





Mobile GC/MS and Sampling Tools for Continuous Air Monitoring

Garth E. Patterson, Cynthia Liu, Dennis J. Barket, Jr.

7th Harsh-Environment Mass Spectrometry Workshop

September 22-24, 2009

NEW THREATS. NEW THINKING.™

SURVEILLANCE & SOLUTIONS DIVISION

IMAGING

ORION

DEFENDIR

ILLUMINATOR

VISIONIR

RADAR

STS-350

STS-1400 & 4400

STS-12000 & 30000

PLATFORMS

SKY WATCH

CERBERUS

COMMAND & CONTROL

CAMELEON ITS

CAMELEON TACTICAL

PURE ACTIV

STARWATCH GMS

DETECTION DIVISION

CHEMICAL

GRIFFIN 450 & X-SORBER

CHEMSENSE 600

CAD KIT

BIOLOGICAL

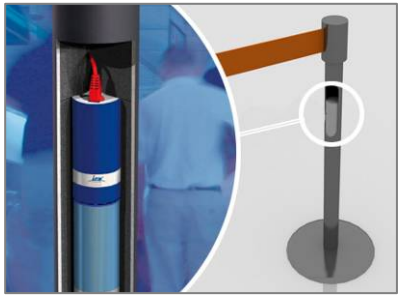
AIR SENTINEL

IBAC

BIO CAPTURE

RAD/NUCLEAR

IDENTIFINDER



STRIDE SYSTEMS

INTERCEPTOR

EXPLOSIVES

FIDO XT & ONBOARD

FIDO FASTGATE

PAXPOINT

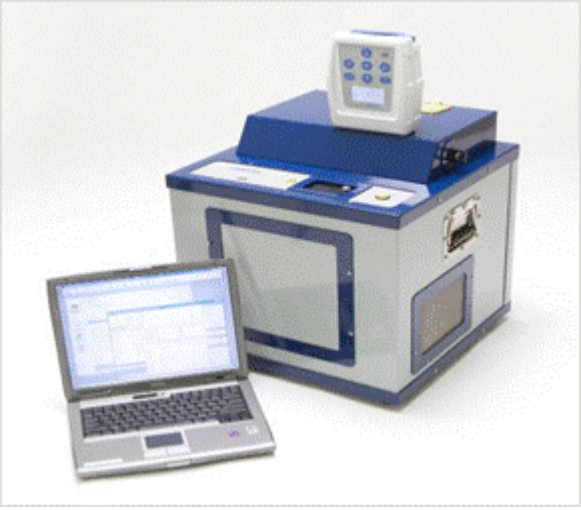
GRIFFIN | 450 – Mobile/Field-Ready GC/MS/MS

Overview and Specifications

- Gas Chromatograph/Mass Spectrometer
- Detects, Identifies, and Confirms ppt concentrations of CWA's, TICS/TIMS, explosives, and pesticides
- Ruggedized and shock mounted for mobile platform use
- Flexible sample inlets for varying end-user applications
- MS/MS capability

- Size ……..…….. 19.2" x 19.2" x 21.1"
- Weight ……...85 lbs
- Mass Range……425 amu / Unit Mass Resolution
- Power Requirement……115-220 VAC, 50/60 Hz

