A Comprehensive Model for Multi-Pathway Risks from Air Pollution: Emission Inventory Preparation

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MNRISKS

All known air emissions sources

All pathways in EPA HHRAP protocol

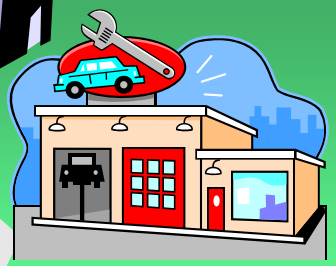
Criteria Pollutants

- PM10
- PM2.5
- SO2
- NOx
- CO
- Lead
- VOCs

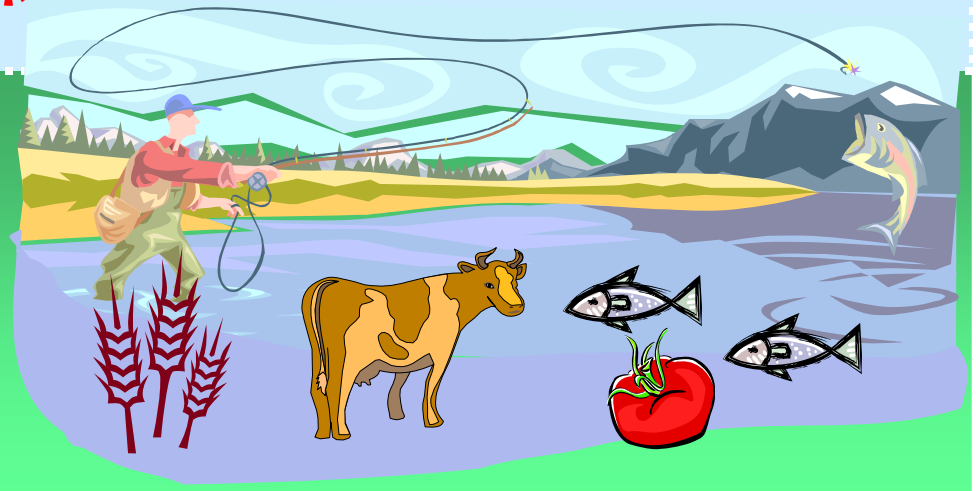
Air Toxics

- CAA HAPs
- Other Toxics
- Lead
- Diesel Exhaust

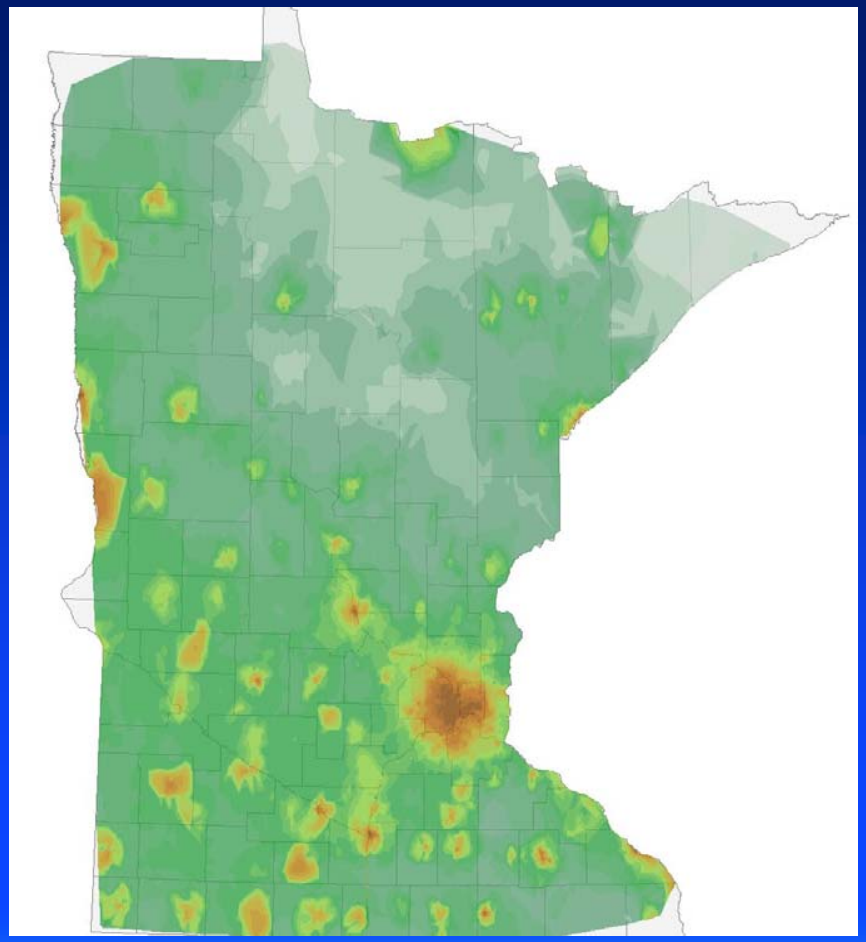
Mobile



Nonpoint



ISSUES



1. Double counting for grouped pollutants
2. Methods for allocating county-level emissions to census tracts
3. Stack parameters and geographic coordinates

