

FORUM 202**AHERA: Protection for the Asbestos Exposed or Illusion for the Masses**

10:30 a.m.–12:30 p.m. Convention Center, 16

Arranger: J. Lewis, Maryland Department of the Environment, Baltimore, MD. Moderator:

A. Obera, The Environmental Consultancy, Austin, TX. Monitors: S. Salot, CTL Environmental Services, Harbor City, CA; J. Webber, New York State Department of Health, Albany, NY.

The Asbestos Hazard Emergency Response Act (AHERA) has been in effect for approximately 15 years. Its goal is to protect students, teachers, and other staff members from asbestos hazards on school property. Congress has extended training and accreditation provisions of AHERA to the industrial, commercial and public building sectors, through the Asbestos School Hazard Abatement Reauthorization Act (ASHARA); however, other provisions have yet to be extended beyond the school setting. This forum will review the historical roots of AHERA, assess its strengths and weaknesses in its current application, and discuss if the regulations are achieving its goal in protection of public health in the school environment. Panelists will discuss if AHERA should be amended to make it more effective as well as to discuss the pros and cons of extending AHERA-like regulations beyond schools to industrial, commercial, and public buildings.

Technology Assessment Road Map: Can We Get to Asbestos Exposure Protection Utilizing Technology and Procedures in the Existing AHERA Regulation? M. Beard, Research Triangle Institute, Research Triangle Park, NC.

When AHERA Does Not Make Sense. S. Hays, Gobbell Hays Partners, Inc., Nashville, TN.

Effectiveness of AHERA Implementation in School Settings. K. Fischer, Horne Engineering Services, Inc., Fairfax, VA.

FORUM 203**Benchmark Your Hearing Conservation Program**

10:30 a.m.–12:30 p.m. Convention Center, 6C

Arranger and Moderator: L. Hager, James, Anderson & Associates, Inc., Okemos, MI. Monitor: R. Brauch, Larson Davis Industrial, Provo, UT.

How do we know how well our hearing conservation programs are performing? In this session, representatives of industry will share and discuss the criteria and metrics they use in administering their hearing conservation programs, including rationale and development. Program effectiveness criteria, recordkeeping, program inclusion standards, and criteria will be addressed. Panelists will describe how their hearing conservation programs address globalization and acquisitions to provide attendees insight as to how industry leaders address these difficult issues. In addition, the 1998 NIOSH Criteria Document will be offered as one model hearing loss prevention program for the future.

Hearing Conservation in Solutia. S. Hacker, Solutia, St. Louis, MO.

3M and Hearing Conservation. L. Wash, 3M, St. Paul, MN.

The NIOSH Criteria Document for Noise: The New Model? L. Hager, James, Anderson & Associates, Inc., Okemos, MI.

The General Motors Approach to Hearing Conservation. D. Gossiaux, General Motors, Flint, MI.

Hearing Conservation in ALCOA. C. Dixon-Ernst, ALCOA, Pittsburgh, PA.

FORUM 204**Federal Lead Programs Update**

10:30 a.m.–12:30 p.m. Convention Center, 6F

Arranger: W. Friedman, U.S. HUD, Washington, DC. Moderator: W. Friedman, U.S. HUD, Washington, DC. Monitors: J. Zhou, Peter J. Ashley, U.S. HUD, Washington, DC.

This forum will provide information and insight into the status and direction of lead hazard control programs in four major federal agencies: CDC, EPA, HUD and OSHA. Presentations will be made and audience questions answered by program leaders in these agencies. Regulatory, policy, guidance, outreach, enforcement, and additional program elements will be discussed.

HUD Lead Program Update I: Lead Safe Housing Rule, Research, Policy, and Guidance. W. Friedman, U.S. HUD, Washington, DC.

HUD Lead Program Update II: Lead Disclosure Rule Enforcement, Project LEAP, Federal Lead Strategy. D. Jacobs, U.S. HUD, Washington, DC.

CDC Lead Program Update: High Intensity Screening, Outreach, and Guidance Programs. G. Noonan, U.S. Centers for Disease Control and Prevention, Atlanta, GA.

OSHA Lead Program Update: National Emphasis Program, Interpretation Development, and Guidance Issuance. M. O'Donnell, U.S. DOL/OSHA, Washington, DC.

EPA Lead Program Update: Regulatory Development and Implementation, Guidance Issuance, Lead Disclosure Rule Enforcement, and Outreach Programs. M. Henshall, U.S. EPA, Washington, DC.

FORUM 205**NIOSH Portable Methods for Measuring Airborne Metals: From Development to Technology Transfer**

10:30 a.m.–12:30 p.m. Convention Center, 15

Arranger and Moderator: N. Lawryk, NIOSH, Morgantown, WV. Monitors: J. Hornsby-Myers, S. Soderholm, NIOSH, Morgantown, WV.

Workers in mining, construction, and related industries are potentially exposed to airborne metals such as silver, lead, nickel, manganese, chromium and zinc, which can cause an array of adverse health effects. Historically, collecting the air samples on filters and sending them to an analytical laboratory for analysis delayed the determination of exposure concentrations for several weeks or longer. To address this issue, a broad-based program was developed at NIOSH with the following goals: (1) Evaluating existing NIOSH methods for the measurement of airborne metals by portable instruments; (2) Developing and testing methods using emerging field portable technologies that may offer simple, inexpensive, and rapid concentration measurements of multiple airborne metals; and (3) Identifying ways to increase self-reported use of methods using field portable technologies by end users through communication interventions. This forum presents progress toward these goals over the past two years, and demonstrates how these methods can be applied in the workplace to help control exposures.