Griffin 450



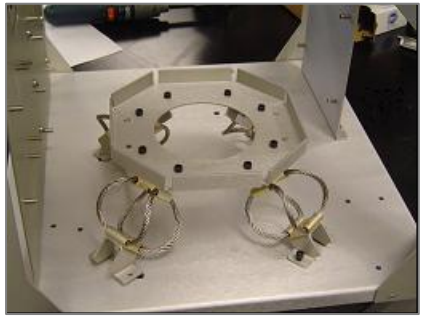
Benefits

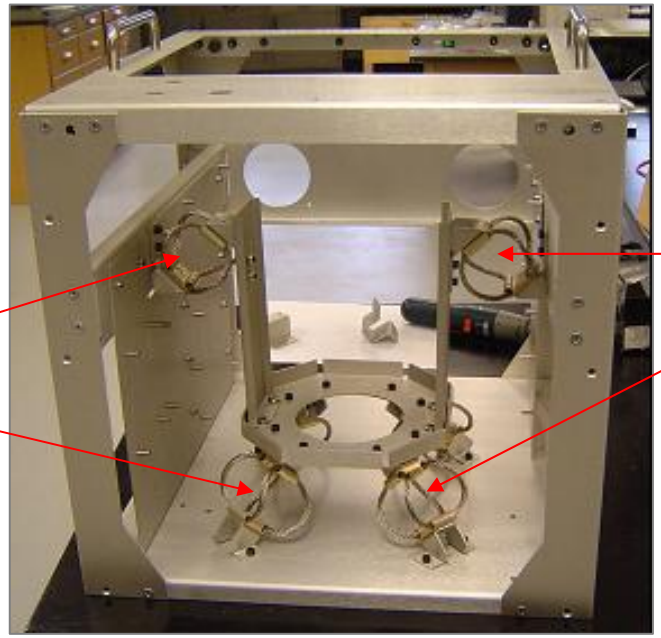
- DIRECT AIR ANALYSIS
  - Sample Loop and Pre-concentration
  - Compatible with Griffin X-Sorber
- Ease of Use
- Extended Analytical Flexibility
- Rapid Response Time
- Positive Identification of Known and Unknown Chemical Threats
- Low Operational/Sustainment Costs
- Minimal Training Required

Key Customers

- DoD Operations
- Public Transportation Facilities
- International Governments Labs
- Mobile Laboratory Applications
- Demil Facilities

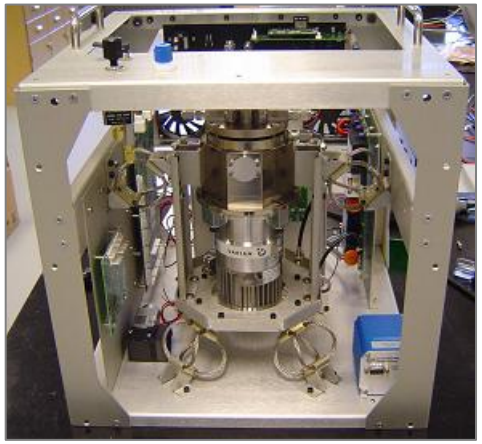
Rugged for Field Use – Wire Rope Isolators





Wire rope isolators

Wire rope isolators

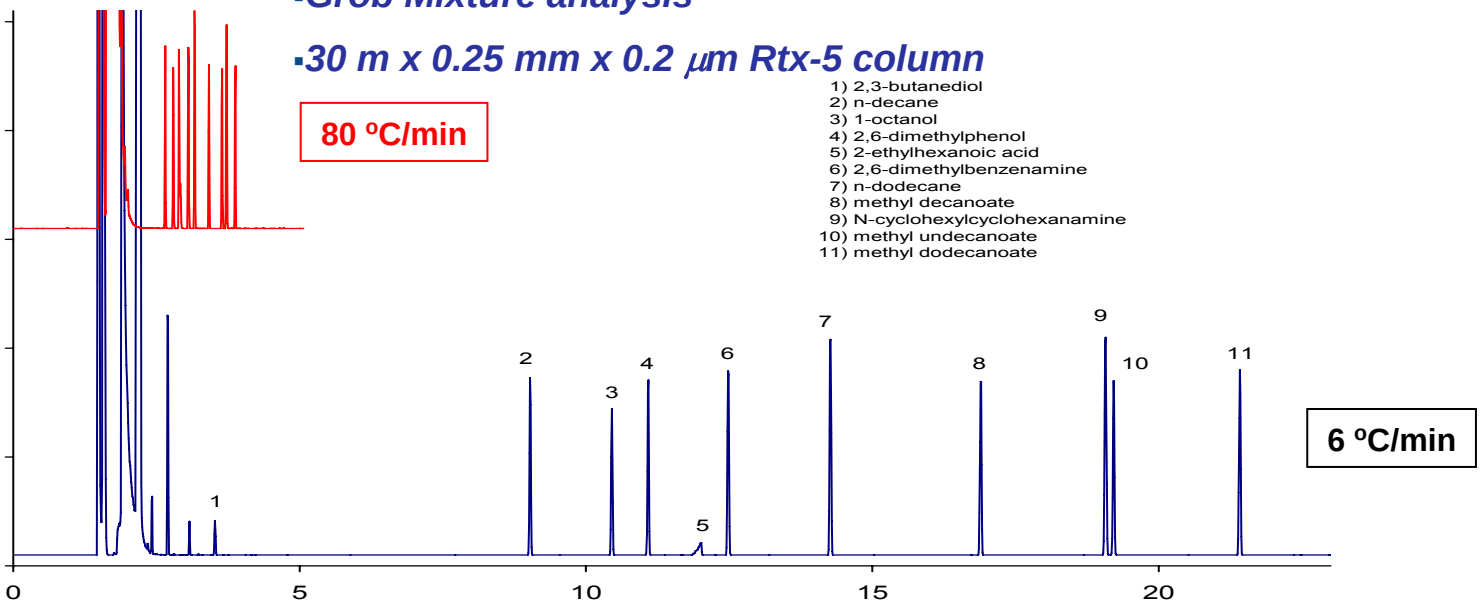


Low Thermal Mass GC

- Ramp rate ≥200˚C/min (column dependent)
- Cooling time ~2-3 min
- Variety of phases
- 1 m – 30 m length
- 0.1 to 0.25 mm id standard

