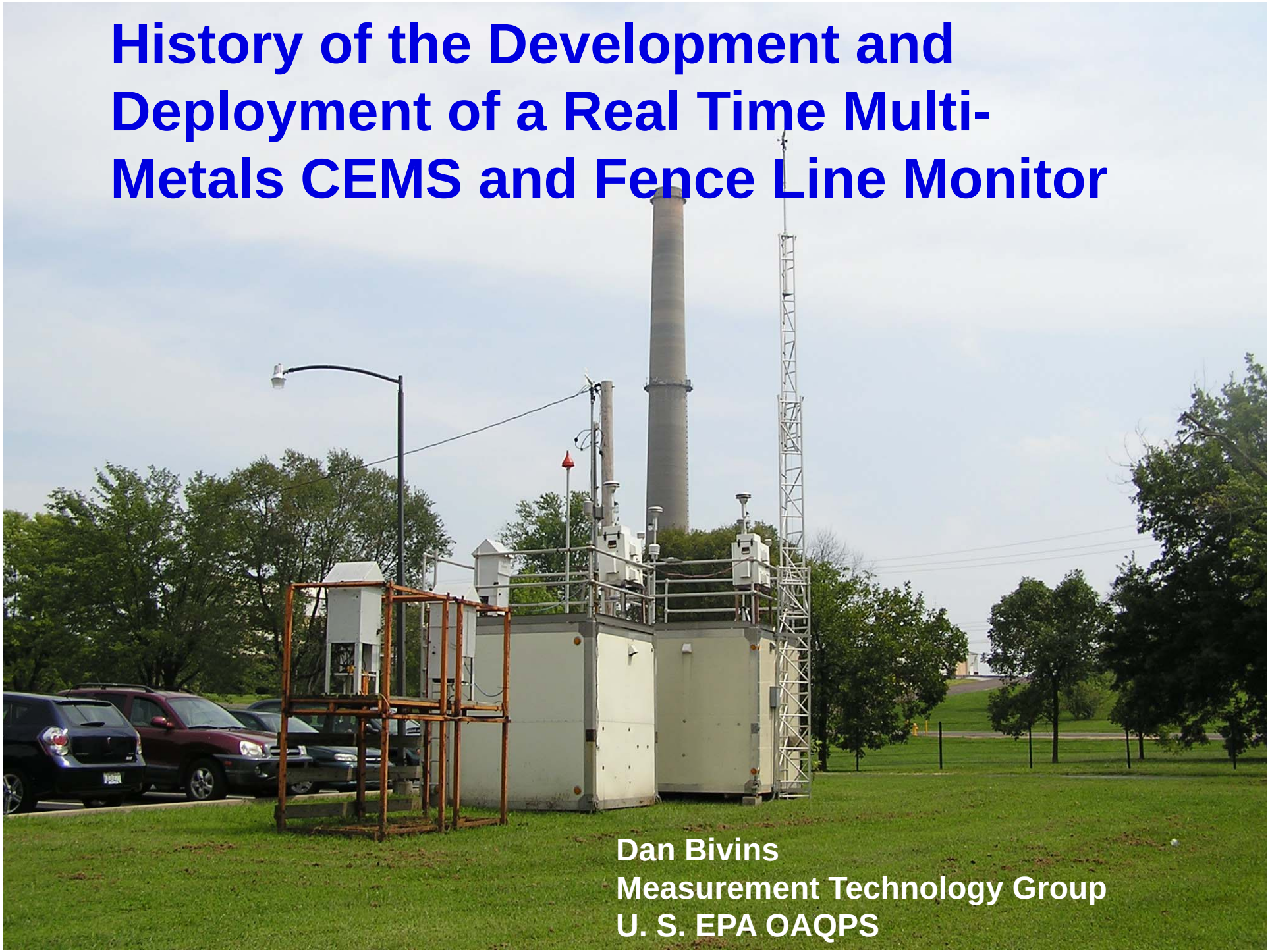
History of the Development and Deployment of a Real Time Multi-Metals CEMS and Fence Line Monitor