Portable Instruments for Measuring Multiple Airborne Metals: Future NIOSH Analytical Methods? N. Lawryk, NIOSH, Morgantown, WV.

Screening Methods for Airborne Metals in Construction. K. Ashley, NIOSH, Cincinnati, OH.

Measuring Airborne Metals at Mining Sites Using Portable Instruments: Advantages and Potential Problems. P. Drake, NIOSH, Spokane, WA.

A Message-Based Campaign for Adoption of New NIOSH Methods for Field Portable Instruments. S. Booth-Butterfield, NIOSH, Morgantown, WV.

FORUM 206**Practical Applications of Mathematical Modeling in Exposure Assessment**

10:30 a.m.–12:30 p.m. Convention Center, 17

Arranger and Moderator: S. Arnold, EH&S, Inc., Midland, MI. Monitors: S. Milz, Medical College of Ohio, Toledo, OH; B. Graffeo, Eli Lilly, Indianapolis, IN.

Mathematical exposure modeling is one of the cutting-edge tools being explored and applied as a cost-effective approach to exposure assessment. Models allow estimation of the magnitude of exposure in the absence of a complete data set. They also allow an approximation of the exposure potential where it is not possible to conduct monitoring, such as in prospective situations like product development, retrospective situations like epidemiology, and where real-time monitoring methods are not available, such as in emergency response situations. During this roundtable discussion, the application of different exposure models in four different exposure assessment scenarios will be presented: The application of the small spill model in a hydrochloric acid (HCl) product safety assessment. The application of mathematical models in estimating air concentrations following a potential re-entrainment of contaminants through air intakes. The application of mathematical models in the estimation of ethylene oxide (ETO) room concentrations due to an unventilated desktop sterilizer. The application of mathematical models in the university environment.

The Application of the Hummel Equation in Modeling Air Concentrations Resulting from Re-Entrainment Following a Small Spill. C. DuBois, 3M, St. Paul, MN.

The Application of the Small Spill Model in a Hydrochloric Acid (HCl) Exposure Assessment. S. Arnold, EH&S, Inc., Midland, MI.

The Application of Mathematical Models in the Estimation of Ethylene Oxide (ETO) Exposure Assessment. M. Nicas, University of California, Berkeley, CA.

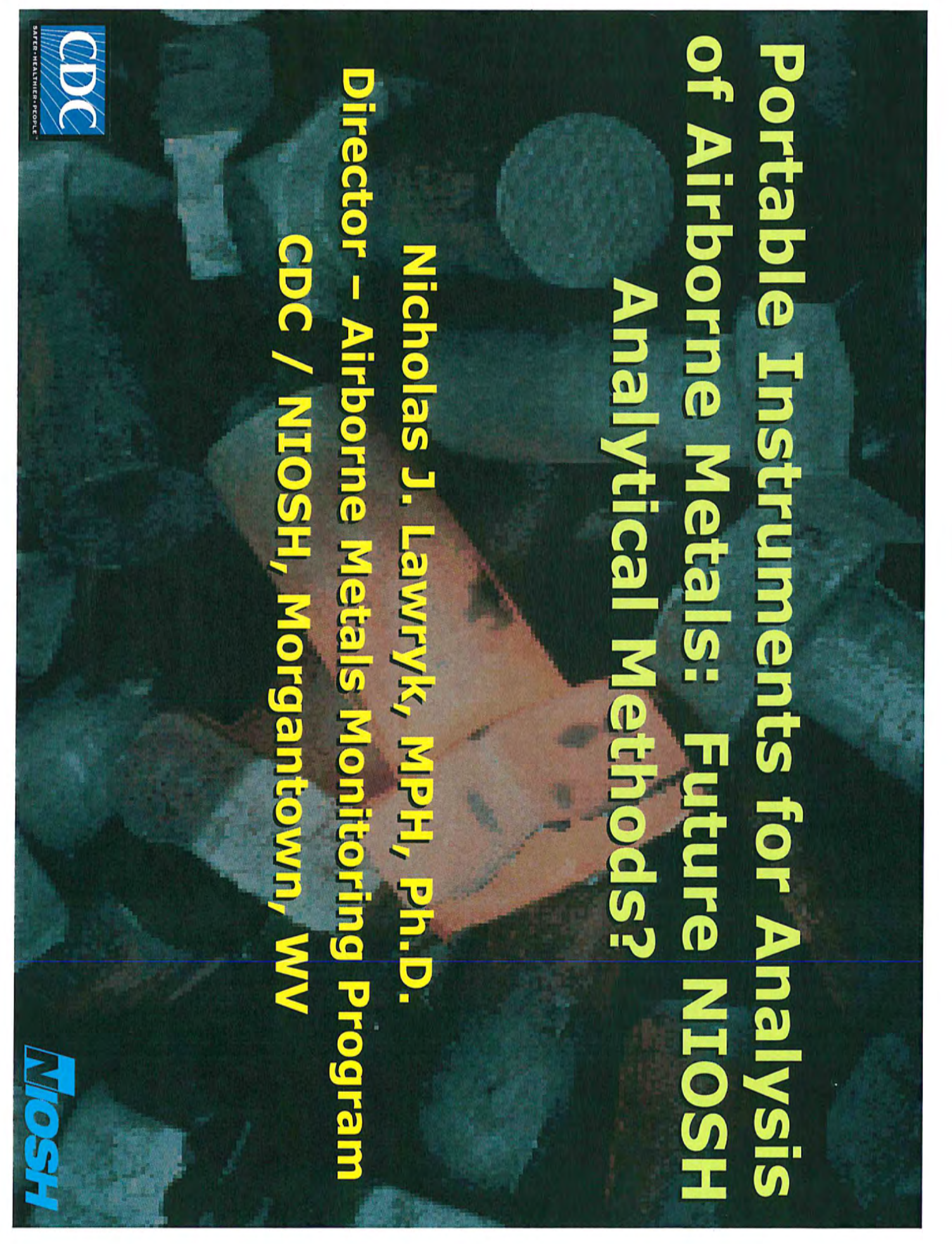
Applying Exposure Modeling on a University Campus. R. Murphy, Bowling Green State University, Bowling Green, KY.