2005 EI OVERVIEW

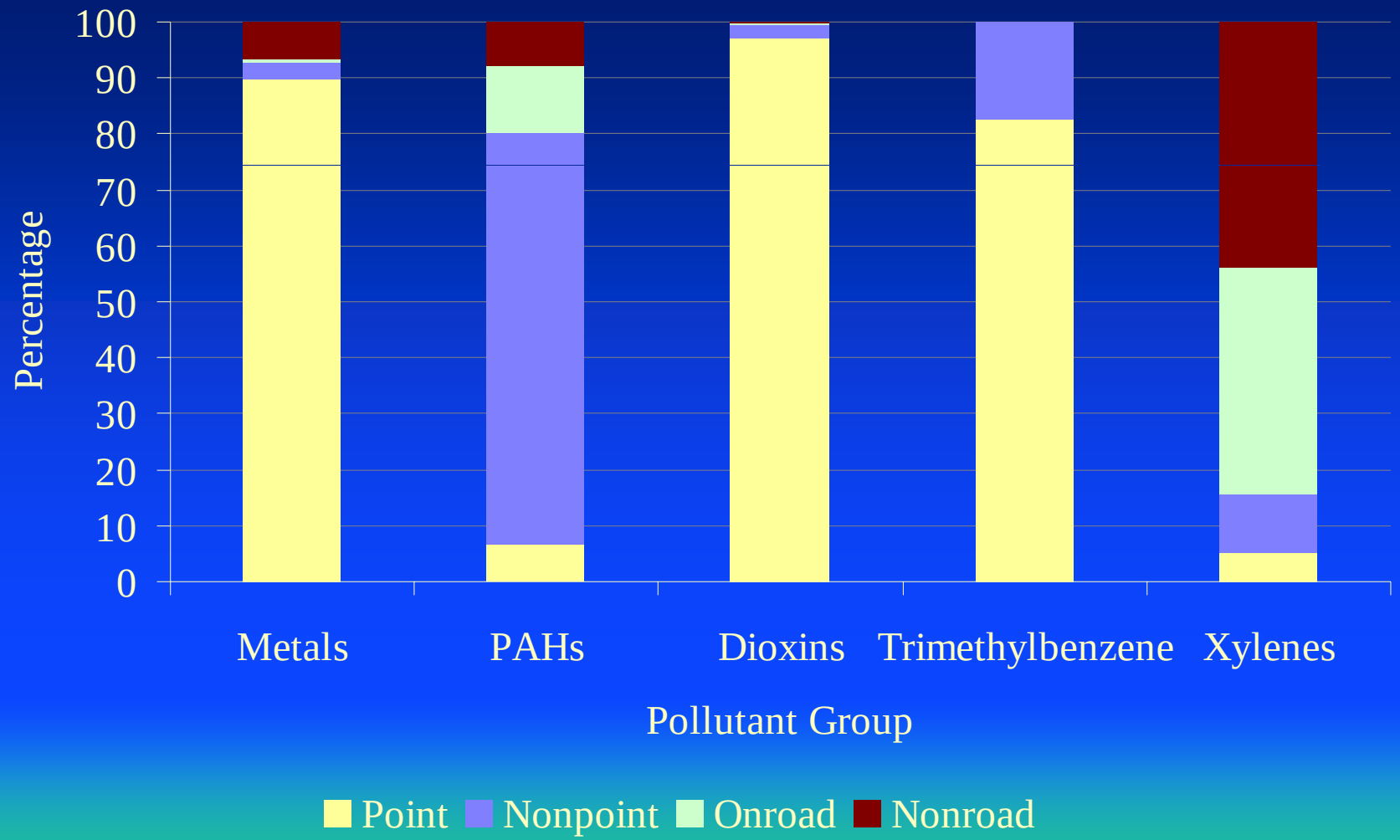
- 286 Pollutants
- 1235 Permitted facilities
  - 599 Reported emissions
  - 20+ - Lack of emissions
  - Others – throughput for combustion
- 51 TRI facilities
- 37 Categories - 86 sub-categories for nonpoint sources
  - 31 - State estimated
  - 6 - From EPA