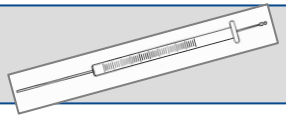
~10 cm

- ***Grob Mixture analysis***
- ***30 m x 0.25 mm x 0.2 µm Rtx-5 column***



Sample Introduction (Inlets)

Direct Liquid Injection



SPME

Autosampler

Direct Air

X-Sorber

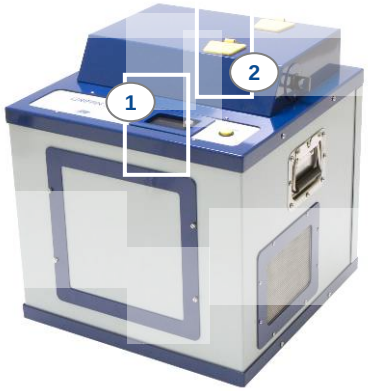
Transfer Line

Split/Splitless Liquid Injector

Griffin 300

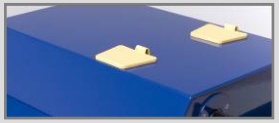
Griffin 400

Griffin 450



Universal Sampling Port

Griffin 450



Pre-Concentration or Sample Loop

LTM-GC

GRIFFIN | X-Sorber – Handheld Sampler/Desorber

Overview and Specifications

- Battery-operated single-person portable air sampling system – rechargeable at host instrument
- Ideal for safer and efficient downrange sampling– programmable sample collection methods
- Integrated GPS sample tagging
- On-board control and data management
- Unattended, autonomous operation for long-term (hours) sampling in specific locations
- Ability to archive samples for subsequent analysis and further confirmation (dual tube sampling)

- Size* …….…….. Est. 9” x 7” x 2.65”
- Weight* ……..Est. 3 lbs

Griffin Handheld Sampler

Benefits

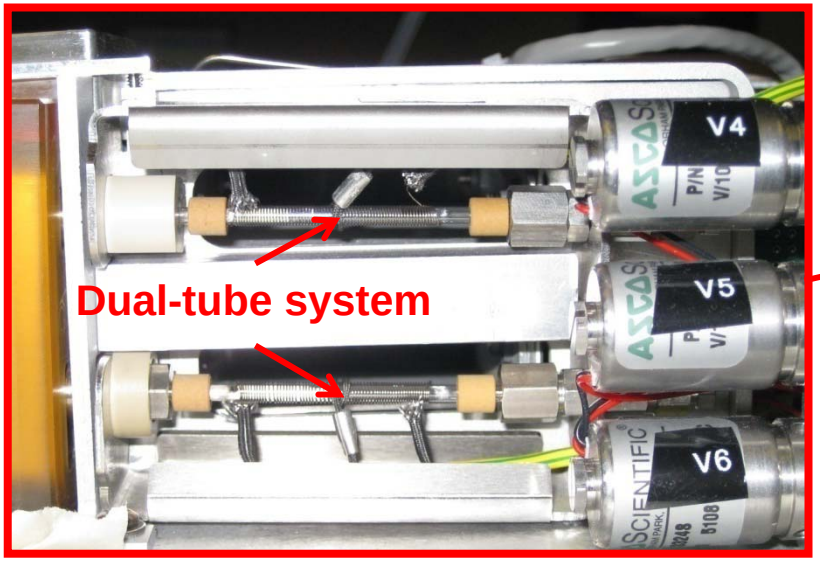
- Trusted sample integrity
- Simplified automation
- Integrated GPS capability
- De-contaminable
- Pre-concentration tubes (¼” diameter X 3.5” long) are compatible with other commercially available thermal desorption systems
- Easy to use, requiring minimal training

