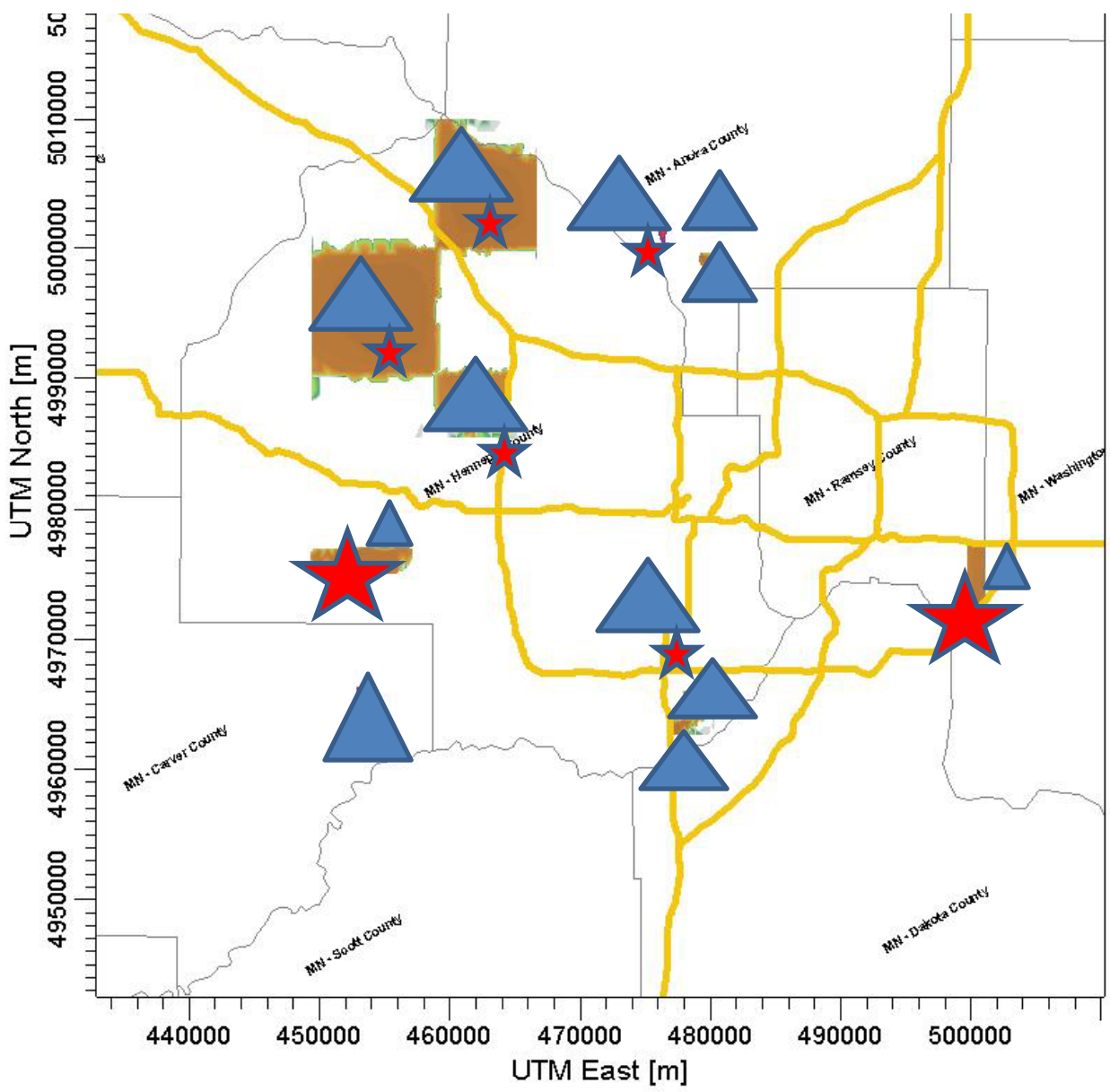


Stationary Diesel Engines –  
Industrial &  
Commercial/Institutional



Area Sources  
All pollutants *except*  
diesel