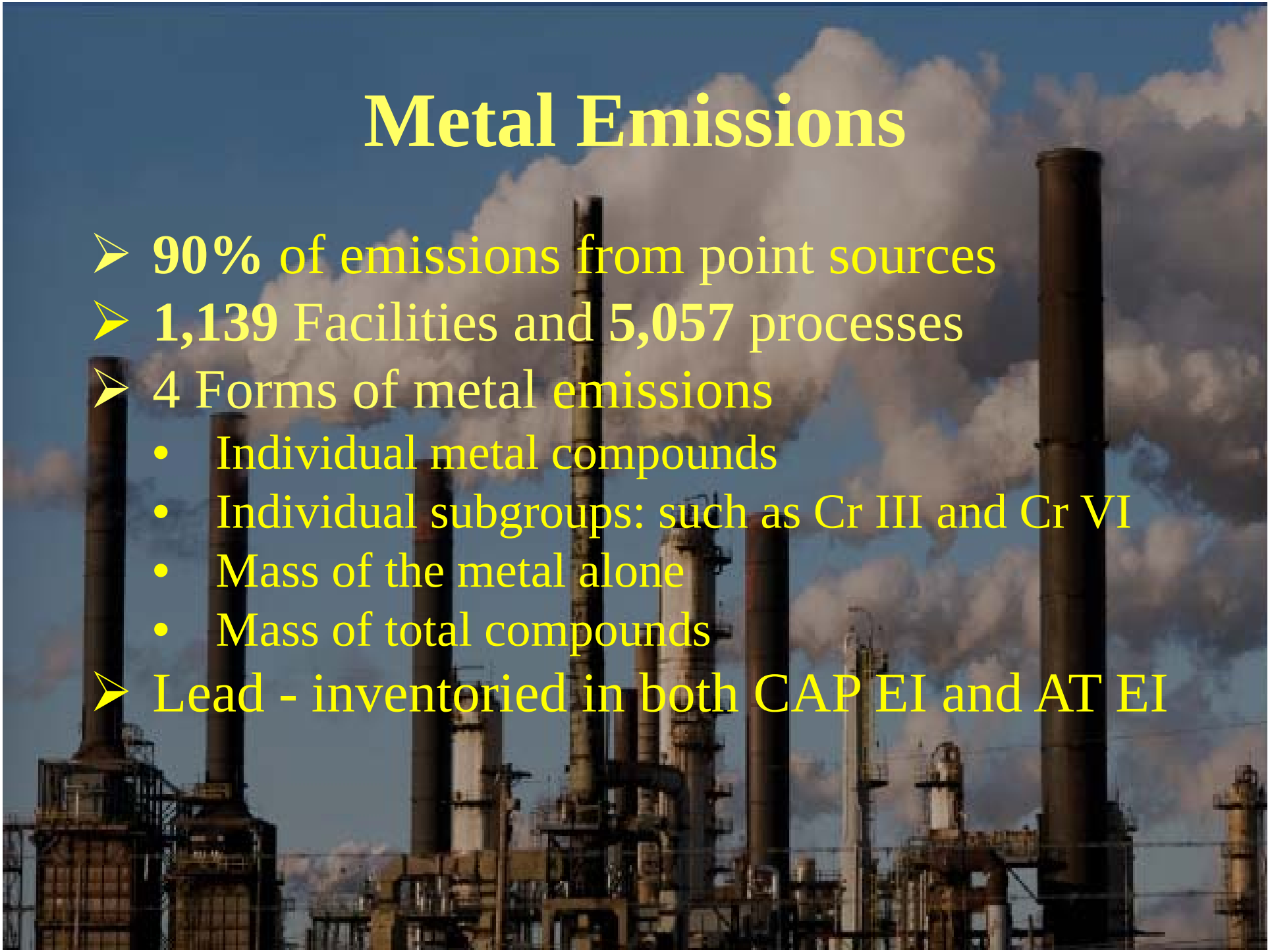
2005 EI OVERVIEW

- Onroad mobile sources - EPA
- NonRoad mobile sources
  - Aircraft & airport ground support equipment - MPCA
  - Locomotives - MPCA
  - CMV - Grow CENRAP 2002
  - Others - EPA