FORUM 207**Recent Occupational Health and Safety Research Results in the Electric Power Industry**

10:30 a.m.–12:30 p.m. Convention Center, 2

Arranger and Moderator: J. Yager, EPRI, Palo Alto, CA. Monitors: R. Marklin, Marquette

Monday



Portable Instruments for Analysis of Airborne Metals: Future NIOSH Analytical Methods?

Nicholas J. Lawryk, MPH, Ph.D.

Director – Airborne Metals Monitoring Program

CDC / NIOSH, Morgantown, WV



Concept

Some existing and developing field-portable technologies for measuring multiple airborne metals show potential to be developed as NIOSH standard methods.

Specific Aims

- ❖ "If the technology is ripe..."
- ❖ Laboratory evaluation
 - ✓ *Characterization studies*
 - ✓ *Field sample analyses*
- ❖ Durability, reliability, and ease of use

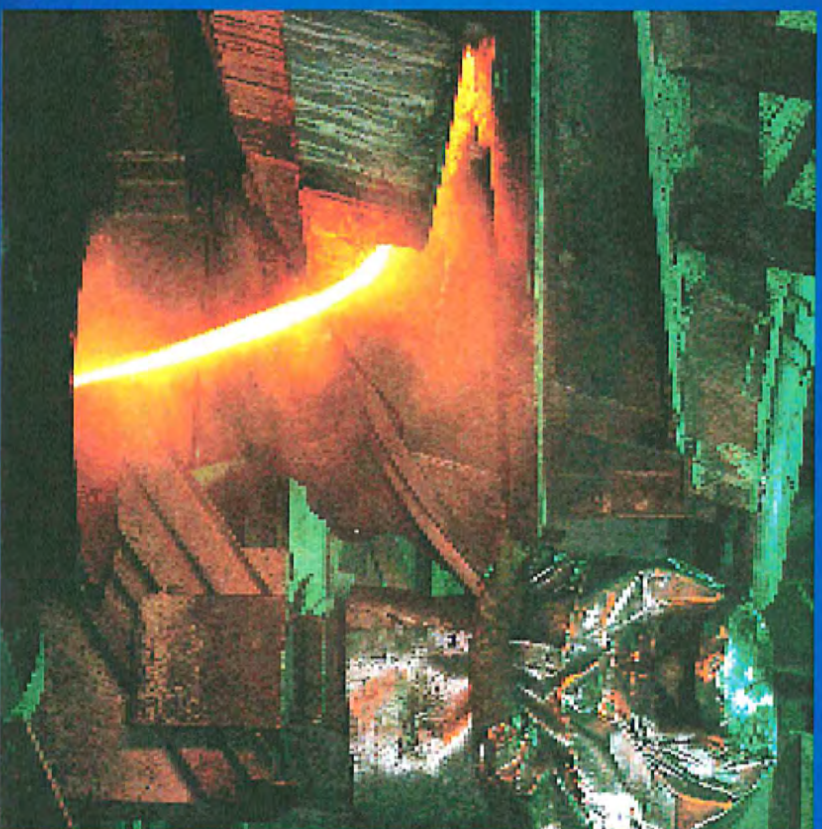
Methods Using Portable Instruments in NMAM

- ❖ **Method 7700** - Lead by Chemical Spot Test
- ❖ **Method 7701** - Lead by Portable Ultrasound / ASV
- ❖ **Method 7702** - Lead by Portable XRF
- ❖ **Method 7703** * - Hexavalent Chromium by Portable Visible Spectrophotometry

What Are We Looking for In A Technology?

- ❖ $LOD \leq 0.1$ OEL
- ❖ Durability
- ❖ Portability
 - ✓ *No larger than a carry-on suitcase*
 - ✓ *Weight under 25 pounds*
- ❖ Relatively inexpensive (< \$25k)
- ❖ Easy to use and maintain
- ❖ Economical to operate
- ❖ Safe to use and transport
- ❖ Short analysis time

Elements of Interest



- ❖ Nickel
- ❖ Chromium
- ❖ Manganese
- ❖ Zinc
- ❖ Cadmium
- ❖ Copper
- ❖ Lead
- ❖ Iron

Some Health Effects from Airborne Metal Exposures

	Ni	Cr	Mn	Zn	Cd	Cu	Pb	Fe
Metal fume fever				●		●		
Liver damage						●		
Cancer	●	●			●			
Asthma	●							
Sinus problems		●						
Parkinson's Disease			●					
CNS disorders							●	
Pneumoconiosis								●
Kidney damage					●		●	