Key Customers

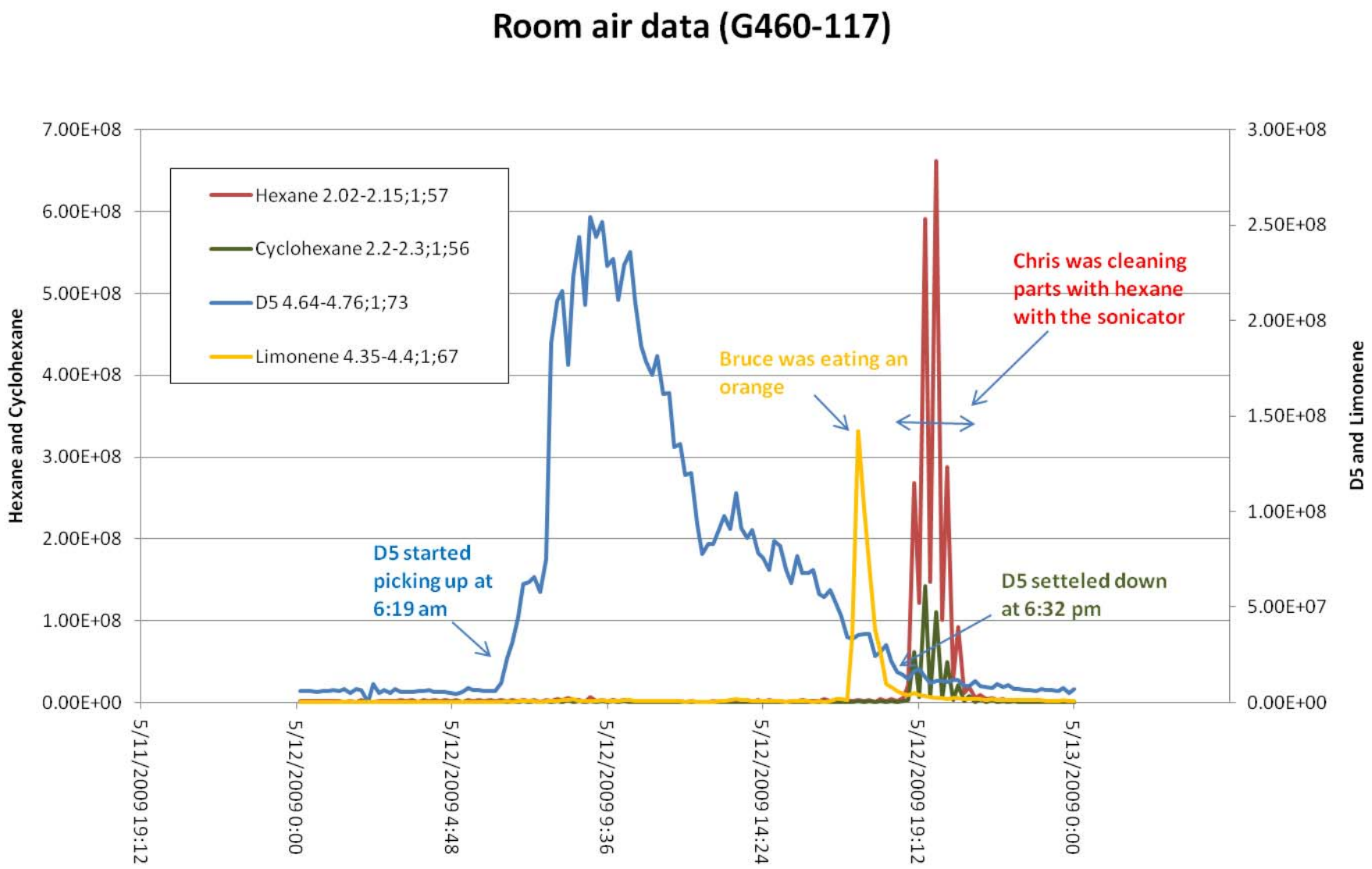
- Force protection
- Security personnel
- International security
- Intelligence community
- Container & Cargo Screening
- Venue protection

Continuous Air Monitoring

- Modified the G450 to employ a continuous monitoring, dual-tube sorption system
- Mixed-bed sorption tube
- While the first sample is analyzed, air is sampled through the second tube