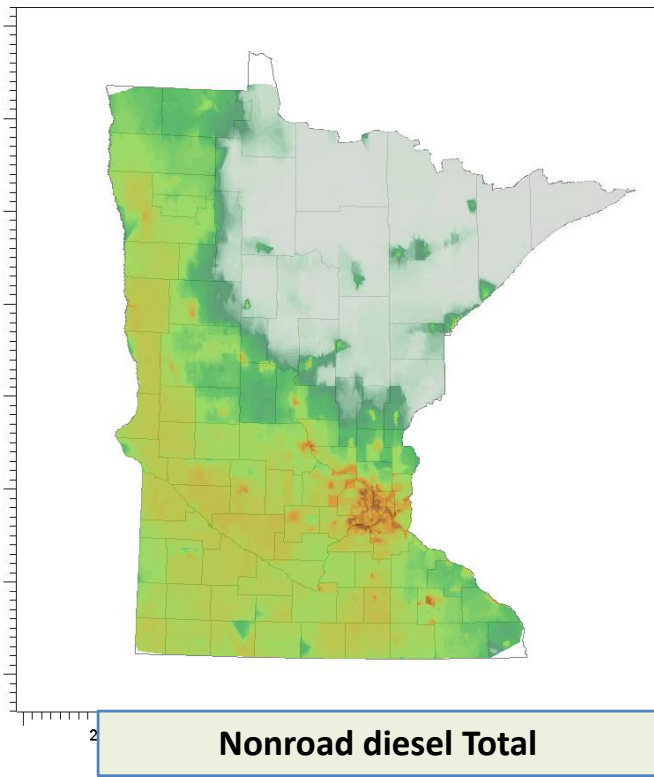




Stationary source fuel combustion - Industrial



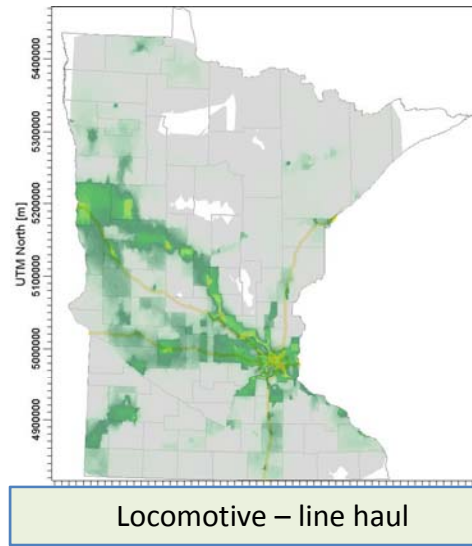
Stationary source fuel combustion - Commercial/Institutional