Technologies in Contention

- ❖ Laser Induced Breakdown Spectroscopy (LIBS)
- ❖ Spark Induced Breakdown Spectroscopy (SIBS)
- ❖ X-ray fluorescence with battery powered X-ray source
- ❖ Microwave Induced Plasma Spectrometry (MIP)

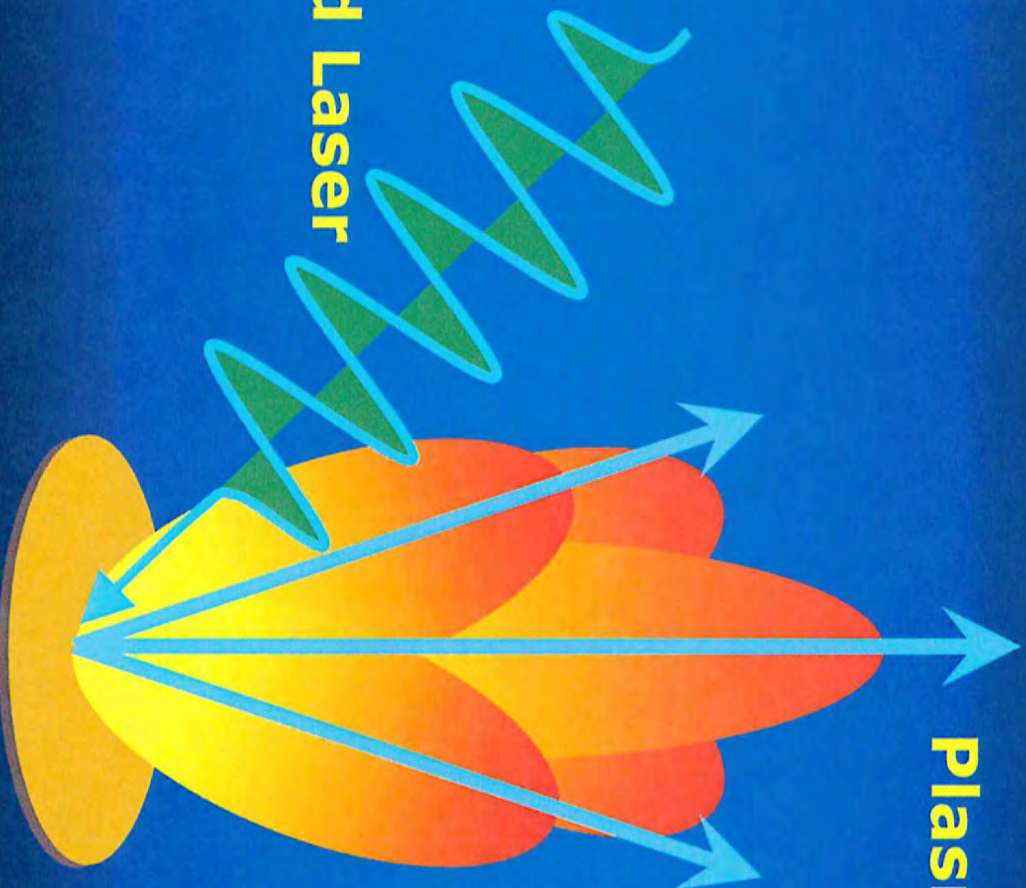
LIBS Basic Theory

Plasma Emission

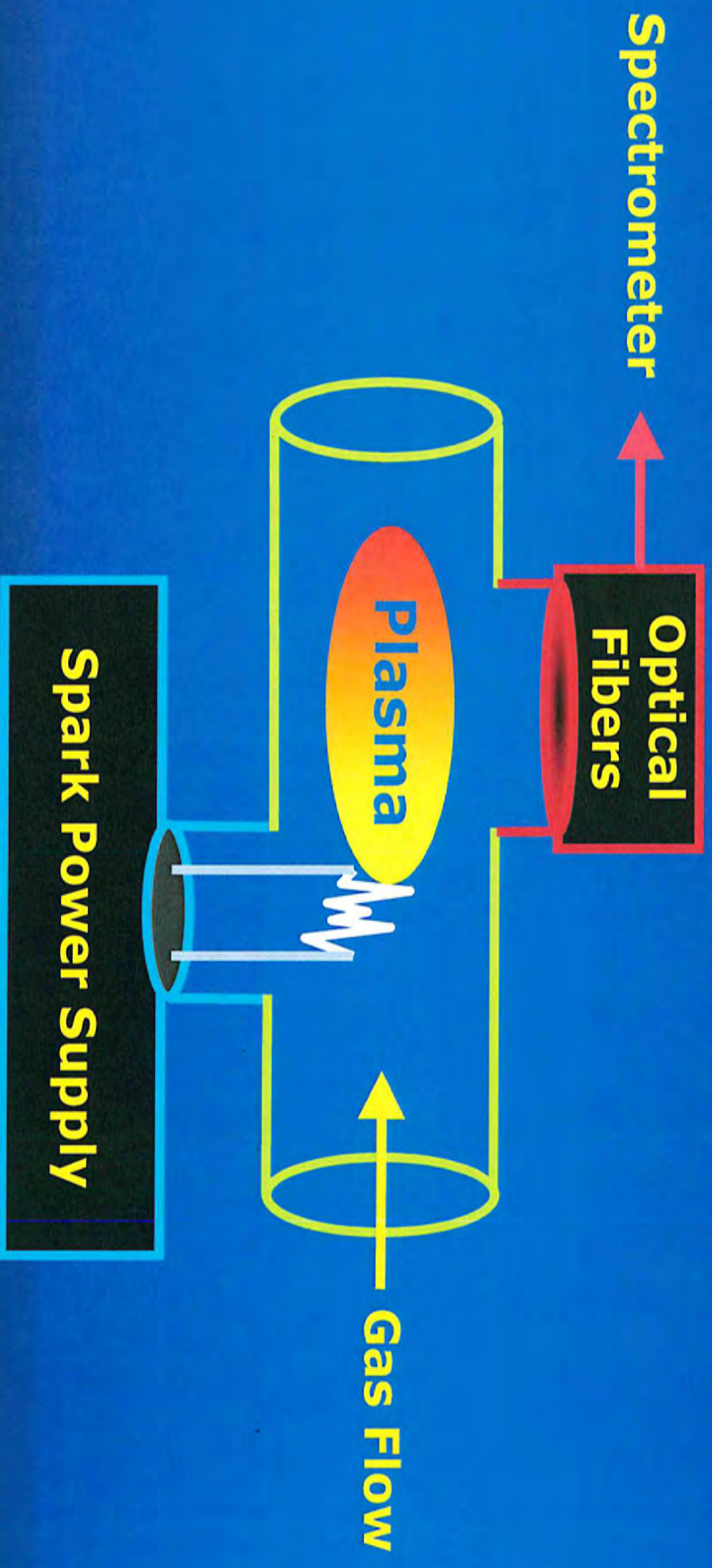