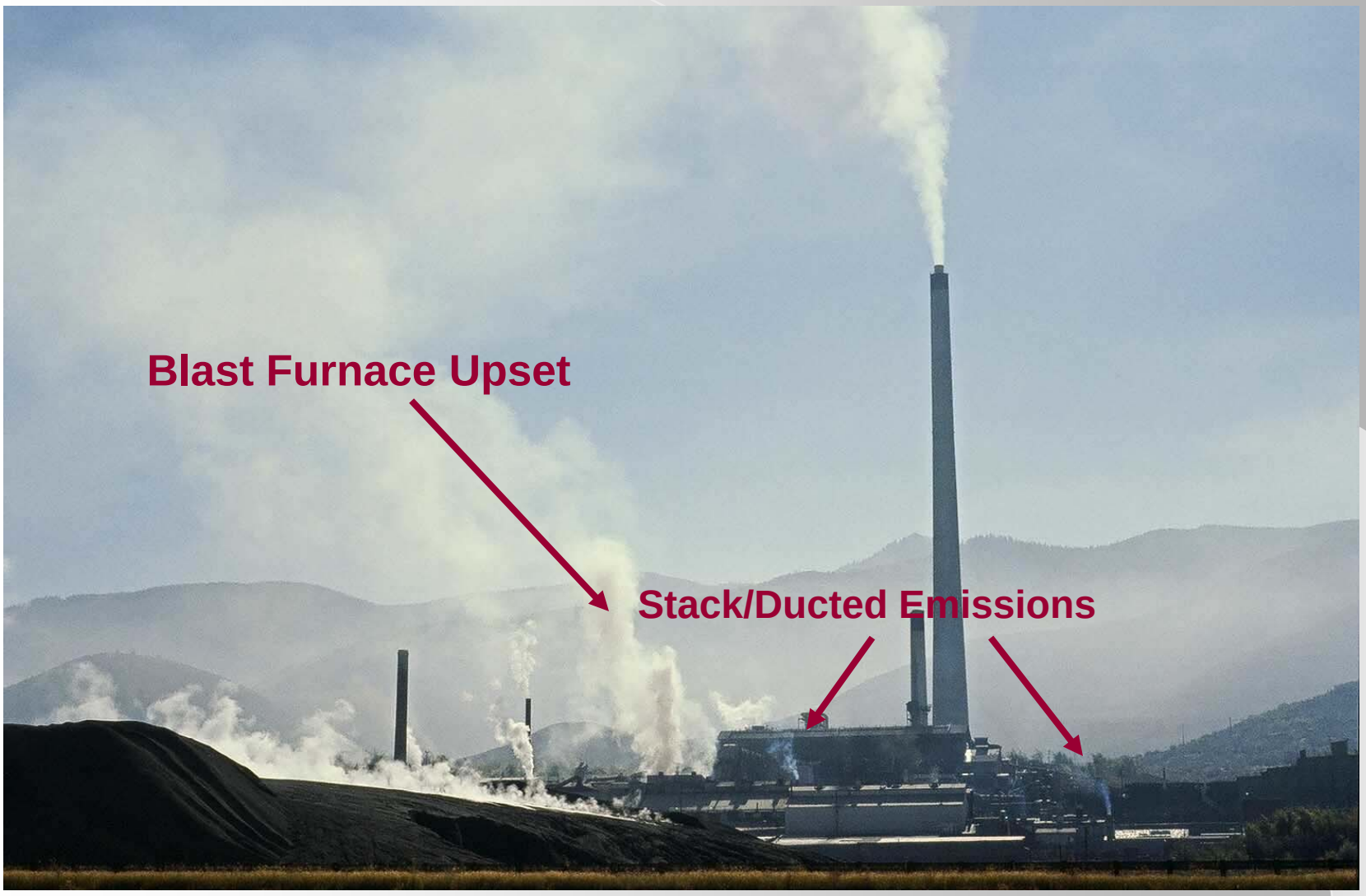


Dan Bivins
Measurement Technology Group
U. S. EPA OAQPS

Why are Multi-Metals Monitors Important?

