What Can You Do With a Large and Unique Dataset?

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How did we get this dataset?

- Detroit Pilot Project NATTS
- LADCO 2003 NATTS follow-up Projects
- DEARS
- Community Monitoring Grant 2005
- Rail Yard Study – RARE Grant

Lessons Learned From Pilot Study

- Detroit air shed is heterogeneous while other Pilot cities were more homogeneous
- Primary risk driver is different for each site in Detroit
- Levels of naphthalene, benzene, and methylene chloride within the top 99th percentile nationally
- Manganese levels were 2 to 5 times higher than the health reference level.
- Inter laboratory precision data set indicated that laboratory selection could be a major factor influencing data comparability nationwide.
- Comparability between laboratories is improving as a result of the performance evaluation program.

Goals of This Grant

- Source apportionment using both the air toxics and fine particulate datasets
- Trends analysis comparing changes in air toxics in Detroit with other cities nationwide and assessing spatial diversity
- Inter laboratory data comparability
- Filter blank contamination issues
- Impact of alterations on MDLs on the ability to discern trends
- Impact of the performance evaluation program on inter laboratory data comparability
- Changes in the levels of risk

$PM_{2.5}$ (Fine Particle) Monitors in 2010

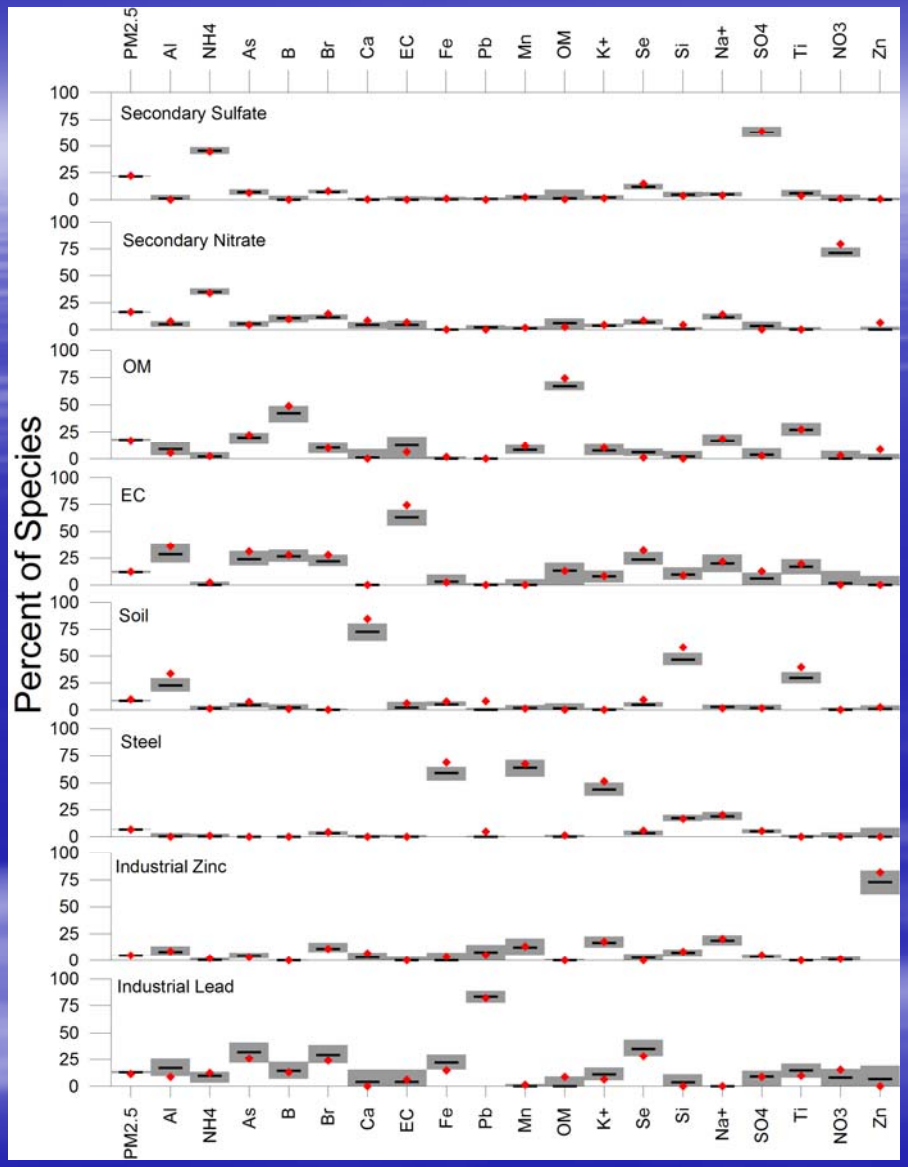
Reports from this Grant

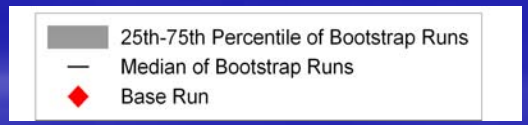
- Source Apportionment (STI lead)
- Trends Analysis (STI lead)
- Filter Blanks Contamination Issues (MDEQ lead)
- Inter Laboratory Data Comparability Issues (MDEQ lead)
- MDL Uncertainty Analysis (Peter Scheff lead, still in progress)
- Updated Risk Assessment (MDEQ lead)
- Comparison of Risk in Grand Rapids MI with Southeast Michigan (MDEQ lead)
- Summary Document – Incorporating all papers (MDEQ lead)