Plasma Plume

Pulsed Laser

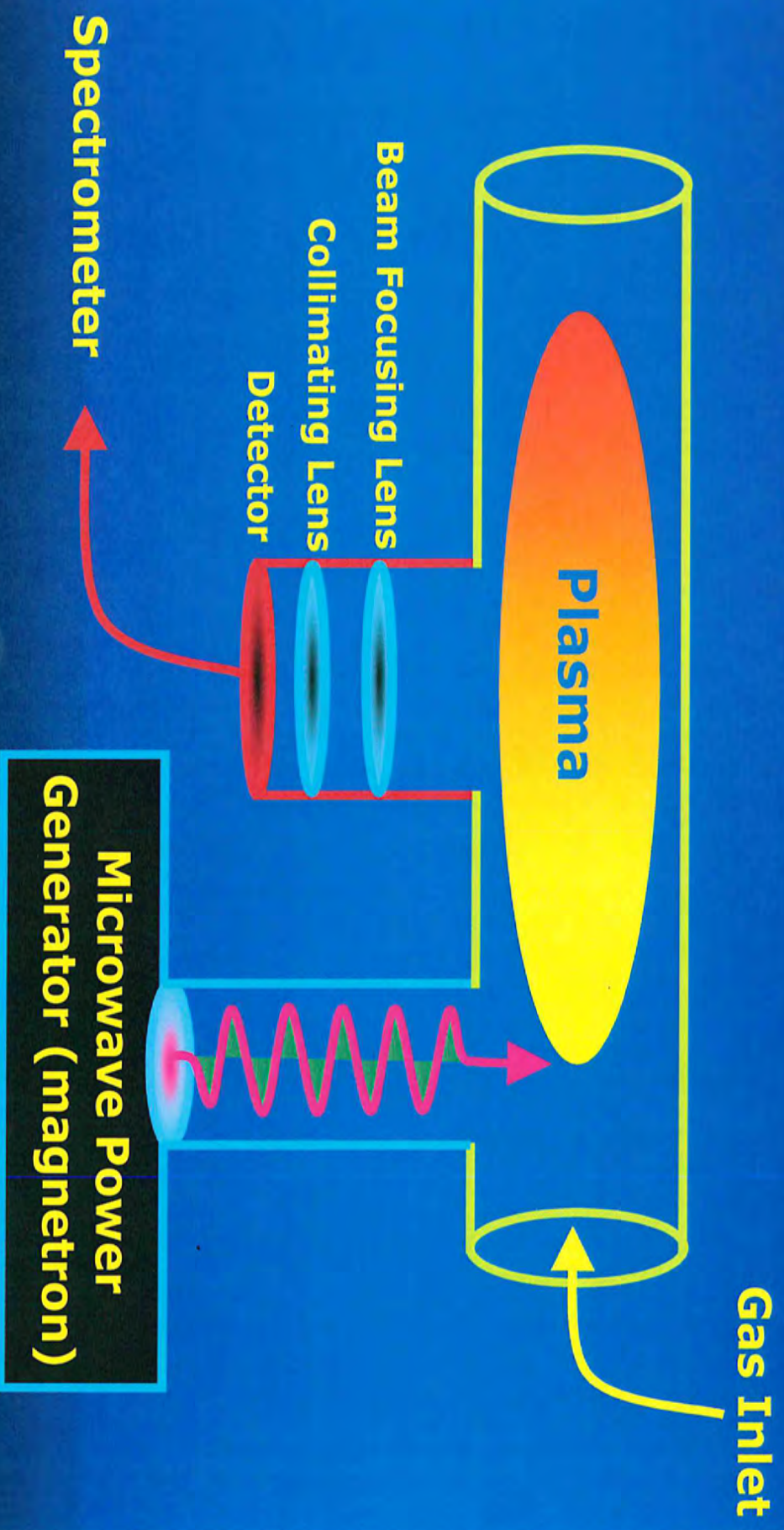
Sample



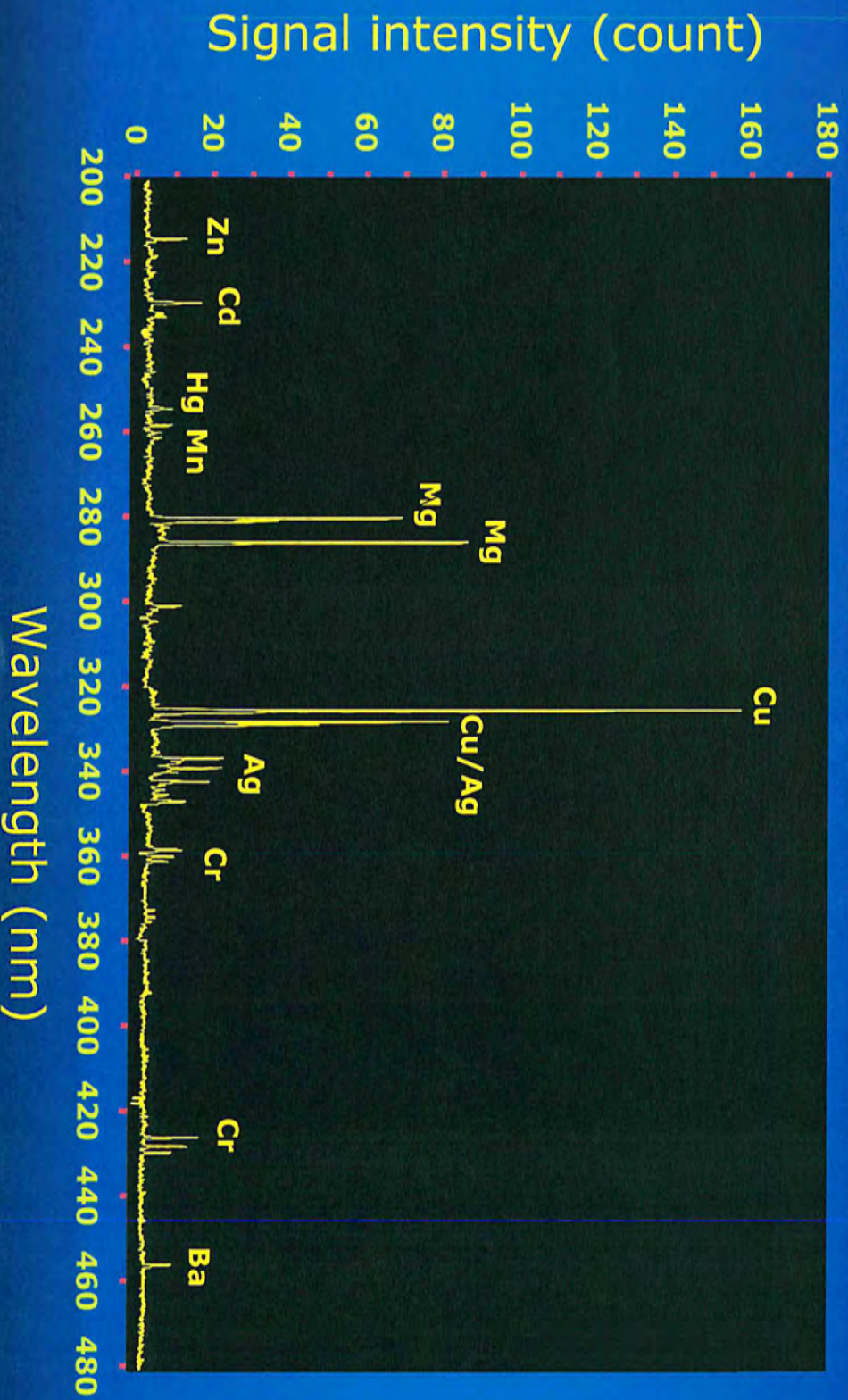
Spark Induced Breakdown Spectrometry (SIBS) Theory