RESOLUTION for ISSUES

Emissions of grouped pollutants





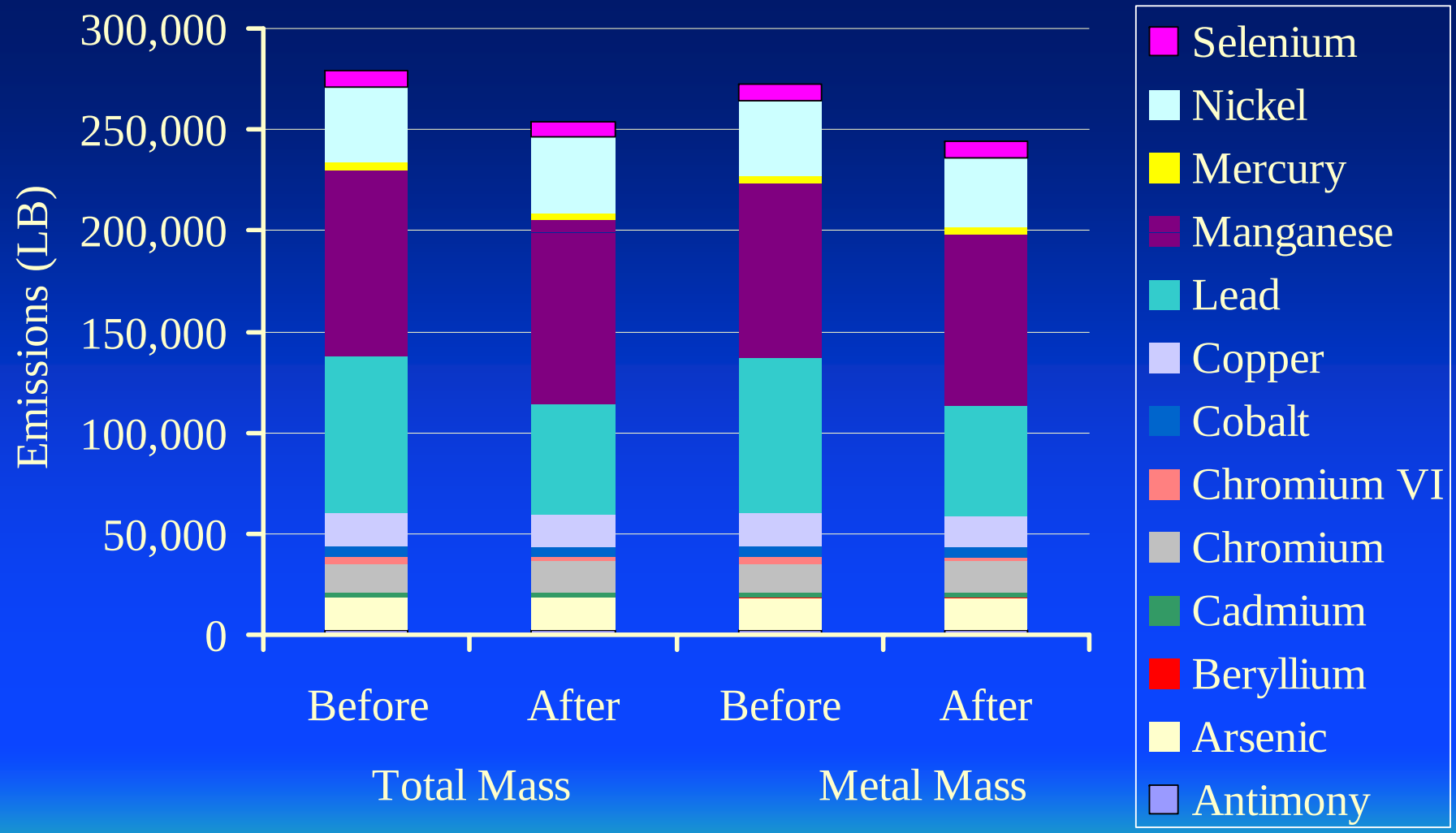
Metal Emissions

- **90%** of emissions from point sources
- **1,139** Facilities and **5,057** processes
- 4 Forms of metal emissions
  - Individual metal compounds
  - Individual subgroups: such as Cr III and Cr VI
  - Mass of the metal alone
  - Mass of total compounds
- Lead - inventoried in both CAP EI and AT EI

Metal Emissions

- Suspiciously high emissions from surface coating operations due to no consideration of
  - Transfer efficiency (30% - 100%)
  - Control efficiency (0 - 99.8%)
  - 32 Facilities – 100 processes
  - Contacted facilities with > 20lb emissions

Metal Emissions

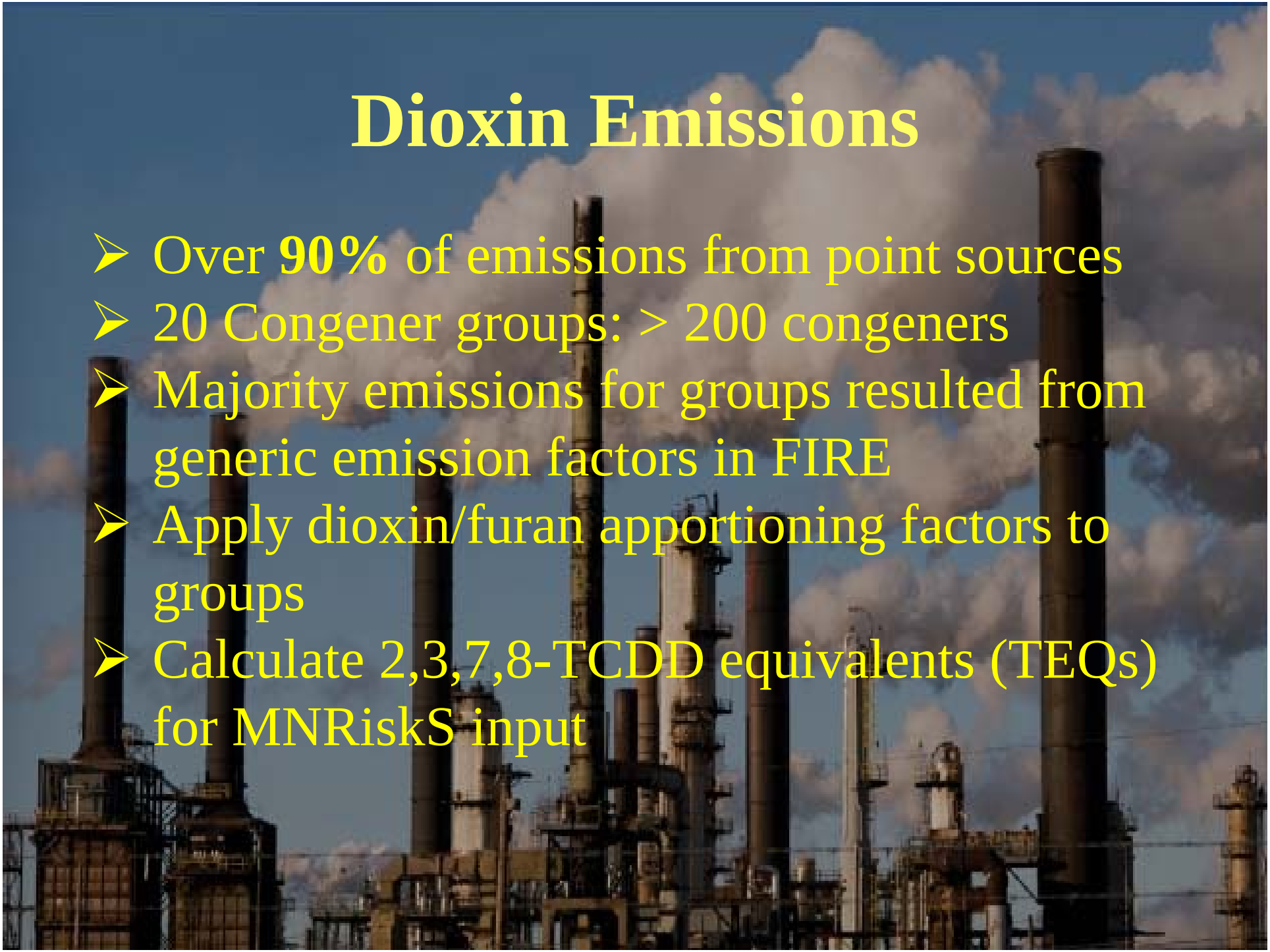


Metal Emissions

- General steps for MNRiskS input
  - Emissions only available for the metal compound - use as emissions of metal elements
  - Cr - speciated to Cr VI and Cr III
  - Emissions of an individual metal compound - converted to emissions of metal elements