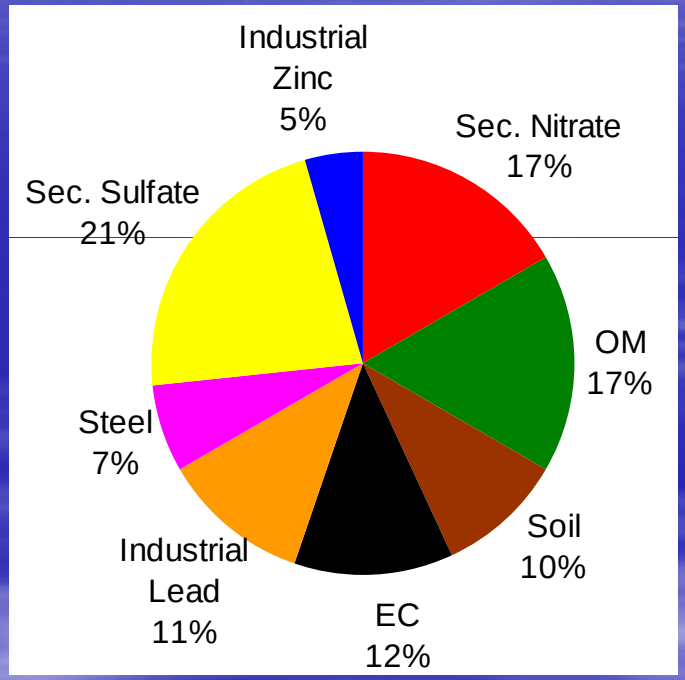
Source Apportionment I

- PMF performed at Dearborn, Allen Park, N Delray and Ypsilanti
- Higher PM2.5 mass at Dearborn driven by soil components such as iron, OM, and sulfate.
- For TSP metals, only manganese and lead higher at Dearborn than Ypsilanti and Allen Park.
- Even though Dearborn and N Delray are close to each other (2 mi apart) large VOC difference were observed.
- When winds at Ypsilanti come from Detroit, $PM_{2.5}$ and trace metal concentrations are much higher.