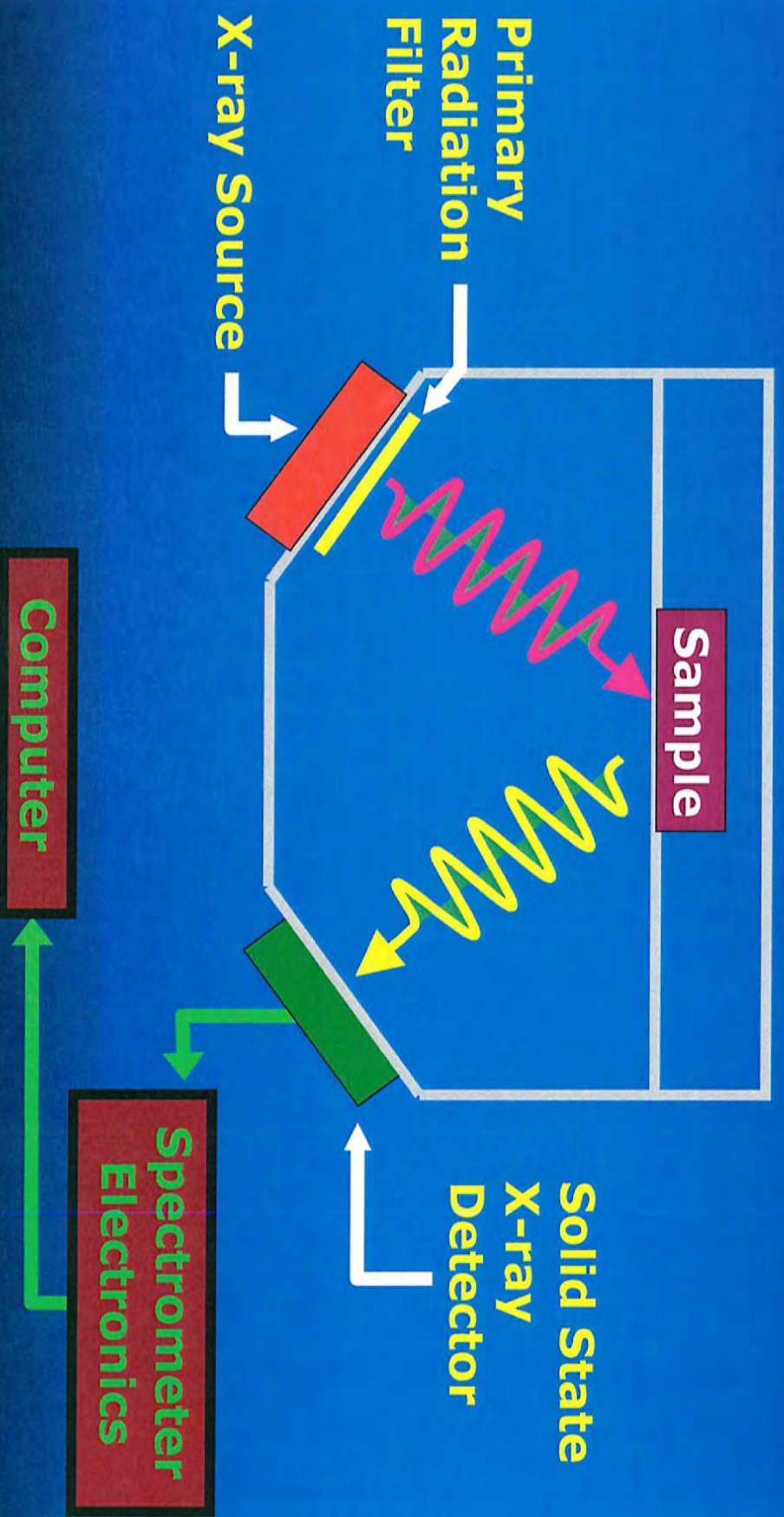
MIP Basic Theory



MIP Spectrum of a Multi-Element Air Sample



XRF Basic Theory

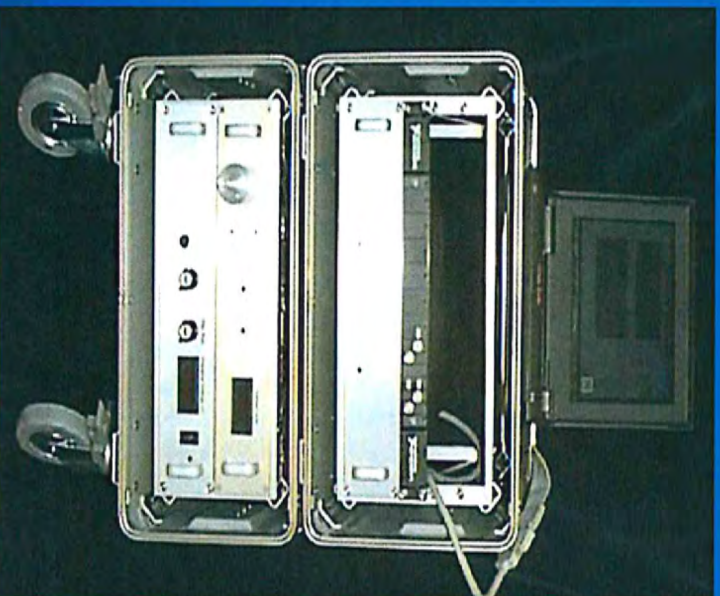


Laser Induced Breakdown Spectrometry (LIBS)



- Portable version built on demand
- Generally “transportable”
- Can be battery powered
- Broad range of elements including “low Z”
- Offers real time measurement
- Tricky for filter analysis

Spark Induced Breakdown Spectroscopy (SIBS)



- Similar to LIBS in most benefits and disadvantages
- Battery power possible
- Less expensive to build than LIBS
- Thoroughly evaluated for lead and chromium

Microwave Induced Plasma (MIP)