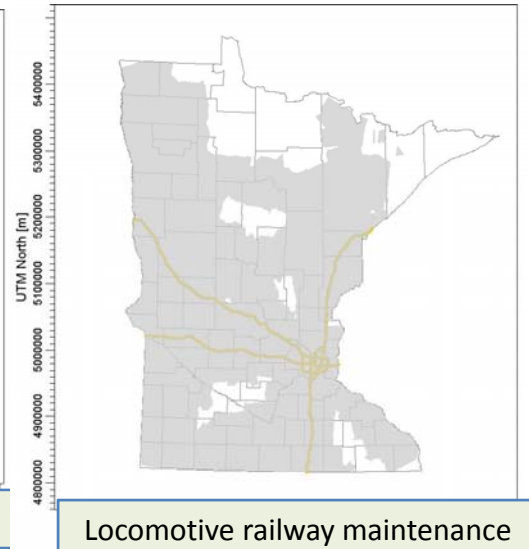
Nonroad diesel Total

# Nonroad Diesel

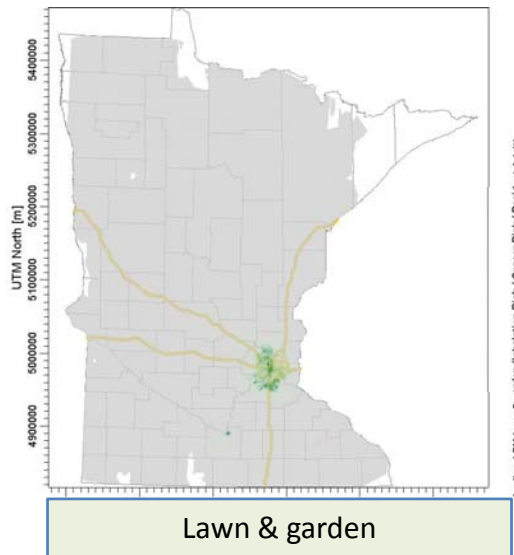
Estimated Inhalation Cancer Risks - statewide