Metal Emissions

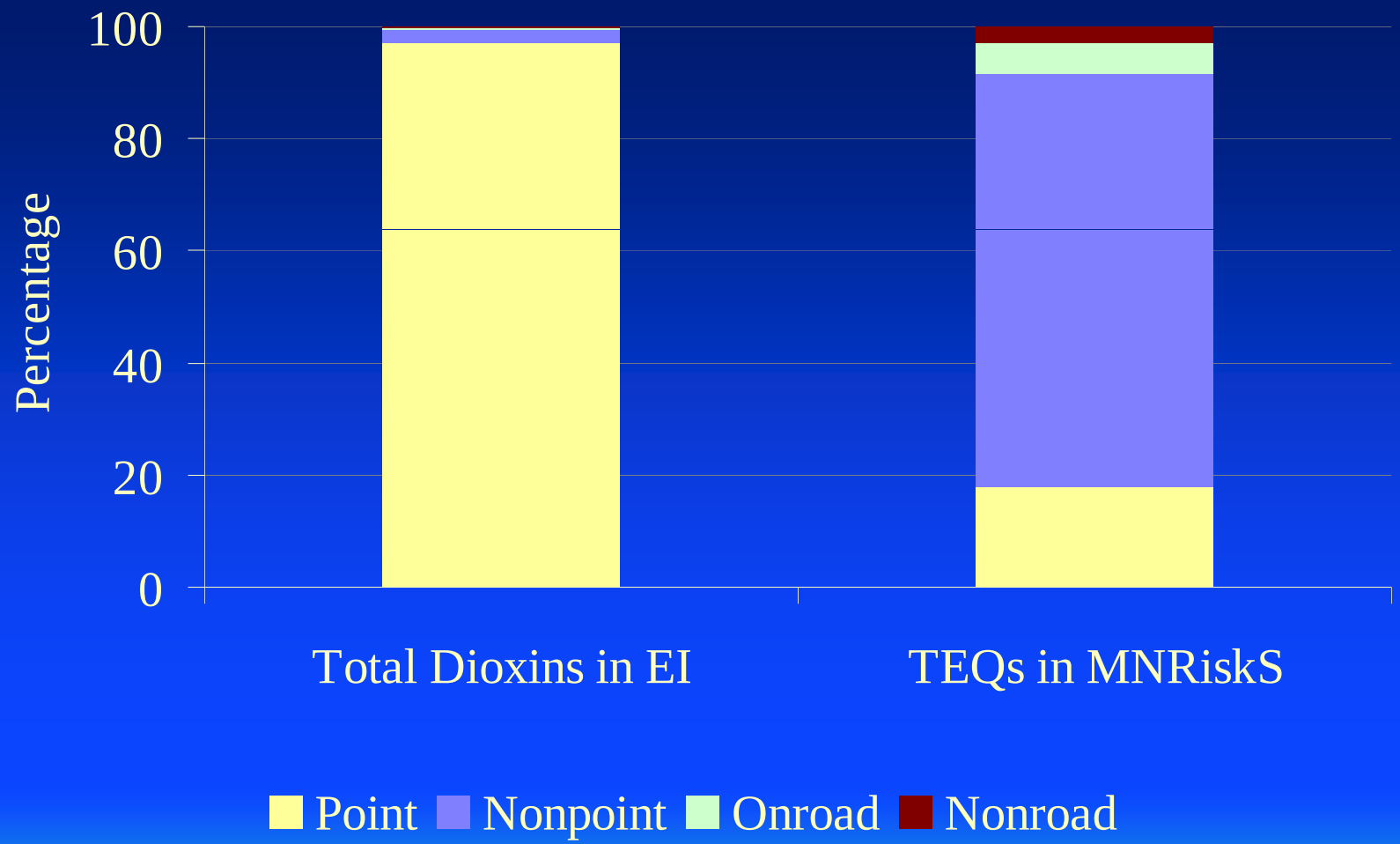
- Recommendations
  - Facilities should report emissions of specific metal compounds or the mass of the metal only
  - Emission factors need to be mutually exclusive for compounds
  - Lead emissions from the CAP EI and AT EI need to be reconciled