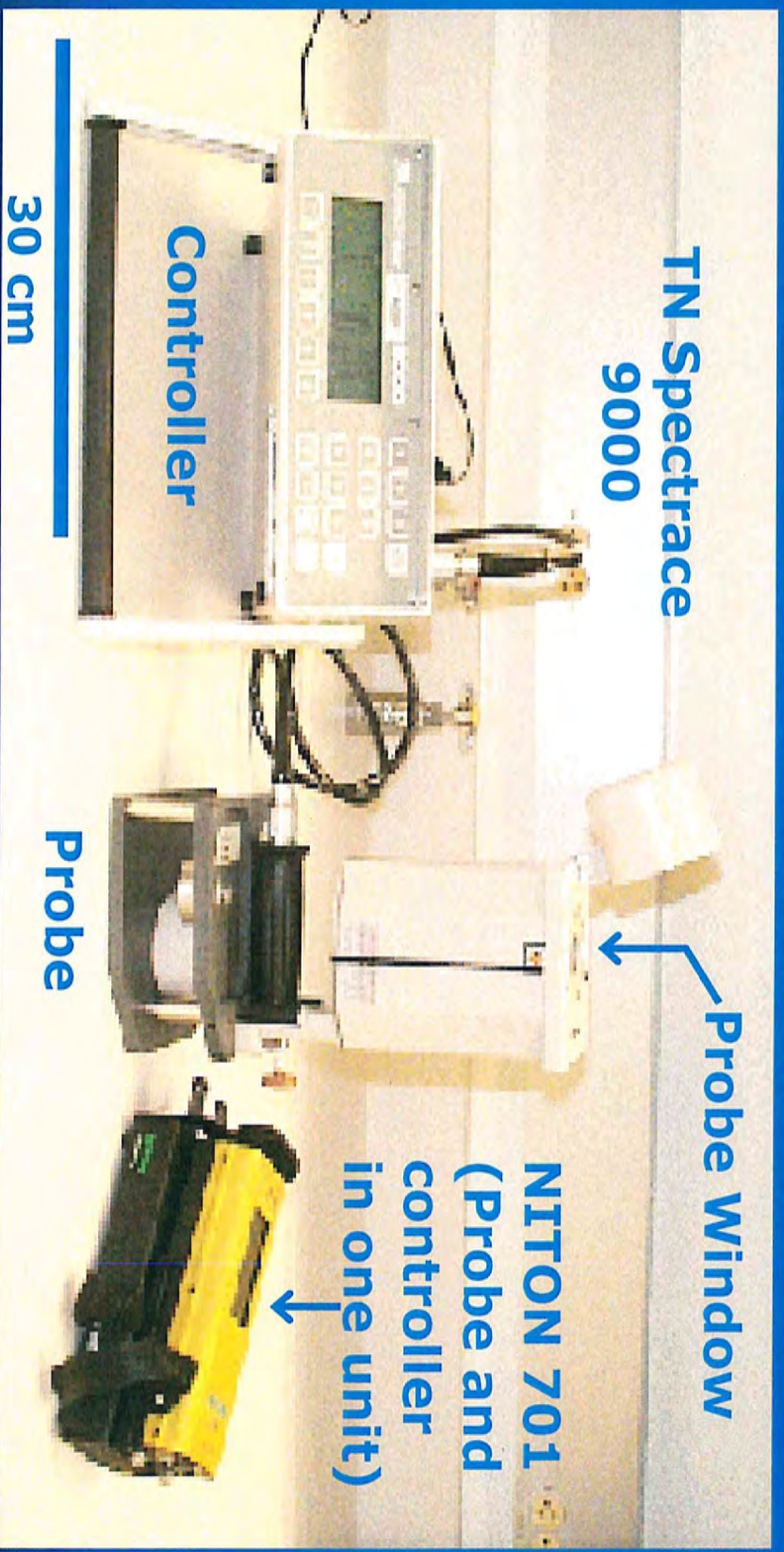
- Prototype technology
- Transportable
- Real time measurement of metals in air
- Characterized for 10 elements (more are possible)
- Not intended for filter analysis

X-Ray Fluorescence with Battery Powered Excitation Source



- Technology ready for mass production
- True field portability
- Battery powered
- No radioactive sealed sources
- Filter analysis
- Can analyze >20 elements

Two XRF Spectrometers With Sealed Sources



Technology Comparisons: Detection Limits ($\mu\text{g}/\text{m}^3$)

	LIBS+	SIBS*	XRF†	MIP‡
Lead	0.18	10	2.2	0.47
Chromium	0.12	10	7.2	0.37
Cadmium	1.20	~140	5.4	0.21

+ Neuhauser et al., 1999

* Estimated (Hunter et al., 2000)

† Estimate based on and 8-hour sample on 25 mm filter

‡ Duan et al., 2000

Technology Characteristics

	LIBS	SIBS	XRF	MIP
<i>Direct Read of Air</i>	+	+		+
<i>Battery Powered</i>		(+)	+	(+)
<i>Filter Analysis</i>	(+)		+	
<i>Field Ruggedness</i>	+		+	
<i>Breathing Zone Samples</i>			+	
<i>True Portability</i>			+	
<i>Off-The-Shelf</i>	+		+	
<i>Price (estimated US\$)</i>	\$ 55k	\$10k	\$ 25k	\$ 50k

Future Research Directions

- ❖ Compare laboratory-based portable XRF measurements against ICP (NMAM 7300)
 - ✓ Experimentally generated samples
 - ✓ Samples collected in the workplace
- ❖ Analyze workplace samples on-location
- ❖ Design suggestions to manufacturer and technology transfer
- ❖ NMAM for successfully measured elements

Conclusion

Among currently available technologies, XRF spectrometry with a battery powered X-ray tube has the strongest potential to be a viable field portable screening technology for measuring multiple airborne metals.

Credits

- ❖ THERMO Noran Corp. (TN Spectrace)
- ❖ Thomas Eagar and Neil Jenkins (MIT)
- ❖ NITON Corp.
- ❖ Amy Hunter (PSI Corp.)
- ❖ Mark Fraser (Mission Research Corp.)
- ❖ Yixiang Duan (LANL)
- ❖ David Cremers (LANL)
- ❖ Don Sackett (Innov-X Systems)
- ❖ Bean (Teh-hsun) Chen (NIOSH)
- ❖ Sidney Soderholm (NIOSH)