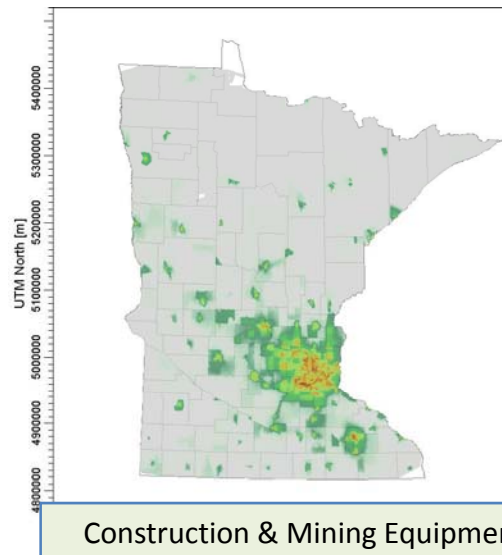
Locomotive - line haul



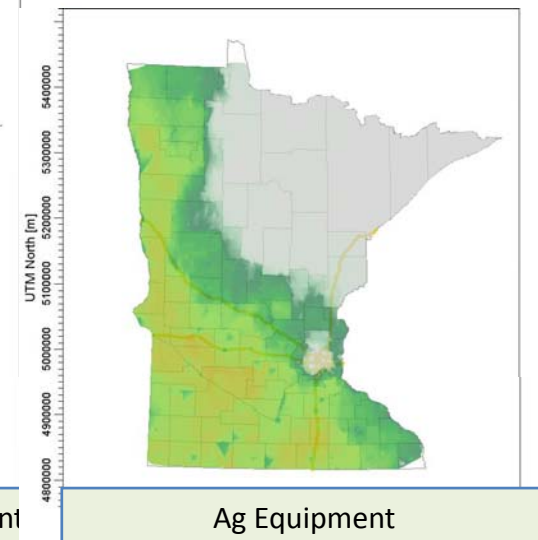
Locomotive railway maintenance



Lawn & garden



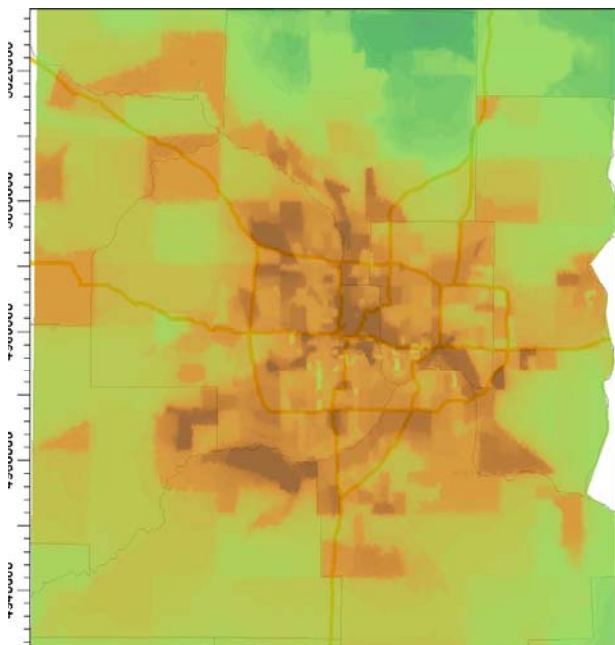
Construction & Mining Equipment



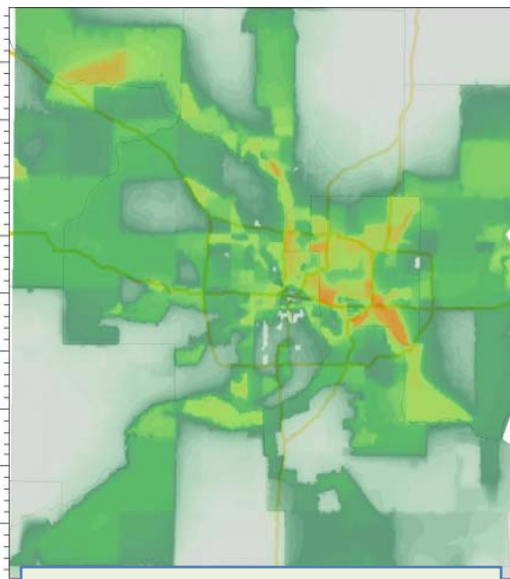
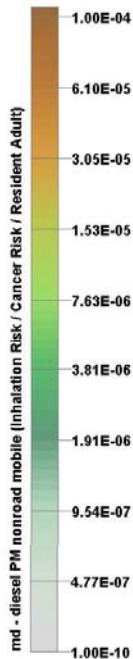
Ag Equipment

# Nonroad Diesel

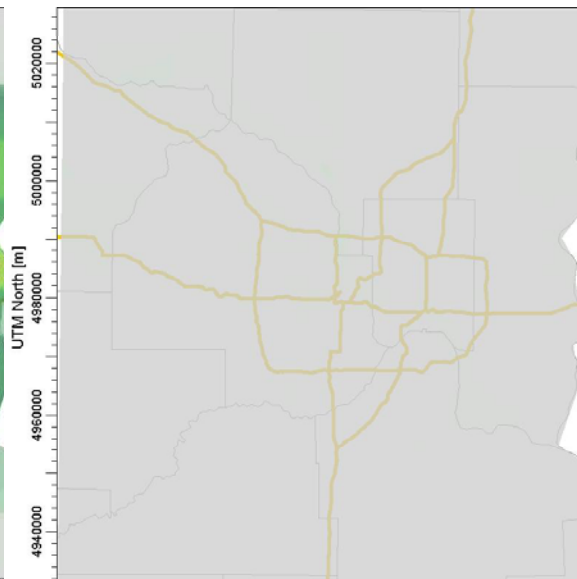
Estimated Inhalation Cancer Risks – metro