- **Eight of EPA's 33 highest concern pollutants**
- **Persistent and are typically under reported**
- **Peak exposures can represent significant fraction of risks**
- **Infrequent/difficult measurements**
- **Highly variable and uncertain**
- **High local concentrations**
- **Can dominate local exposure**
- **Environmental justice issue**
- **Right to know community exposure**
- **Effectively enforce compliance**
- **Feedback to plant operators to effectively reduce emissions before they become a problem**
- **Assess and protect public health**

Fugitive and Stack Emission



Fugitive Metal Emissions from a Smelter

Xact 620 Ambient Metals Monitor

PM size-selective inlet

Temperature controlled 19 inch rack

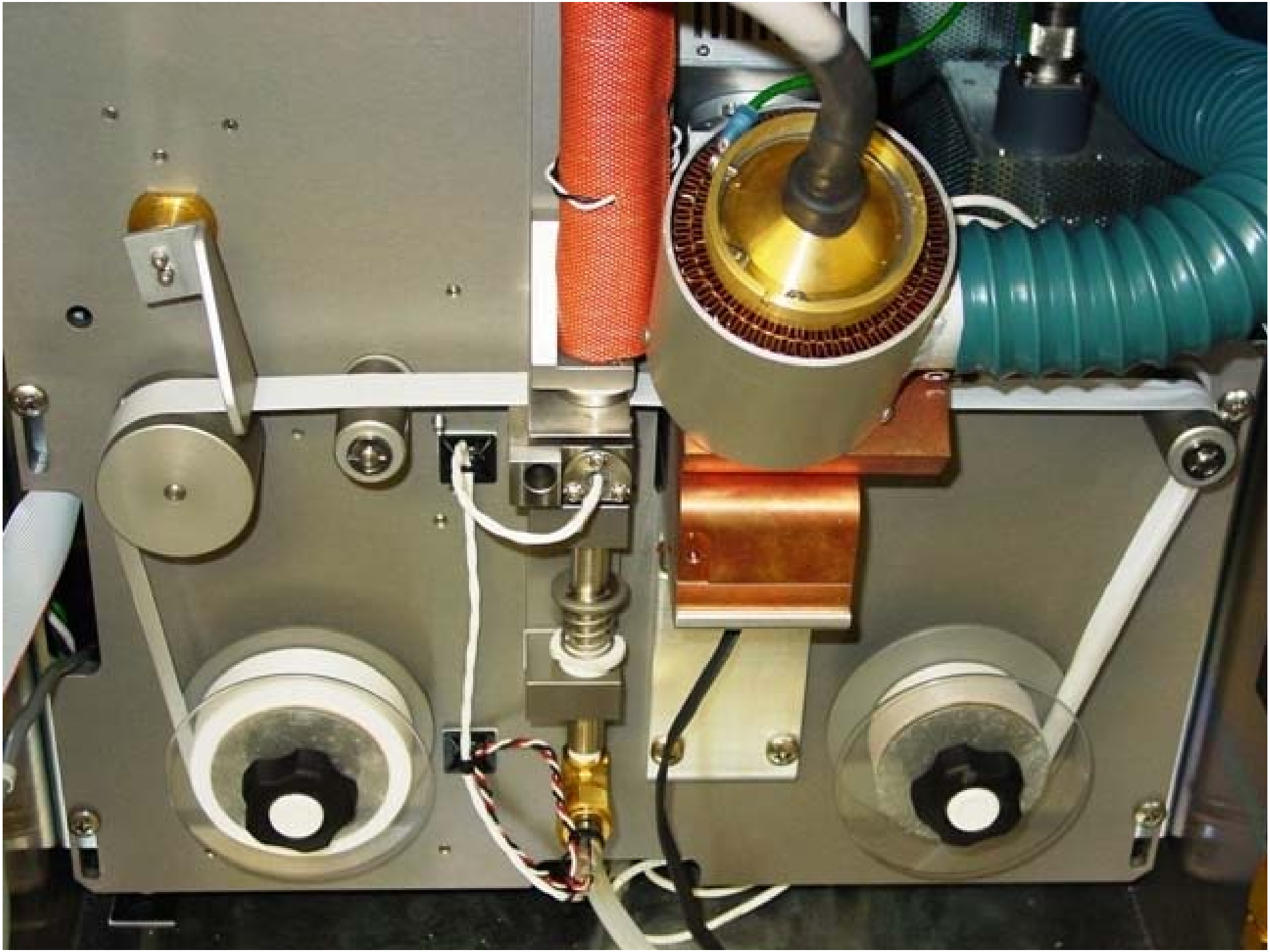
Heater

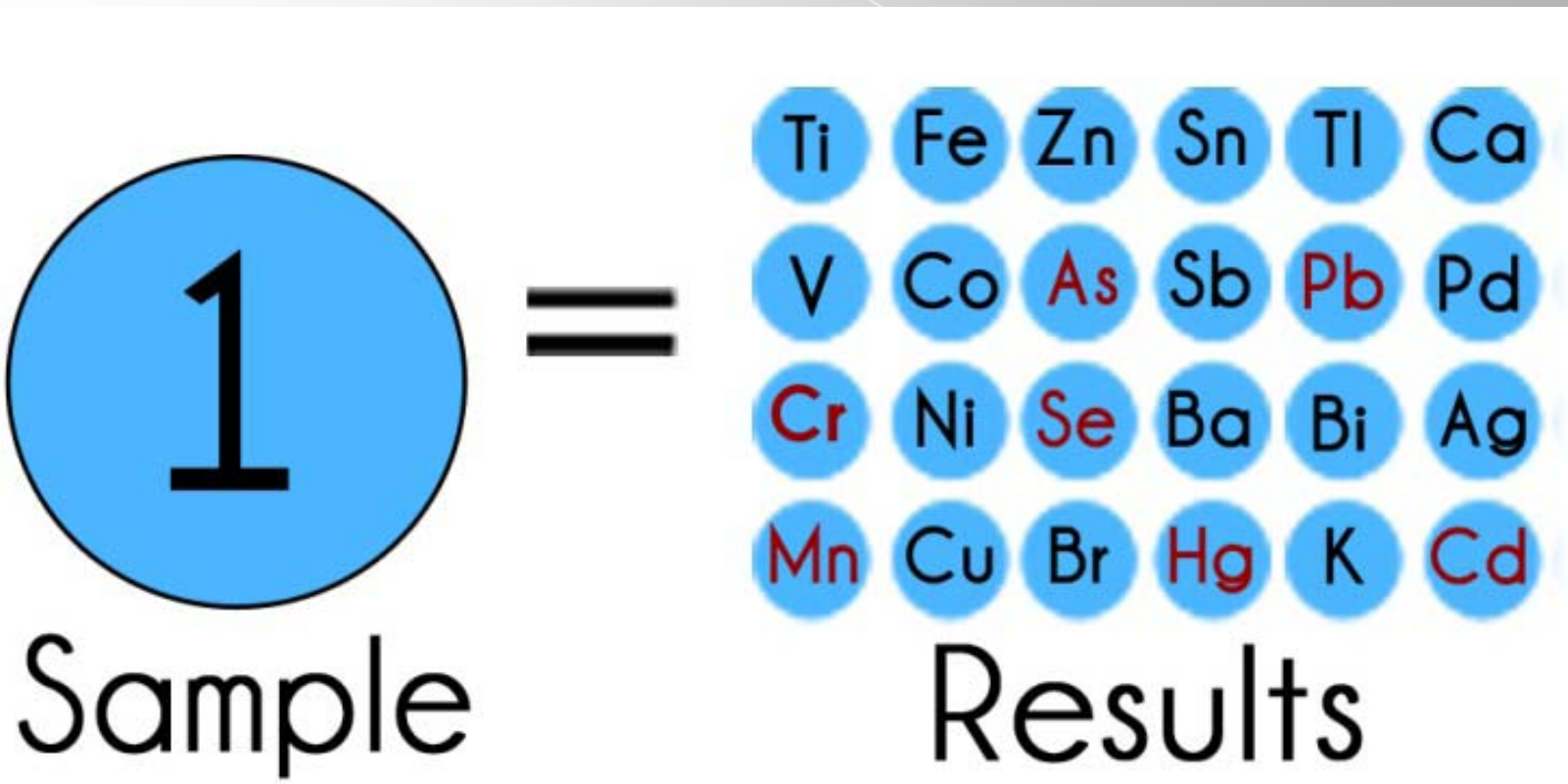