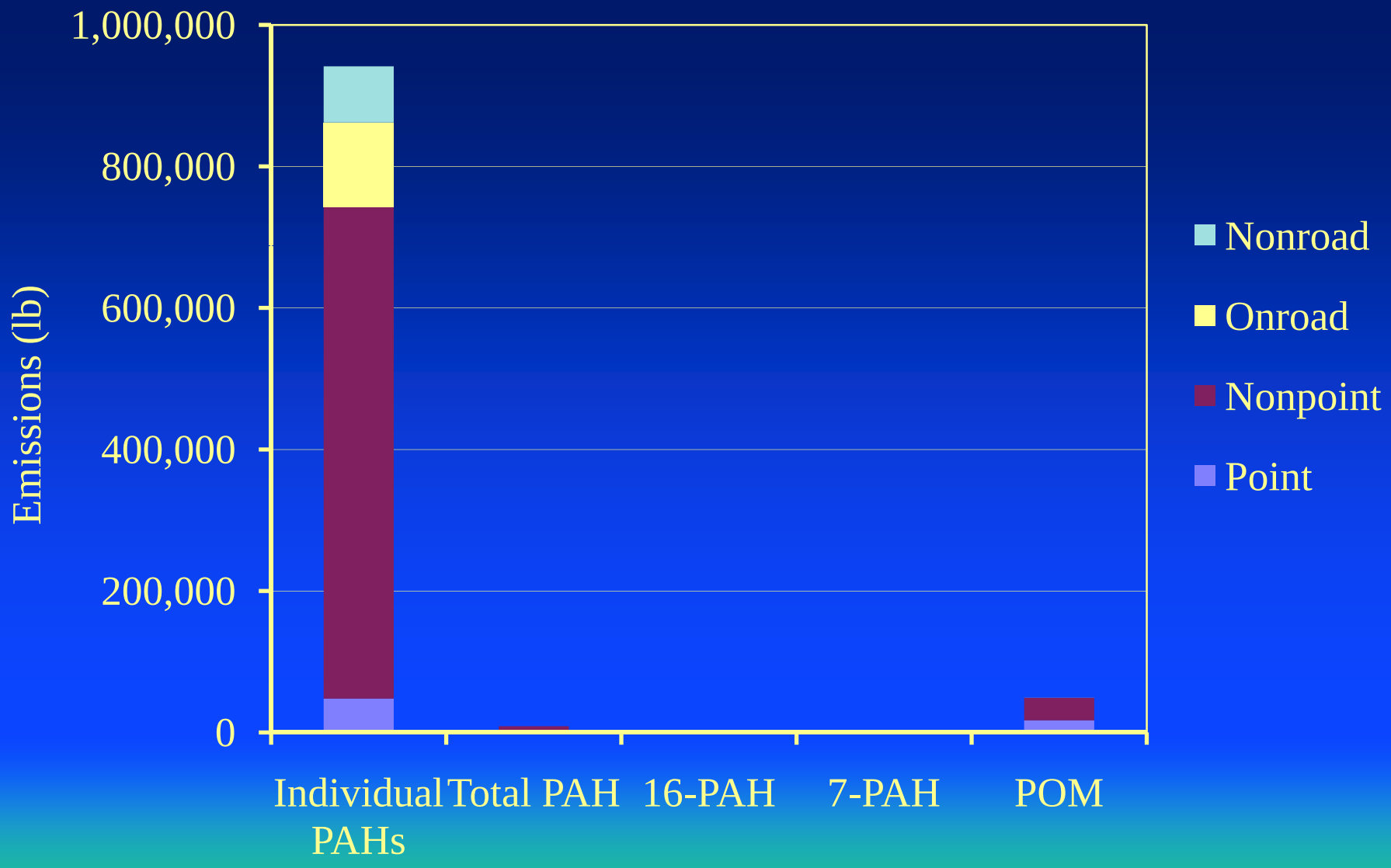
Dioxin Emissions

- Over **90%** of emissions from point sources
- 20 Congener groups: > 200 congeners
- Majority emissions for groups resulted from generic emission factors in FIRE
- Apply dioxin/furan apportioning factors to groups
- Calculate 2,3,7,8-TCDD equivalents (TEQs) for MNRiskS input

Dioxin Emissions

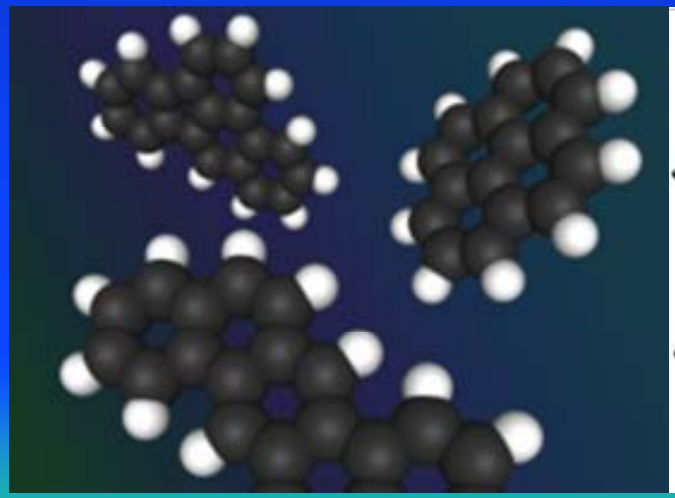
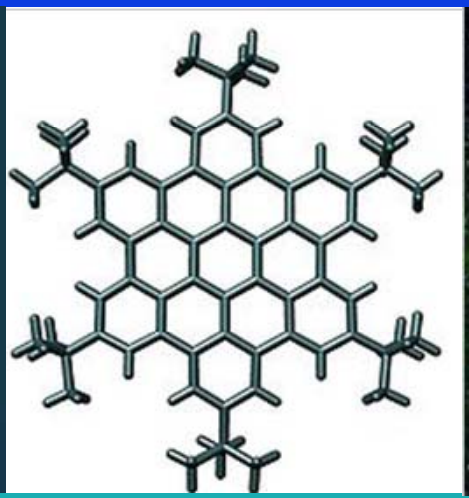