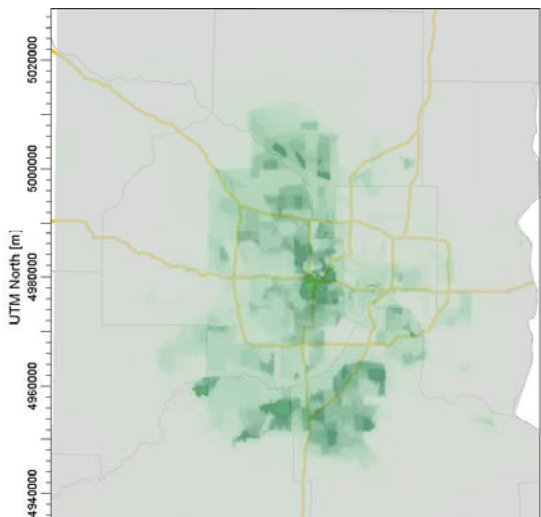
Nonroad diesel total



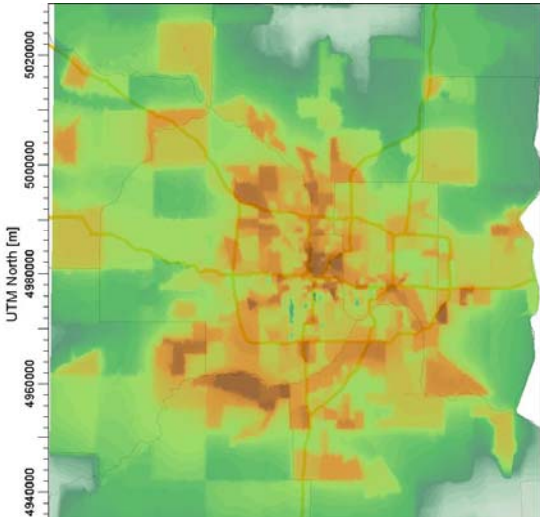
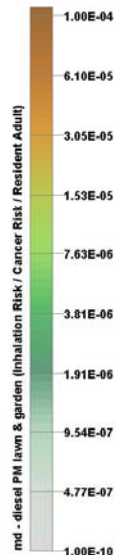
Locomotive – line haul