Sampling & Analysis Module

Operator interface/control panel

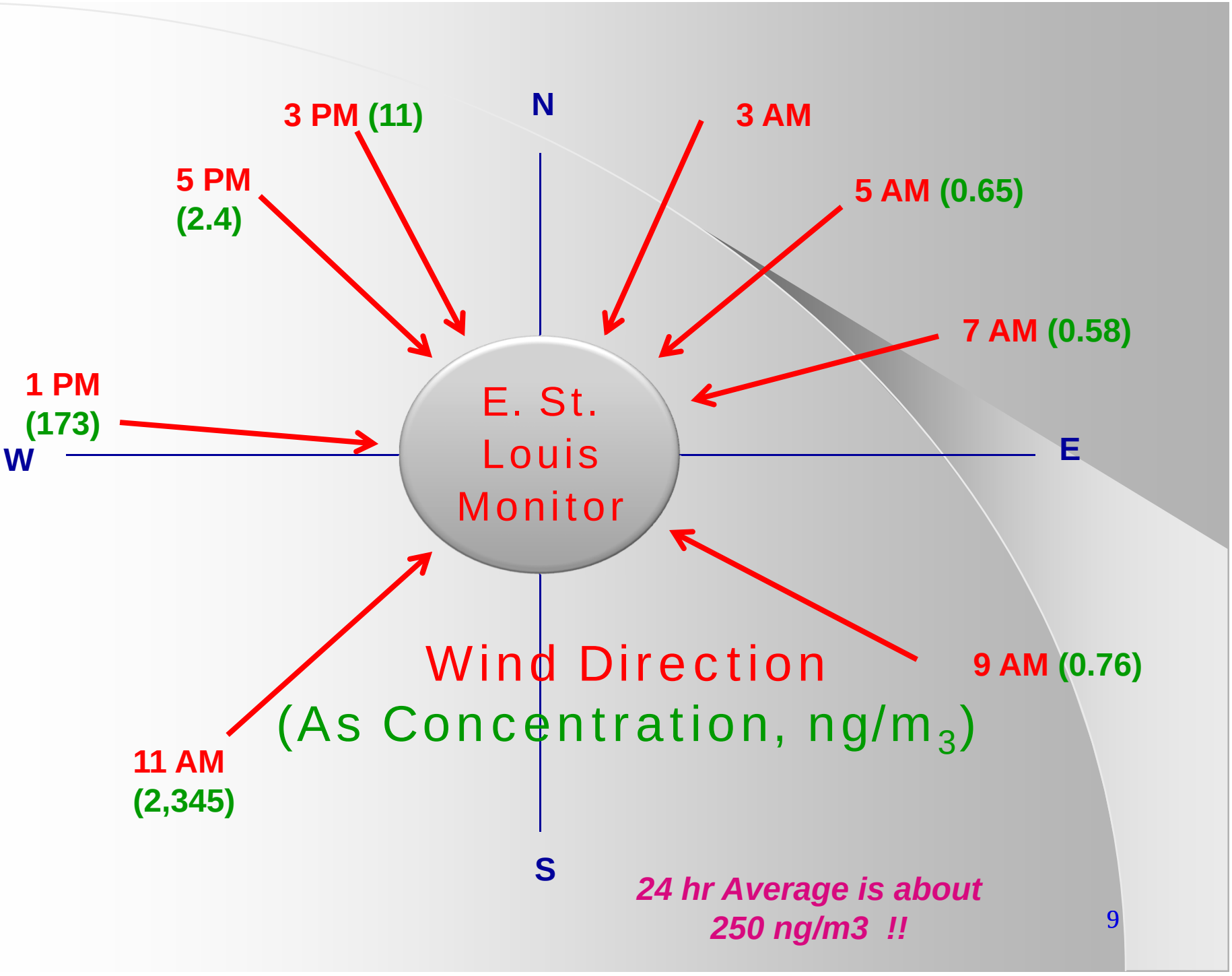
Flow control module

23 Elements Measured
X-Ray Fluorescence

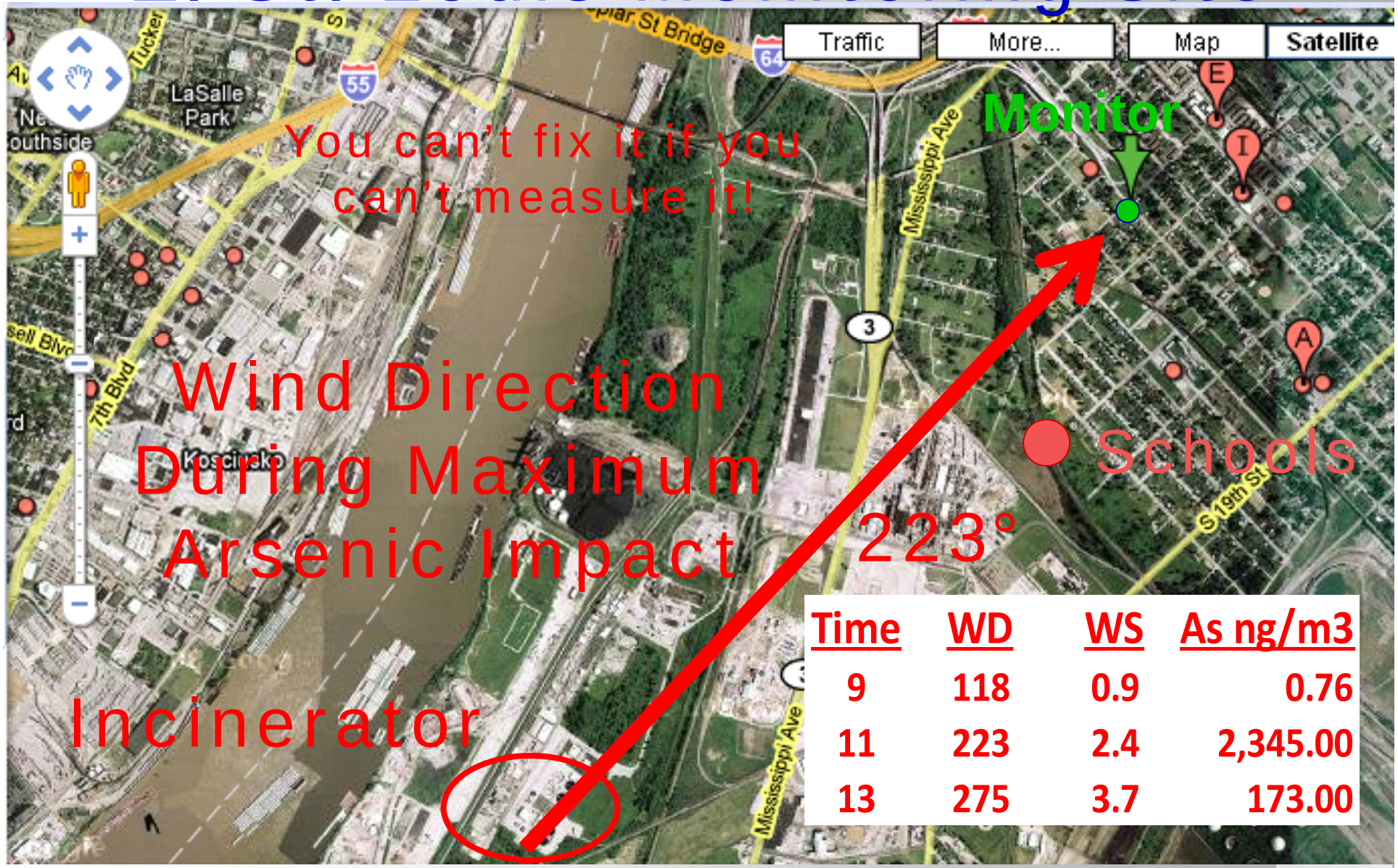




1000 times more sensitive than Pb NAAQS!