PAH Emissions

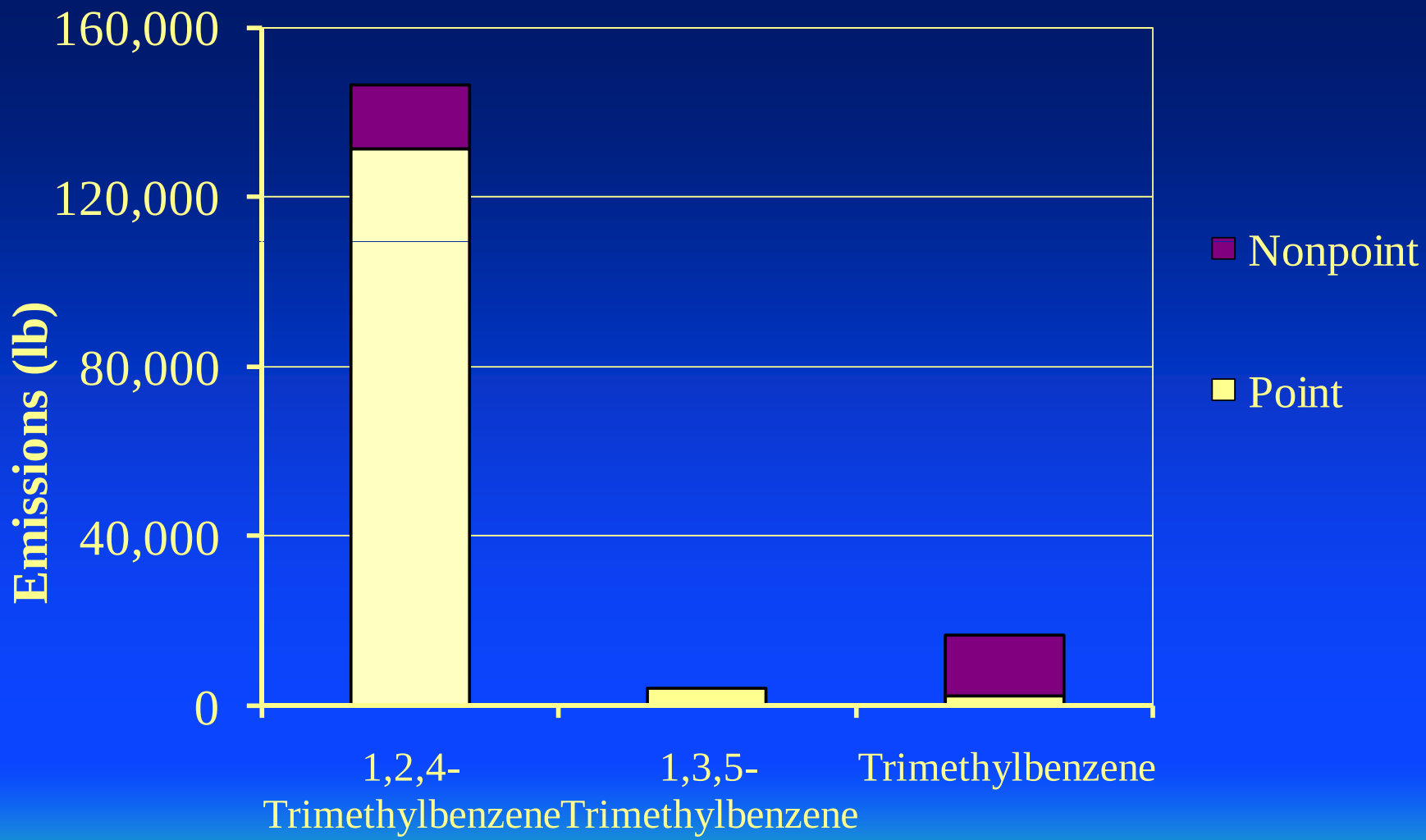


PAH Emissions

- No changes on emissions
- Adjust toxicity values in the MNRisks input
  - EPA NATA 2002 guidance
  - Minnesota Department of Health guidance


Trimethylbenzene Emissions



Trimethylbenzene Emissions

- No changes on emissions
- Total trimethylbenzenes used for MNRiskS model input
  - Only total - use it
  - No total - use the sum of isomers
  - Both total and isomers
    - Use total if the sum of isomers < total
    - Use the sum of isomers if the sum of isomers > total

Xylene Emissions

- 84% Emissions from mobile sources
- 5 Forms
  - m,p-xylene
  - m-xylene
  - p-xylene
  - o-xylene
  - xylenes (mixed isomers) – 99%

Point sources

- No change on emissions
- Xylenes used for MNRiskS model input

Apportion Emissions

Nonpoint sources

- Emission data at individual facility level: landfills, public owned treatment works (POTWs), and dry cleaners
- Emission data at the county level
  - Throughput data not available from individual facilities - appropriate surrogates
  - Throughput data might be available from individual facilities: human cremation and drum and barrel reclamation