Internal Laboratory Air

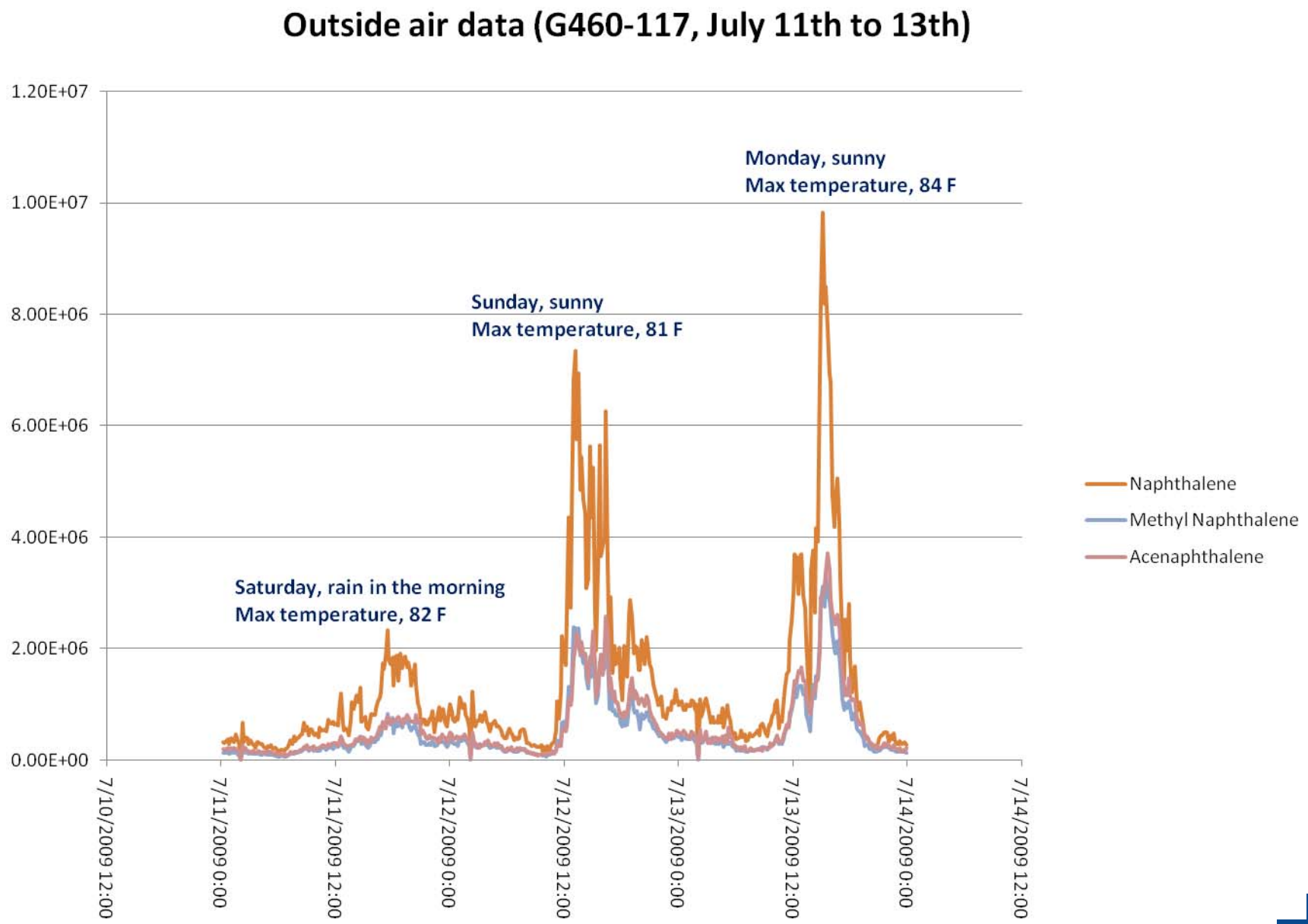


External Air Monitoring

Purdue University

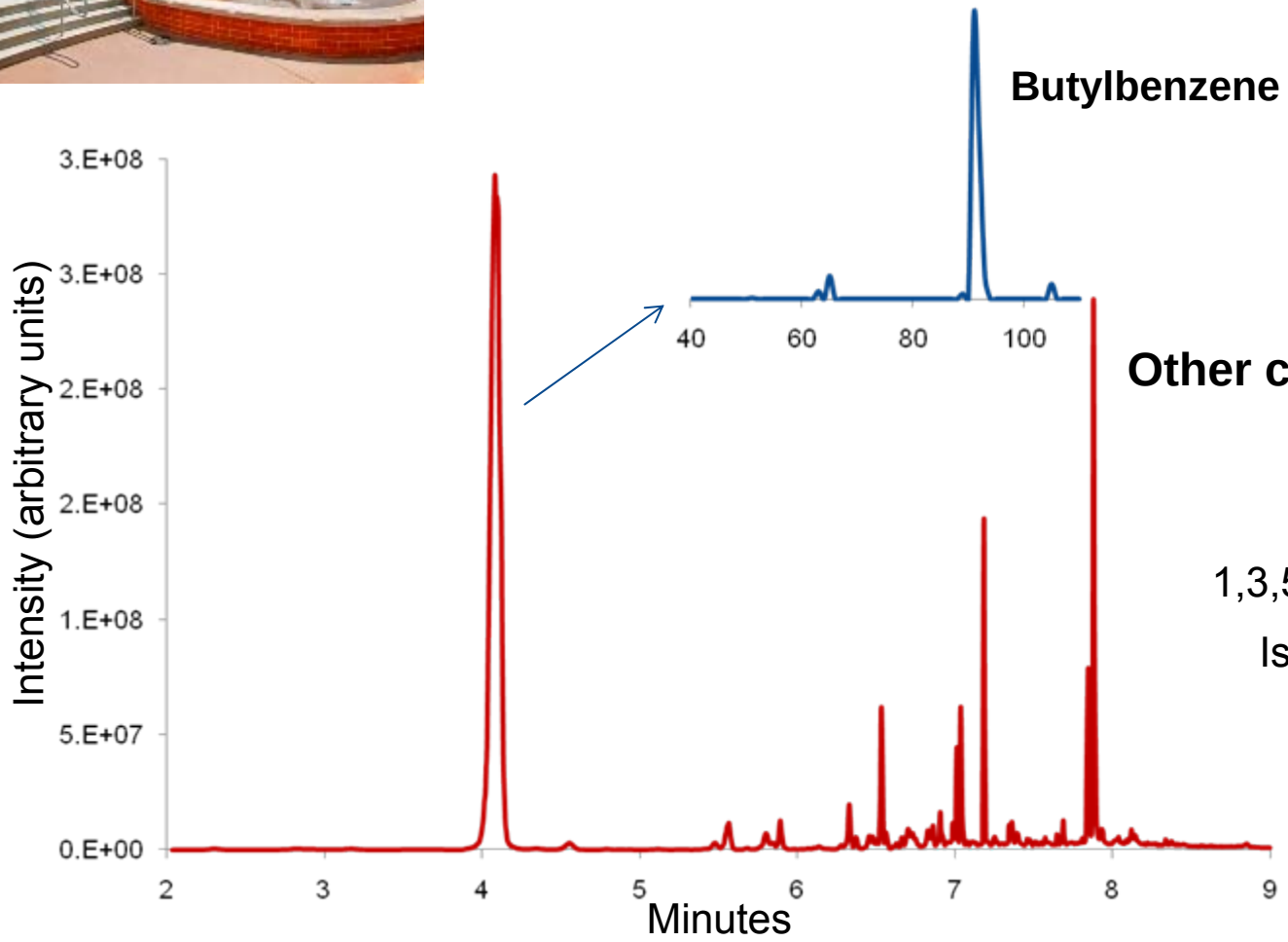
- Plumbed a line from the instrument, housed in the lab to one of the building's external windows
- The parking lot was resurfaced the previous week
- A mixture of naphthalene, methyl naphthalene, and acenaphthalene was observed
- Fluctuations in temperature and cloud cover affected the chromatogram

External Air Analysis Outside Griffin



X-Sorber Air Testing in the Kurz Building

Kurz Building at Purdue Research Park has hood space that can house our Griffin MS systems for the analysis of toxic chemicals. The new building had a residual solvent signature.



Other chemicals observed:

p-xylene

o-xylene

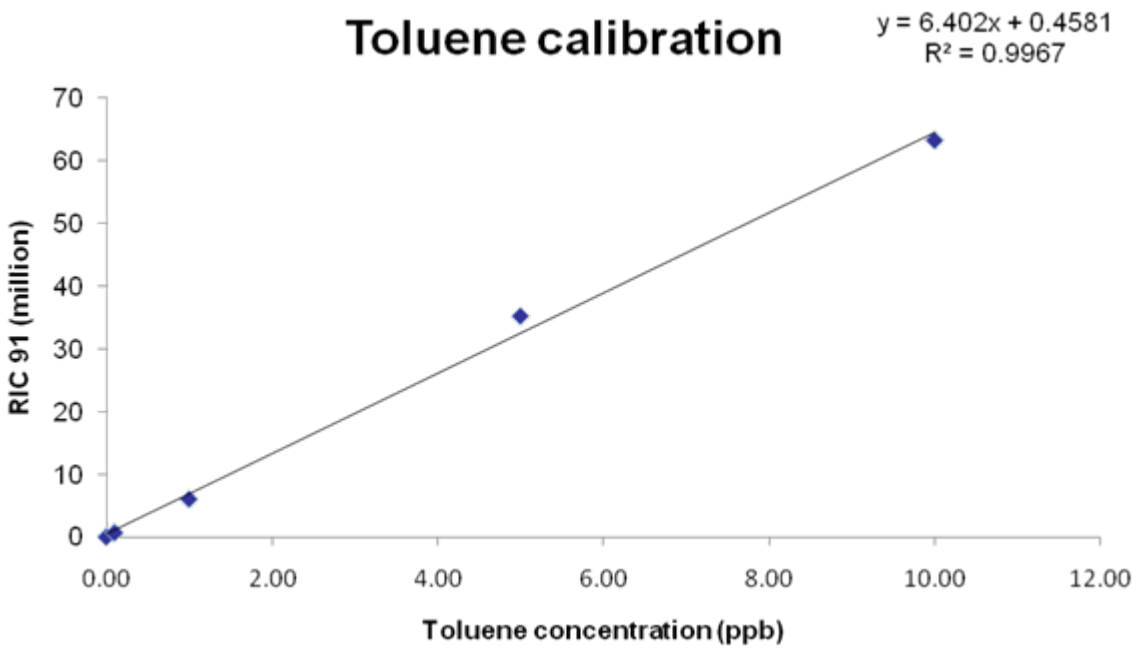
1,3,5-trimethyl benzene

Isopropyl benzene

Dodecane

Toluene Calibration Curve

We calculated a calibration curve for toluene using the X-Sorber and a G450 GC-MS. We were able to achieve detection limits in the sub-ppb range.

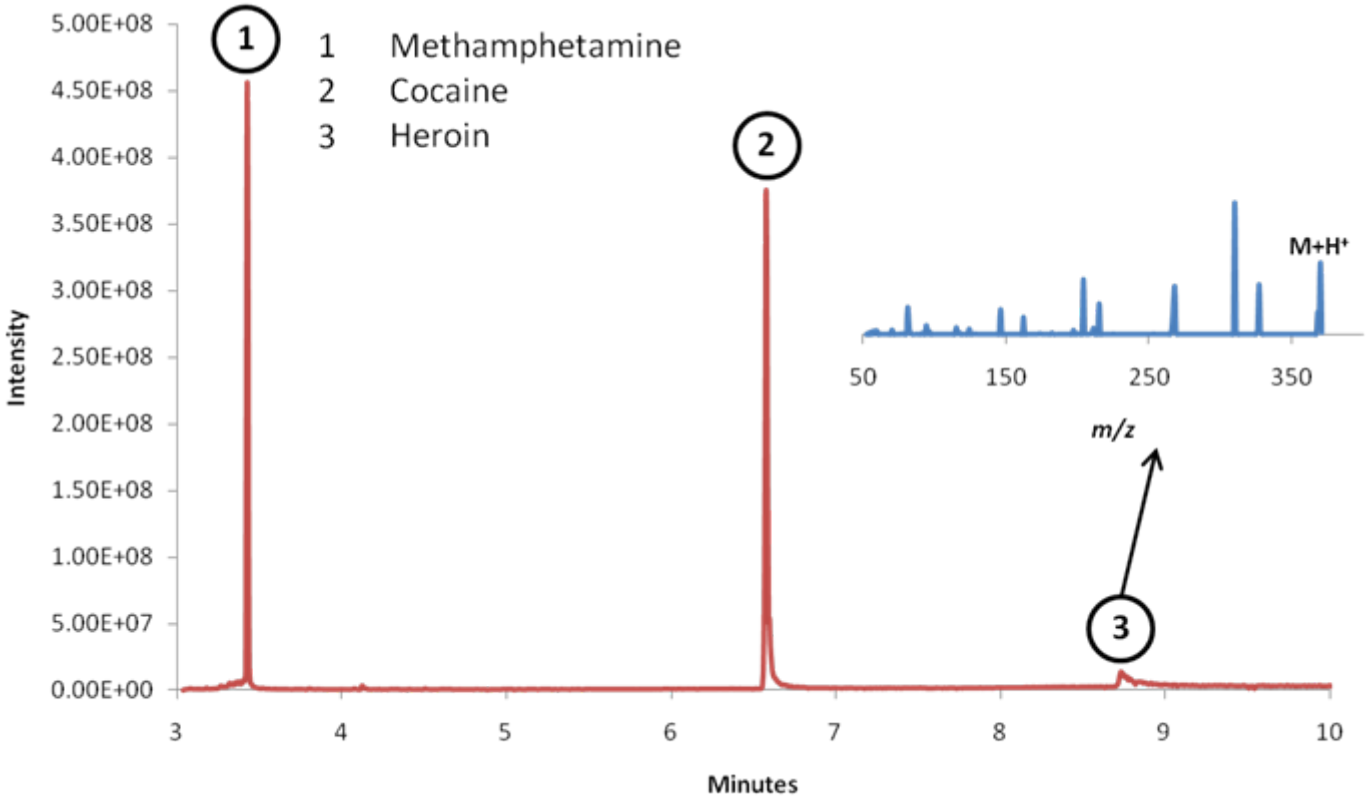


Using this curve, we determined levels of toluene for the following locations :