N
3 PM (11)
3 AM
5 PM
(2.4)
5 AM (0.65)
7 AM (0.58)
1 PM
(173)
W
E
E. St.
Louis
Monitor
Wind Direction
(As Concentration, ng/m3)
9 AM (0.76)
11 AM
(2,345)
S
24 hr Average is about
250 ng/m3 !!

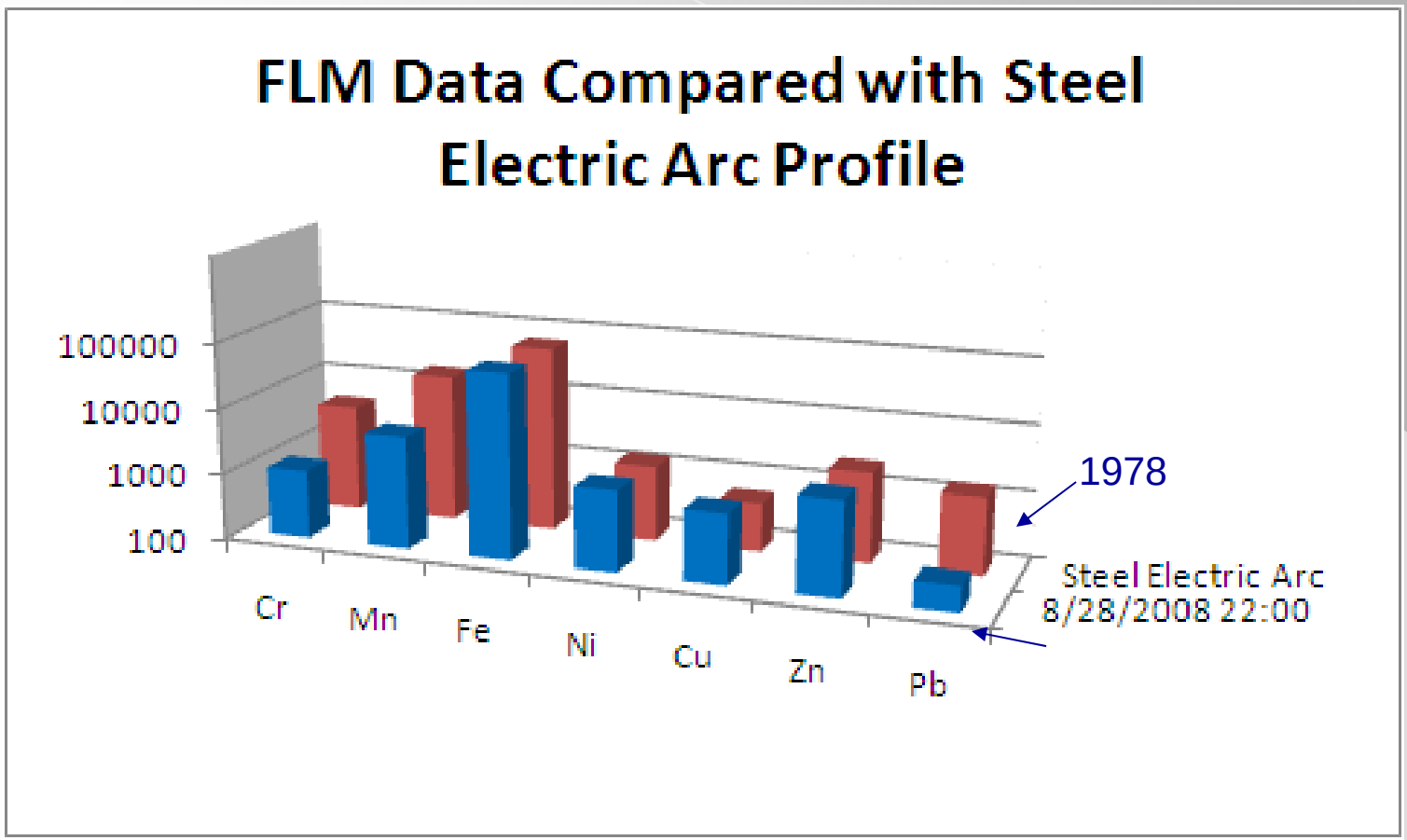
E. St. Louis Monitoring Site



Time	WD	WS	As ng/m3
9	118	0.9	0.76
11	223	2.4	2,345.00
13	275	3.7	173.00

Distance was 2 miles

Profile Comparison and Source Identification



Comparison of key elements in FLM data and known source profiles enables source identification

Timeline and Partners for CEMS

- **1999 - Cooper Environmental develops prototype CEMS**
- **2000 - Army with our group serving in advisory role, installed prototype on ammunition destruction incinerator**
- **2002 – ORD - Environmental Technology Verification on CEMS**
- **2004 – Eli Lilly Company – Alternative monitoring for MACT**
  - **Lilly costs - 3 to 5 million dollars**
- **2005 – Lilly and Cooper wins EPA's Environmental Excellence Award**

Timeline and Partners for Fenceline/Ambient Monitor

- **2005 – Our group explores idea of converting CEMS to ambient monitor**
- **2005 – Detection limit study with CARB proved detection limits good for ambient platform**
- **2006 – 21M^2 OSWER grant for fugitive monitor study - $30K**
- **2007 – OAQPS helps fund prototype development - $50K**
- **2008 – OAQPS funds ambient feasibility study in field - $75K**
- **2009 – OAQPS funds ambient accuracy and precision study in MO - $100K**
- **2009 – MO/Washington University participated in accuracy and precision study – not cost to EPA**
- **2010 – OAQPS funds development of protocol, performance specifications, and QA/QC - $125K**

Other Interested Parties

- **OECA – Investigative case**