Human Cremation

- Number of cremations per crematory available for 2006-2008
- Use average fraction per crematory to allocate the 2005 state total
- Addresses available for majority crematories
- No address - web search and phone calls
- Emissions were allocated to 55 crematories for MNRiskS input

Drum and Barrel Reclamation

- 1,818,182 barrels reclaimed in Hennepin County in 2002 from EPA
- Finding after a search - one facility with the operation
- 480,000 barrels reclaimed in 2008 – data collected from the facility
- Updated the EI

Surrogates for Apportioning Nonpoint Source Emissions

Category Name	Surrogates for Tract Apportioning
Commercial and Consumer Products Usage	Population
Commercial Cooking	Commercial Land Use
Degreasing	Population
Gasoline Service Stations	Gas Station Locations
Graphic Arts	Commercial Land Use
Residential Wood Burning	Population
Stationary Source Fuel Combustion - Commercial/Institutional	Commercial Land Use
Stationary Source Fuel Combustion - Industrial	Industrial Land Use

Surrogates for Apportioning Nonroad Mobile Source Emissions

Category	Surrogates for Tract Apportioning
Agricultural Equipment	Rural Land Area
Commercial Equipment	Population
Commercial Marine Vessel	Water Fraction
Construction and Mining Equipment	# Point Sources Per Tract
Industrial Equipment	# Point Sources Per Tract
Lawn and Garden Equipment	Population
Logging Equipment	Forest Area
Pleasure Craft	Water Fraction
Railway Maintenance	Railway Miles
Recreational Equipment	Population
Locomotive Emissions	Railway Miles

Apportion Onroad Mobile Source Emissions

Use vehicle miles traveled (VMT) as a surrogate

VMT = AADT x L

Where

AADT = average annual daily traffic count

L = length of road segment

Stack Parameters and Geographic Coordinates

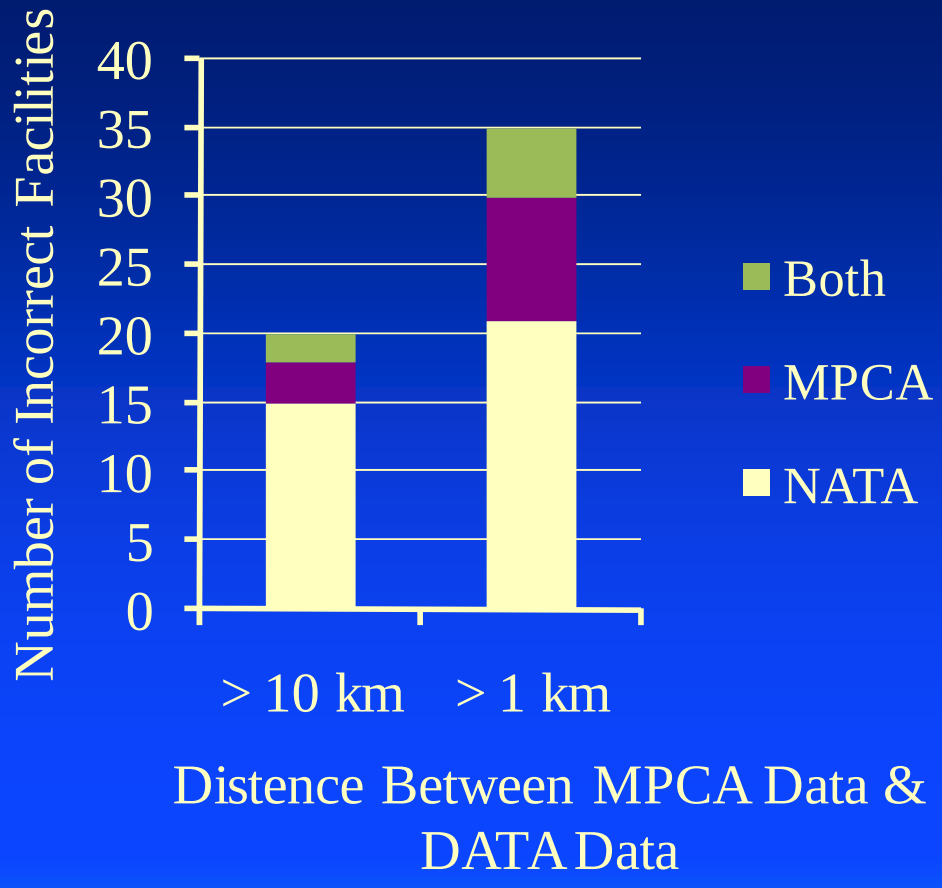
- Data from a permitting database
- Permitting processes pay little attention
- Anticipating incorrect or incomplete information

Stack Parameters

- Use average values by SCC for missing stack parameters
- Default stack values
  - Height - 10 m
  - Diameter - 2 m
  - Exit velocity - 1 m/s
  - Exit temperature - 293 K

Geographic Coordinates

- Compare locational data with the draft 2005 NATA
  - > 200 m - 89 facilities
- Use aerial photography to get correct data



CONCLUSION

Issue	Resolution
Grouped pollutants	Collect data for individual pollutants Clean up and fill gaps for emission factors
Allocating emissions	Better understanding emission data Collect facility-level data
Stack parameters & X/Y coordinates	Include requirements in EI reporting

Acknowledgement

Nate Edel for his effort on correcting metal emissions from point sources