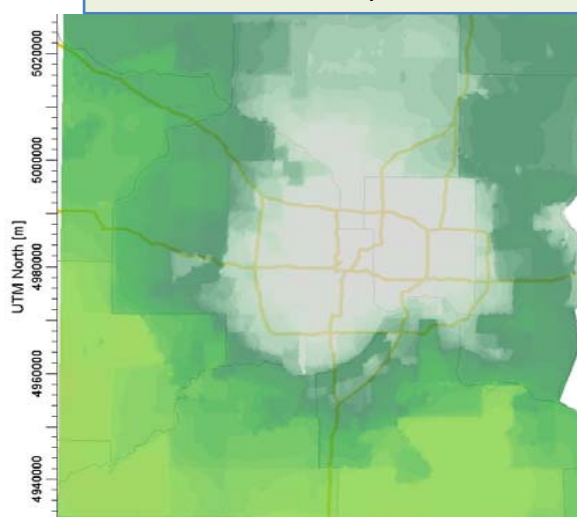
Locomotive – railway maintenance



Lawn & garden



Construction & Mining Equipment



Ag Equipment

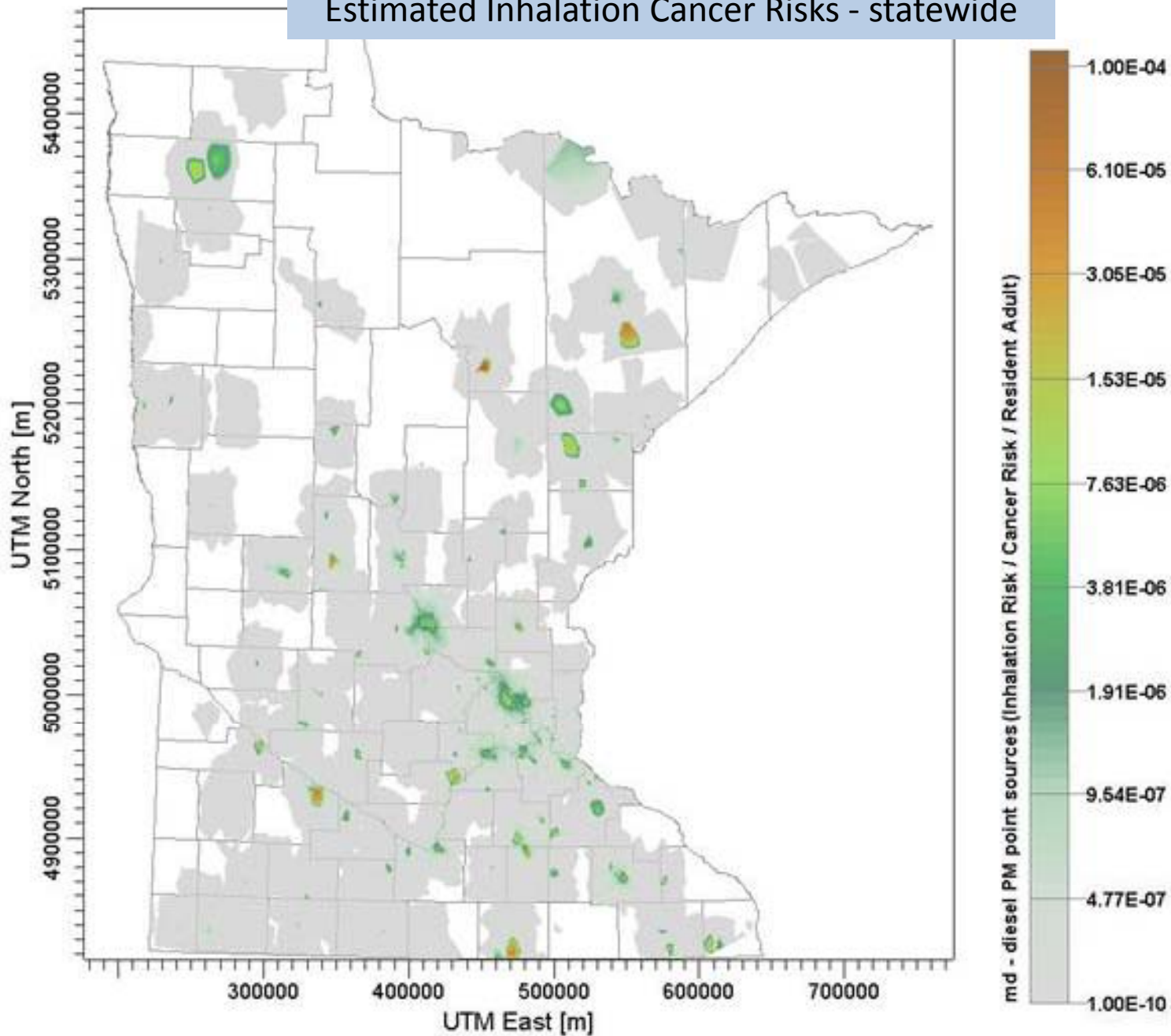
md - diesel PM locomotive (Inhalation Risk / Cancer Risk / Resident Adult)

md - diesel PM ag equipment (Inhalation Risk / Cancer Risk / Resident Adult)