Dearborn PMF Results

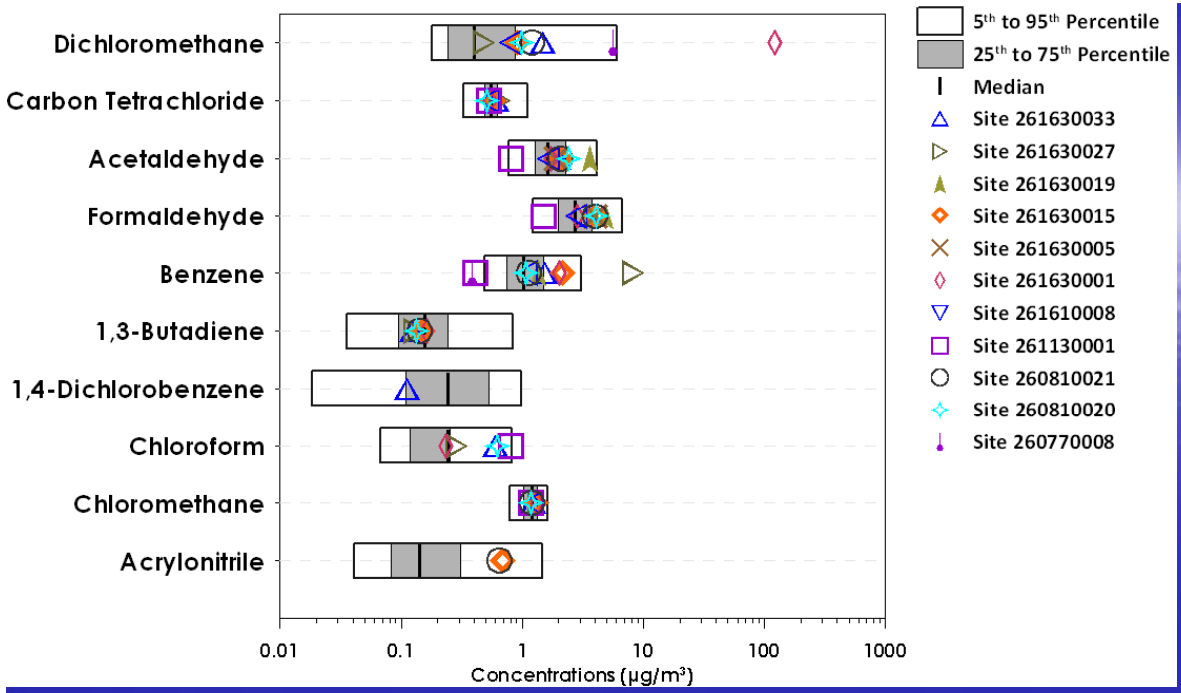






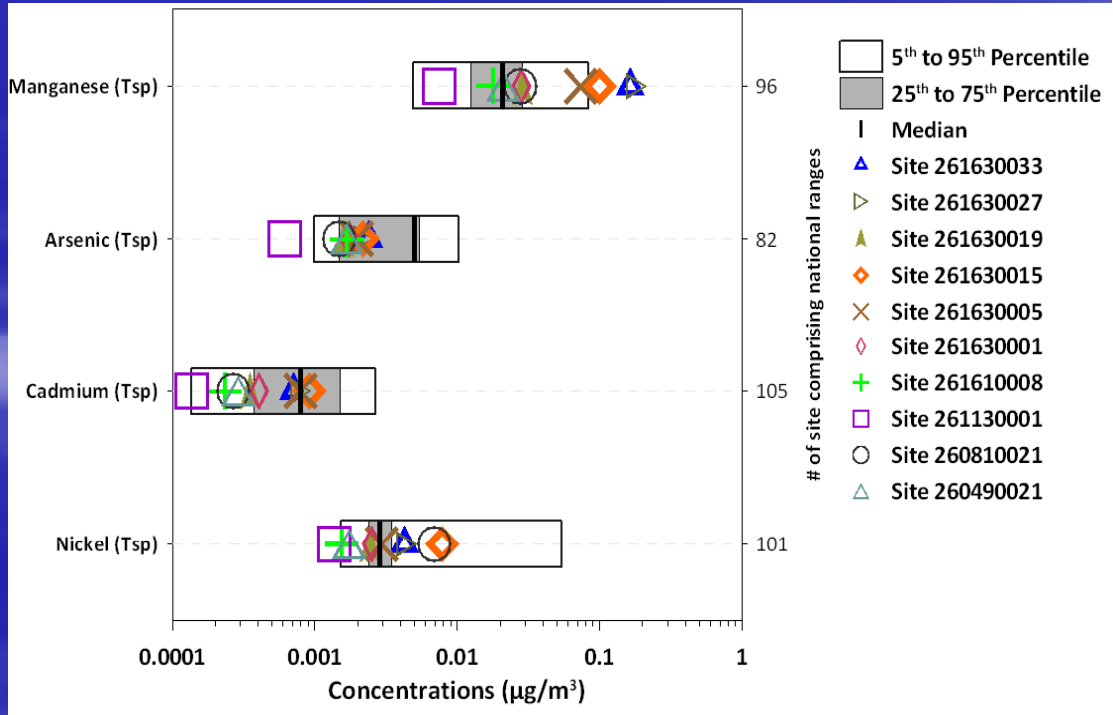
Trends I

- Most sites for most pollutants are within the national range.
- Major exception, Manganese at S Delray, Dearborn, N Delray, and River Rouge – due to steel mills.
- VOC concentrations at most sites decreasing over time, Metals all but Nickel at N Delray are decreasing over time.
- Dichloromethane and chloromethane are decreasing faster in Michigan than other sites in the country; this is probably a result of higher initial concentrations.