- **NEIC – 2 investigative cases**
- **Oregon DEQ – Schools**
- **Arizona DEQ and Region 9 – Schools and EJ**
- **SCAQMD – secondary lead smelters**
- **OTAQ – airports – Pb in avgas**
- **ORD, NERL – modeling interest**
- **OAQPS – School Air Toxics follow-up, Pb federal equivalent method, future standards**

Potential Applications for Fenceline/Ambient Monitors

- **MACT**
- **Ambient Air Quality Standards**
- **Source Apportionment**
- **Emission Factor Refinement**
- **Identification of unknown sources of metals emissions**

Where are they in operation now?

- **Australia**
- **South Korea**
- **Canada**
- **Missouri**
- **China**
- **Soon in Ohio**

Tools

- Fence Line Monitor
- Performance Specifications
- QA Procedures
- Implementation Protocol
- Traceability Protocol
- Apportionment

Where do we go from here?

- **Deploy ambient monitor to School Air Toxics Program in Oregon and then to Ohio for Region V**
  - **OAQPS purchased mobile ambient monitor**
- **Could deploy ambient monitor at small airports for Pb in avgas studies for OTAQ**
- **Could deploy ambient monitor for Arizona and Region 9**

Conclusions

- **Stack CEMS and instrumental methods are available. No other continuous multi-metal monitors are available.**
- **Now we have a proven, real time, direct reading multi-metals ambient monitor available.**
- **Can identify intermittent sources not detected by EPA ambient FRM monitors**
- **Technology is ready for permitting and enforcement applications for both stacks and in ambient applications.**
- **Investment by OAQPS encouraged developer from prototype stage to off-the-shelf**
  - **OAQPS < $400K**
  - **Cooper and others $6 - 7 Million!**