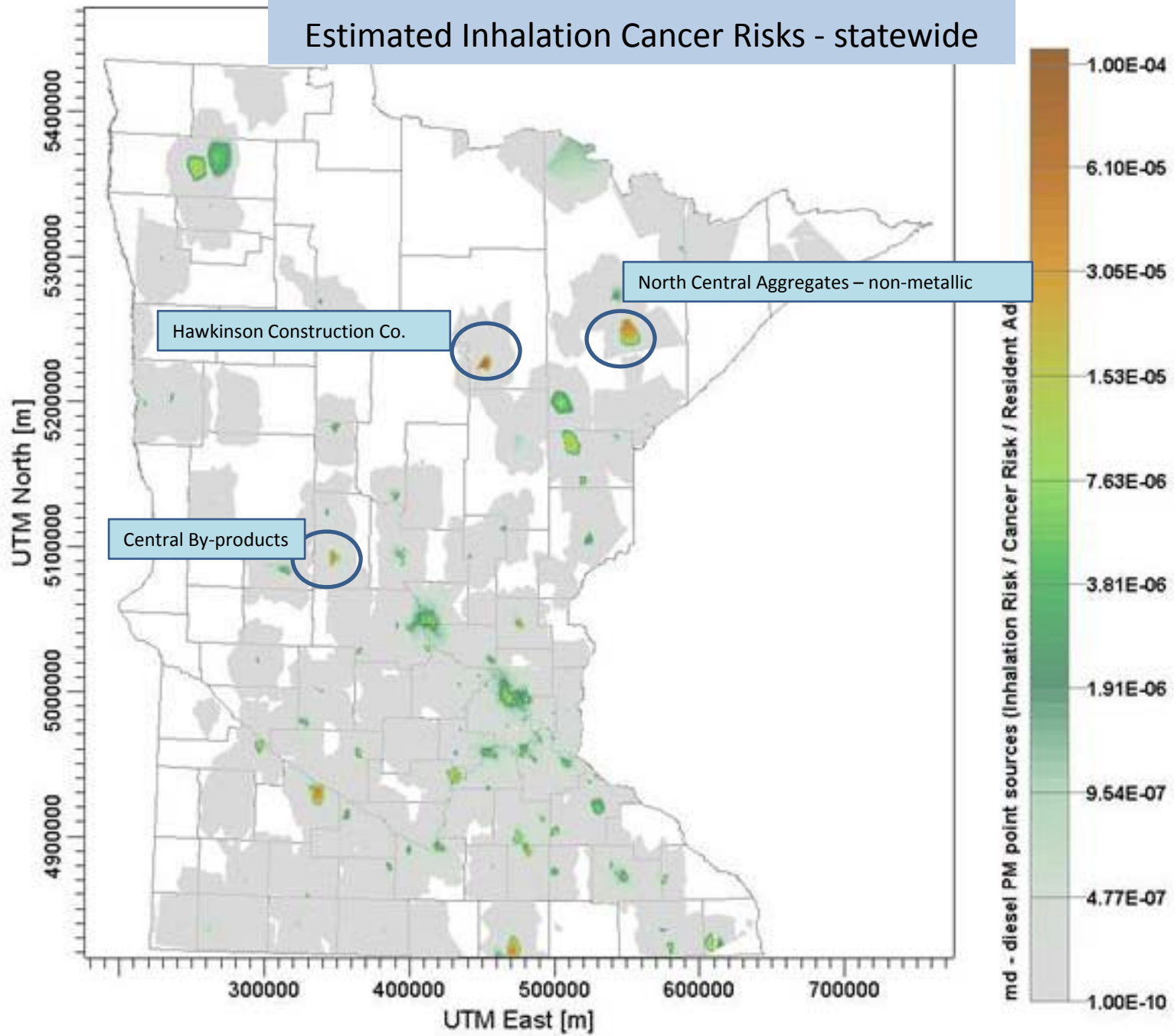
### Point Sources

Estimated Inhalation Cancer Risks - statewide



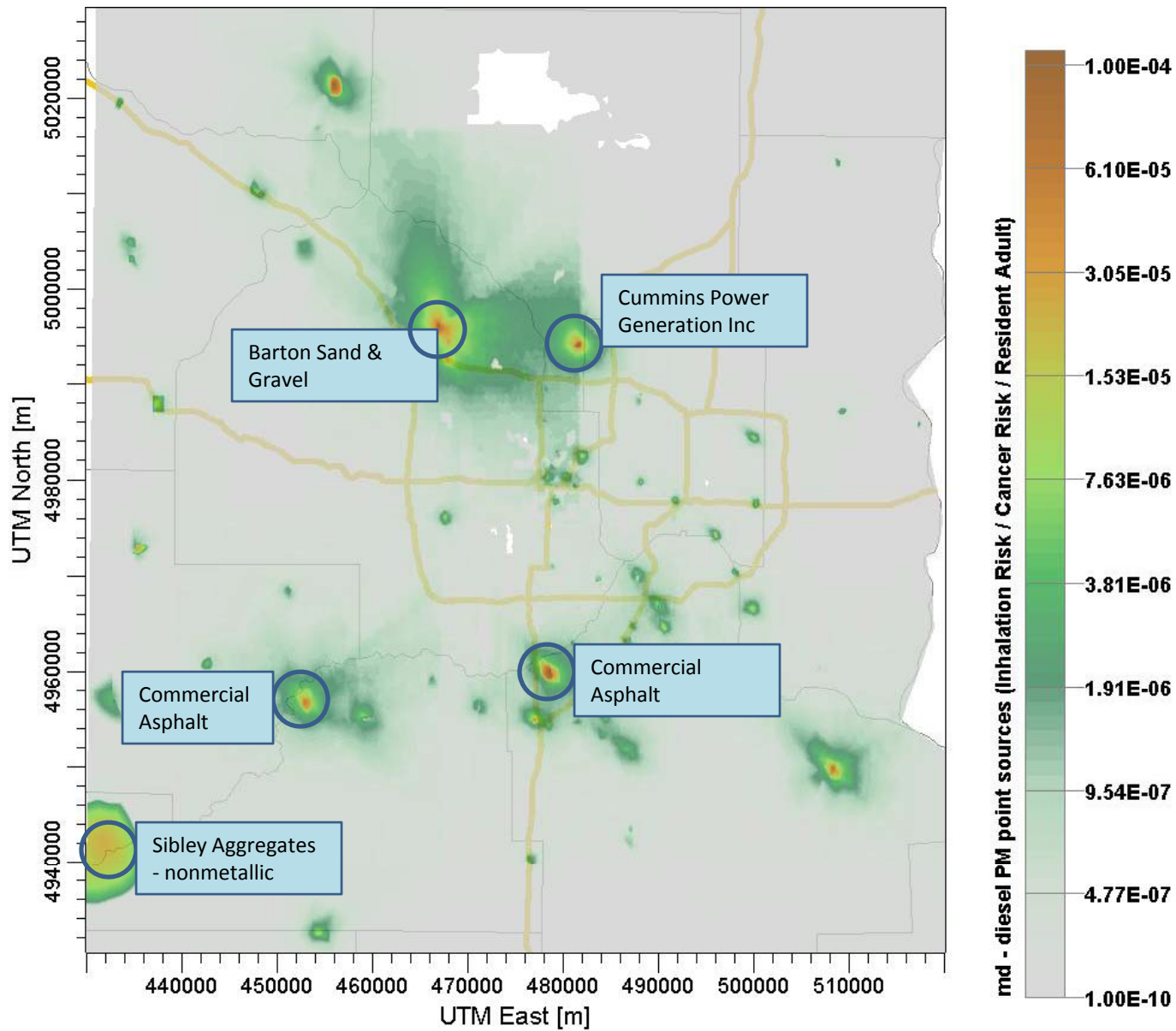
### Point Sources

### Estimated Inhalation Cancer Risks - statewide



# Point Sources

## Estimated Inhalation Cancer Risks - metro



## Uncertainties & Limitations

Some simplifying assumptions:

- stack parameters unavailable for many sources – assumed SCC averages
- stack locations from existing data (e.g., front door address, main stack, facility centroid)
- surrogates used to apportion county emissions to census tracts
- mobile and area source emissions represented as census tract polygons (high traffic road segments modeled explicitly)
- short term emission rates derived from steady state assumption

## Uncertainties & Limitations

Some caveats:

- Diesel risks based on CalEPA inhalation unit risk value – no EPA consensus on value
- Fence line risks not systematically evaluated
- Data quality varies by source and by source category

## Uncertainties & Limitations

- We don't have population data for non-road mobile apportionment – need survey data
- Stationary fuel combustion emissions highly uncertain due to non-exclusive fuel consumption data for the category
  - Double-counting in area, point & nonroad categories
  - Area source emissions could decrease by up to 1/3 or more
  - Will make adjustments to correct this in 2008 inventory