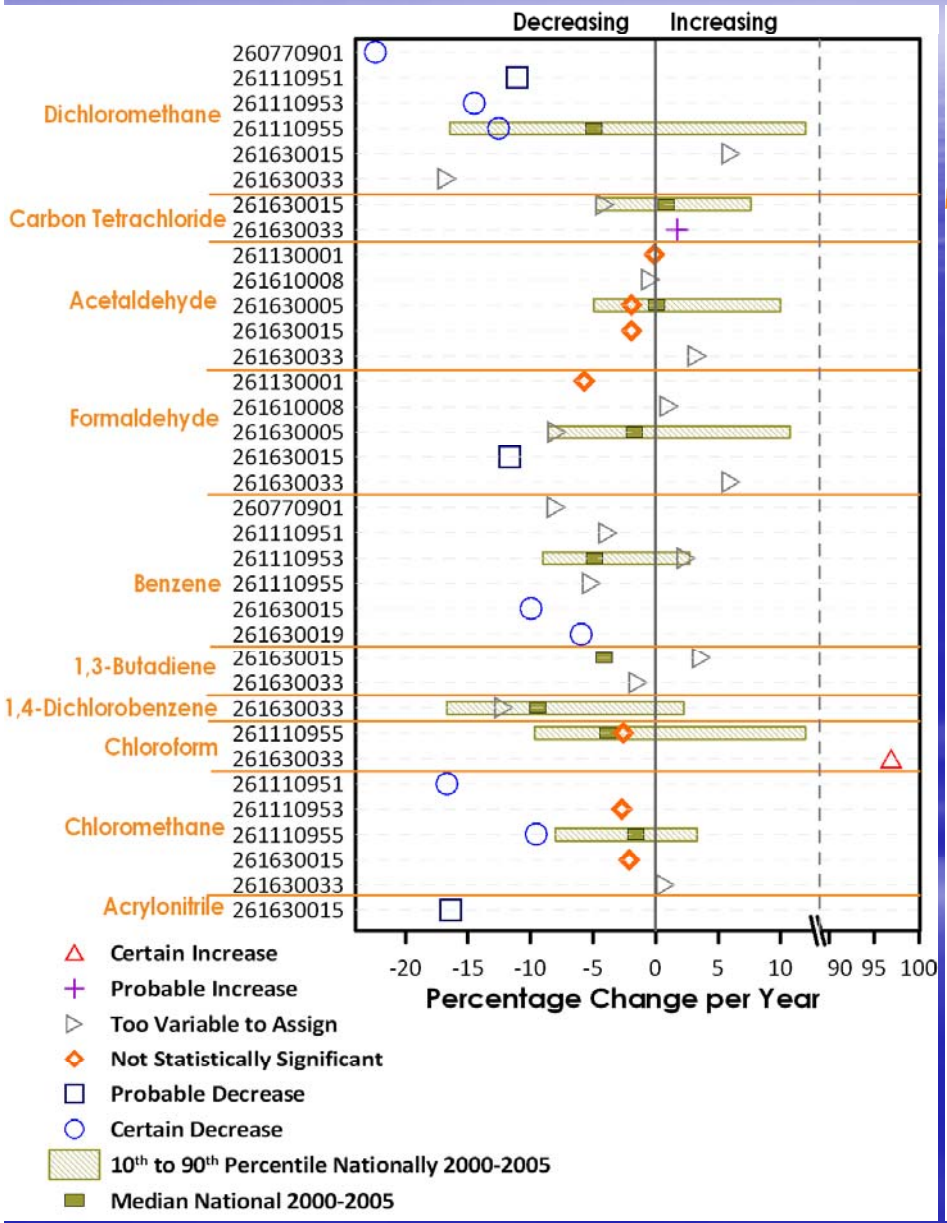


VOC Trends

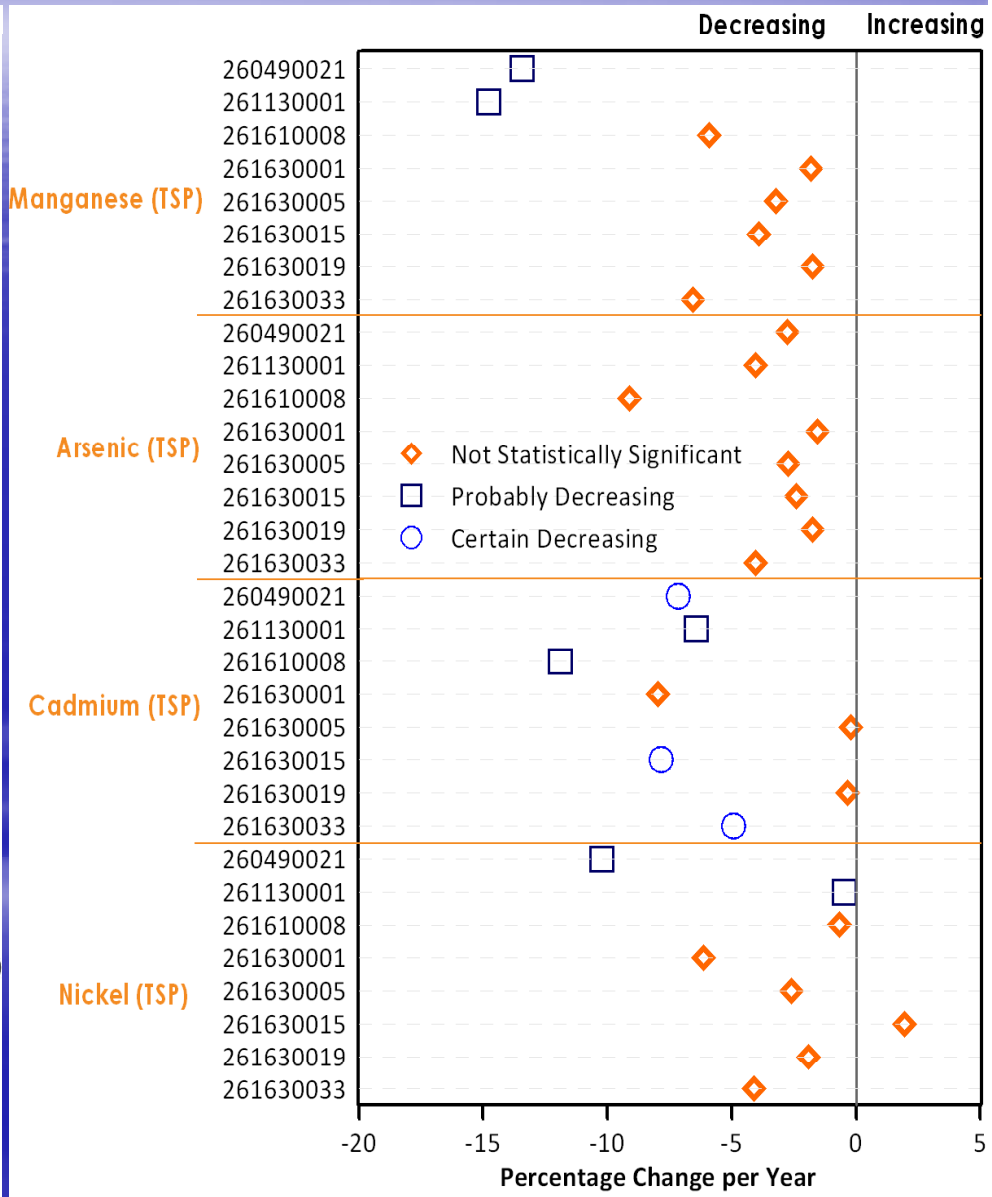
Metals Trends



VOC Trends



Metal Trends



Filter Blank I – Manufacturing Issues

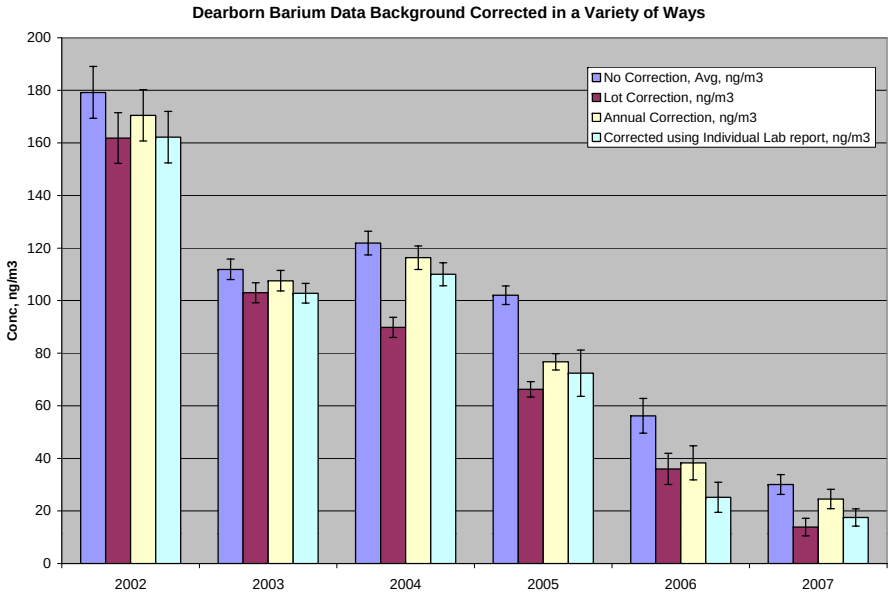
- Both quartz and glass from Manufacturing Process
  - Cr, Fe, Mn, Ni, and Pb
- Ba higher in glass than quartz
- If sorted by lot number
  - Ba, Fe, Mn, and Zn were variable
- Contimation below detection limits for
  - As, Be, Cd, Co and V both types; Mo quartz

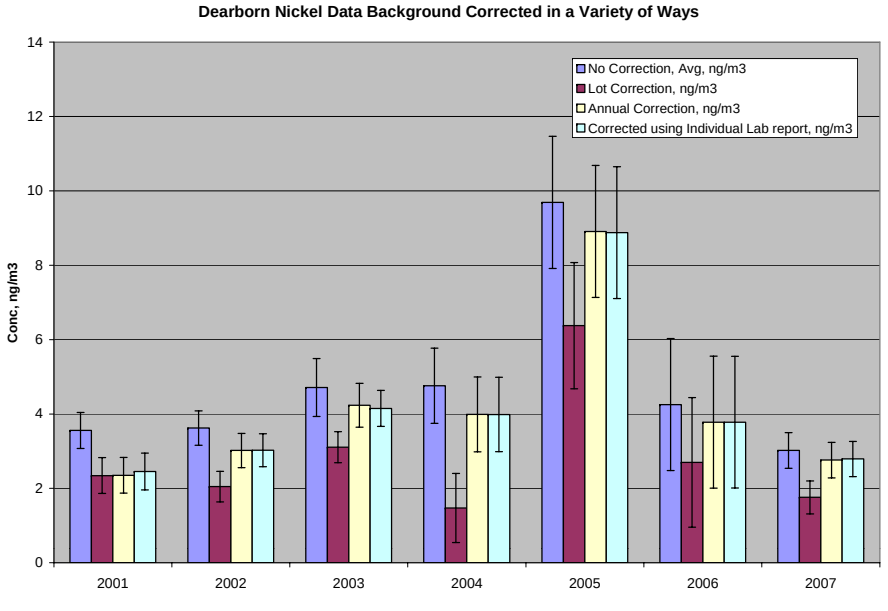
Filter Blank II – Lab Issues

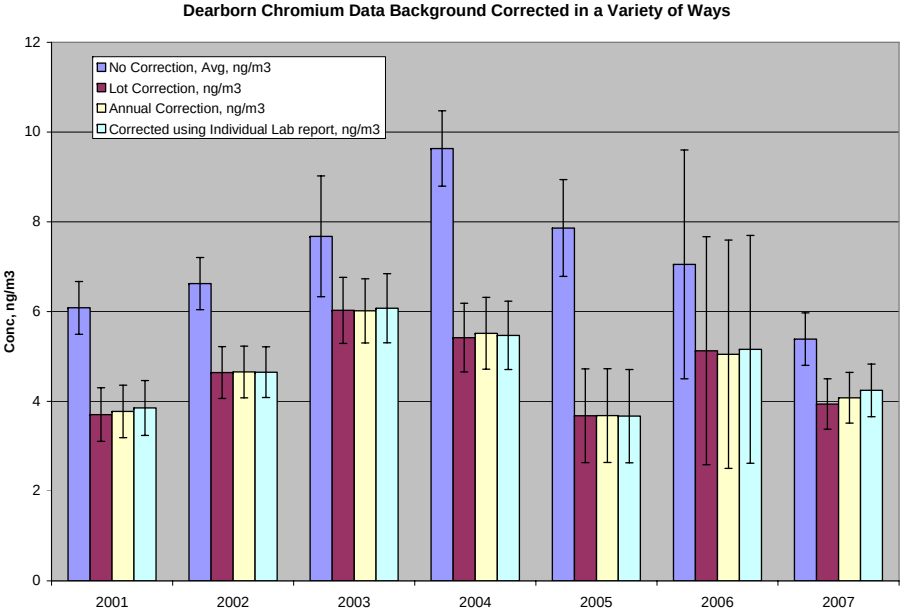
- Extraction Process
  - As and Be similar to manufacturing – minimal
  - V significant
- Laboratory Regants contribute about 1/3 of total contamination
  - Cd, Co, Cr, Mn, Ni, Pb, and Zn
- Digestion contributed minimal amounts of
  - Ba, Fe, and Mo
- Extraction and filtering contributed
  - Mn and Zn

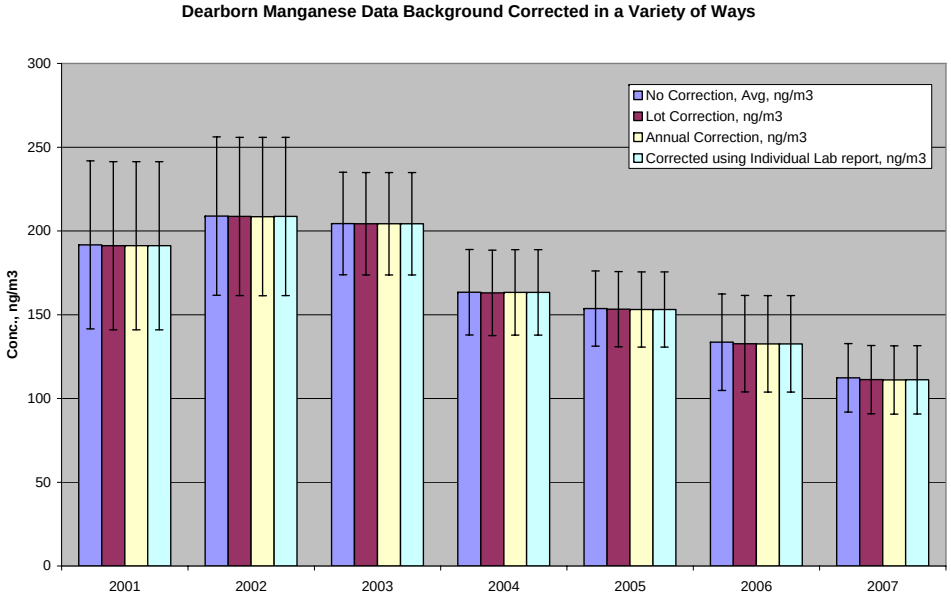
Filter Blank III – Background Correction

- Background correction was performed in various ways: lot ave, monthly ave, annual ave
  - Depending on year levels of contamination to filter blanks can be signification and highly variable
  - Elements of concern Cd, Co, Mo, Ni and Zn
- Background correction not an issue for Fe, Mn, and Pb.
- Method of background correction highly important for Ba or Ni
- Background correcting Cr data results in large change in magnitude, but method has very little impact


Dearborn Barium Data Background Corrected in a Variety of Ways
Conc, ng/m3
No Correction, Avg, ng/m3
Lot Correction, ng/m3
Annual Correction, ng/m3
Corrected using Individual Lab report, ng/m3
0
20
40
60
80
100
120
140
160
180
200
2002
2003
2004
2005
2006
2007


Dearborn Nickel Data Background Corrected in a Variety of Ways
Conc, ng/m3
No Correction, Avg, ng/m3
Lot Correction, ng/m3
Annual Correction, ng/m3
Corrected using Individual Lab report, ng/m3
0
2
4
6
8
10
12
14
2001
2002
2003
2004
2005
2006
2007


Dearborn Chromium Data Background Corrected in a Variety of Ways
Conc, ng/m3
No Correction, Avg, ng/m3
Lot Correction, ng/m3
Annual Correction, ng/m3
Corrected using Individual Lab report, ng/m3
0
2
4
6
8
10
12
2001
2002
2003
2004
2005
2006
2007


Dearborn Manganese Data Background Corrected in a Variety of Ways
Conc., ng/m3
No Correction, Avg, ng/m3
Lot Correction, ng/m3
Annual Correction, ng/m3
Corrected using Individual Lab report, ng/m3
0
50
100
150
200
250
300
2001
2002
2003
2004
2005
2006
2007

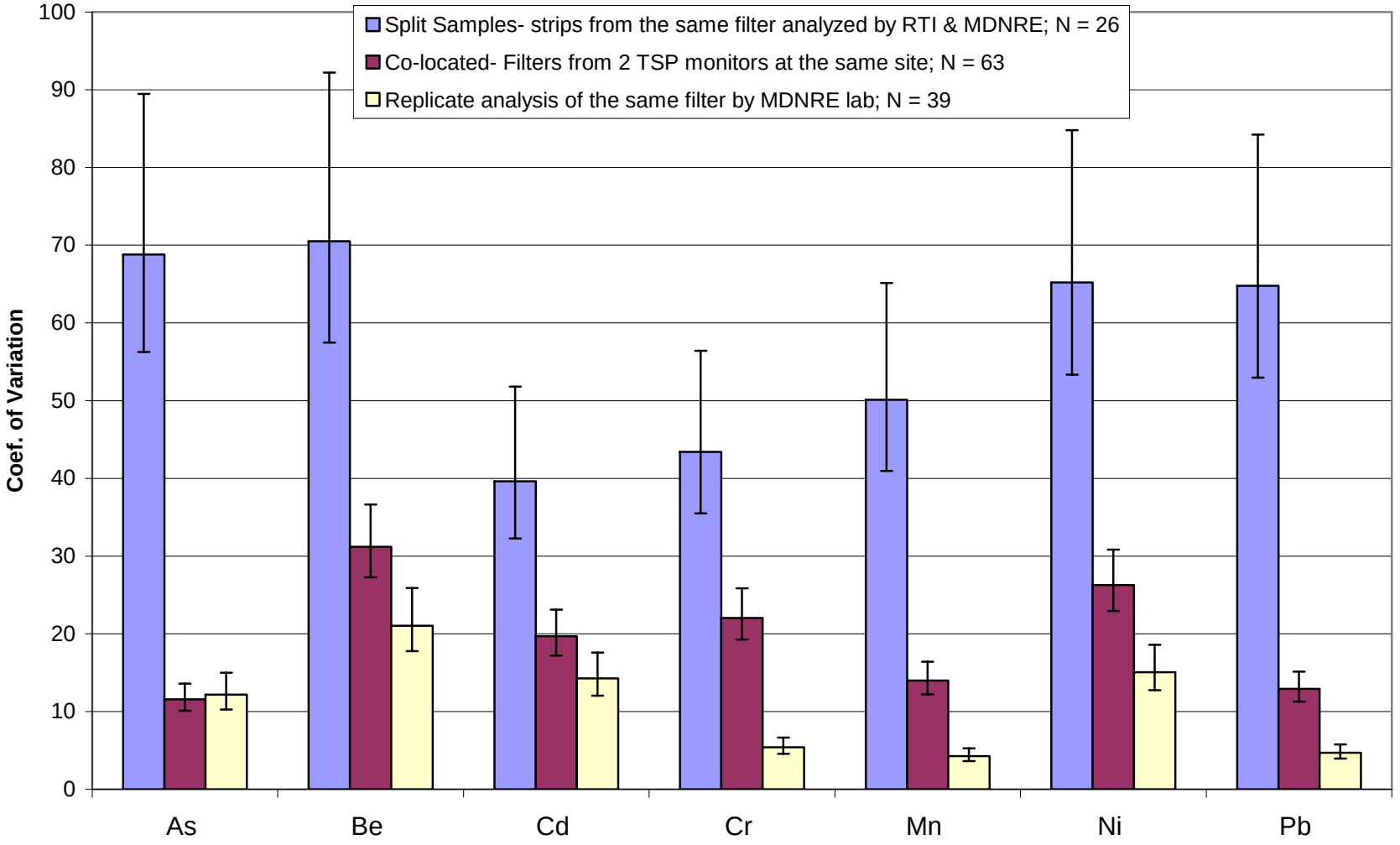
Inter Laboratory Comparability I

- Split samples were collected at the Dearborn site for Carbonyls and VOCs on a once every three day schedule
- 1/3 of time both samples sent to DEQ lab to assess precision, 1/3 of time both samples sent to ERG to assess precision, and 1/3 of time one sample sent to each lab to assess inter laboratory comparability

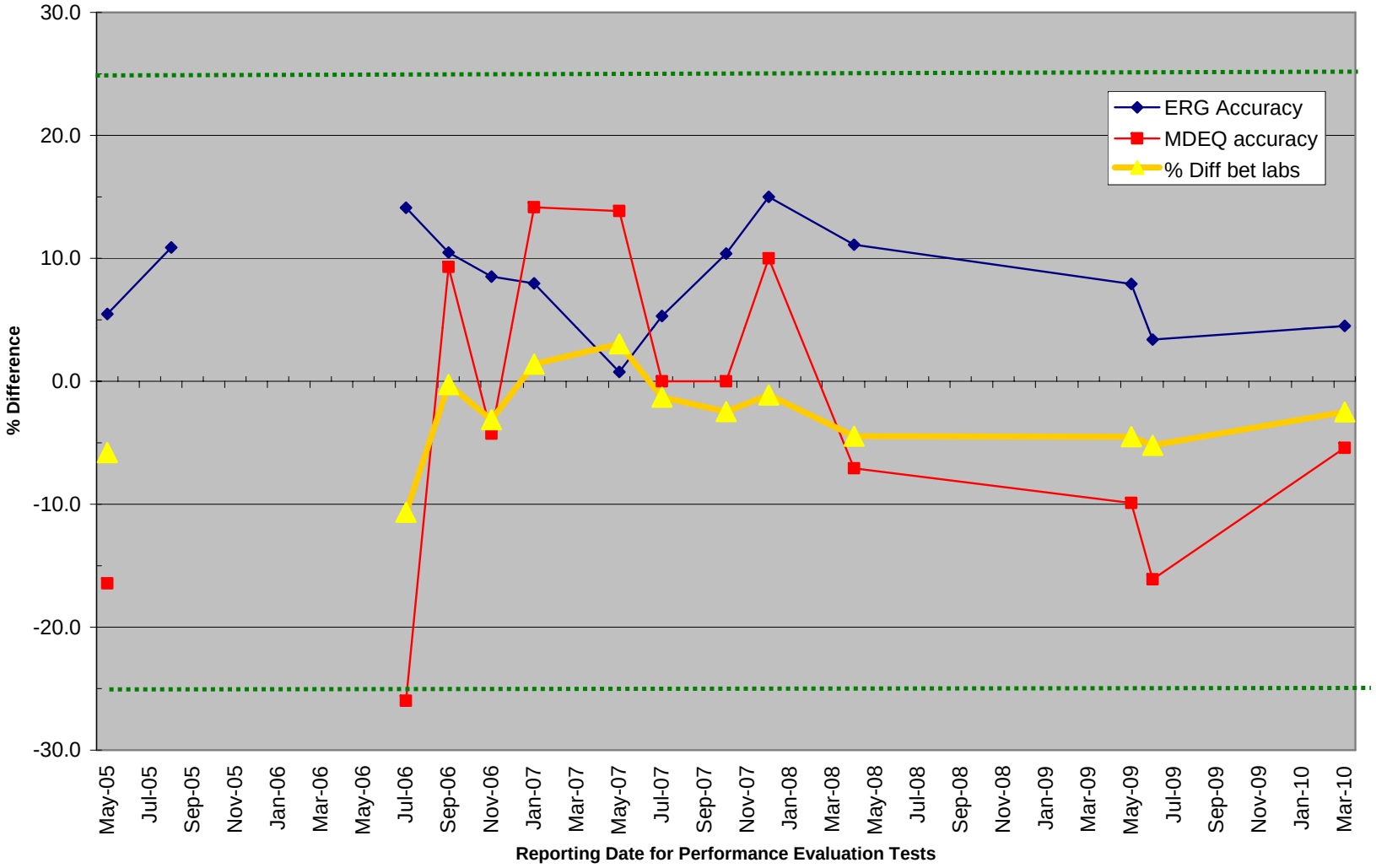
Sources of Variation in the Detroit Pilot Project Trace Metals Data

Strips from 30 filters were analyzede by both MDNRE and RTI laboratories. RTI used ICP AES for Mn and Pb and ICP/MS for remaining elements. MDNRE used ICP/MS for all. Filters were collected from March 2, 2001 through April 26, 2002 on glass fiber filters using Hi-vol samplers.

Co-loc Site = 261630015, SW HS



Laboratory Accuracy and Comparability for Methylene Chloride



Updated Risk Assessment I Priority Air Toxics

- Acetaldehyde
- Acrylonitrile
- Benzene
- 1,3-Butadiene
- Cadmium
- Carbon Tetrachloride
- Chloroform
- Chloromethane
- Chromium VI
- 1,4-Dichlorobenzene
- Formaldehyde
- Manganese
- Methylene Chloride
- Nickel

Updated Risk Assessment II

- Most compounds showed a decrease from DATI I
- Slight increases at background sites, Ypsilanti and Houghton Lake, for arsenic, chromium VI and Nickel
- Chloroform issues have not been resolved, but are below the health protective benchmark
- Manganese remains above the health protective benchmark

Conclusions

- Papers from this grant will be out later this year, with a summary document.
- Watch how large your project is, it's always more work than you envision.
- Working with collaborators can be tricky.
- Good way to get software in tight budgets and training for modeling techniques, such as PMF.
- Reduction in personnel due to retirements and budget reductions makes doing analysis like this harder, and cannot always be anticipated.