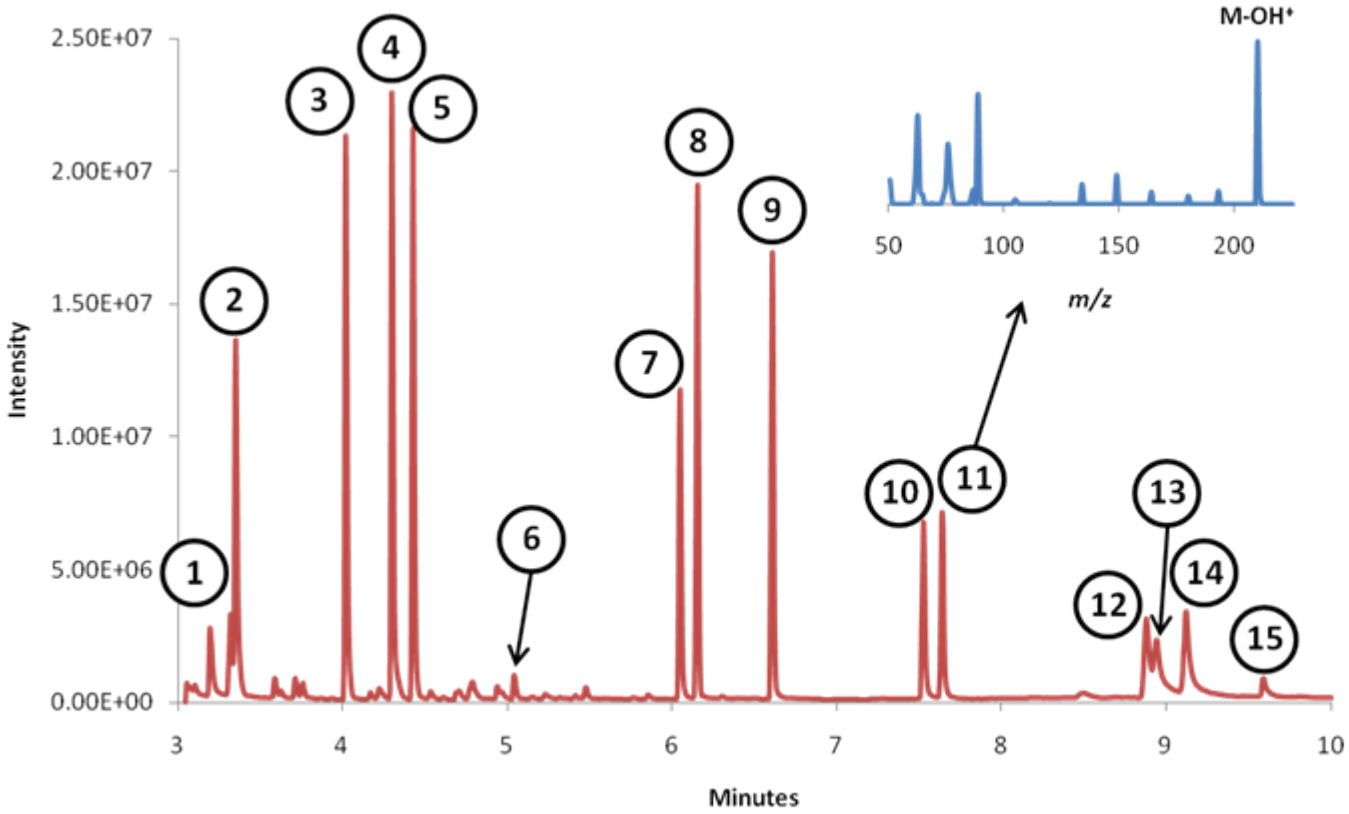
Outside air	0.08 ppb
Office	0.22 ppb
Lab air	0.69 ppb
Kurz	117 ppb

ANALYSIS OF LOW-VOLATILITY CHEMICALS

Analysis of a Drug Mixture using GC/MS

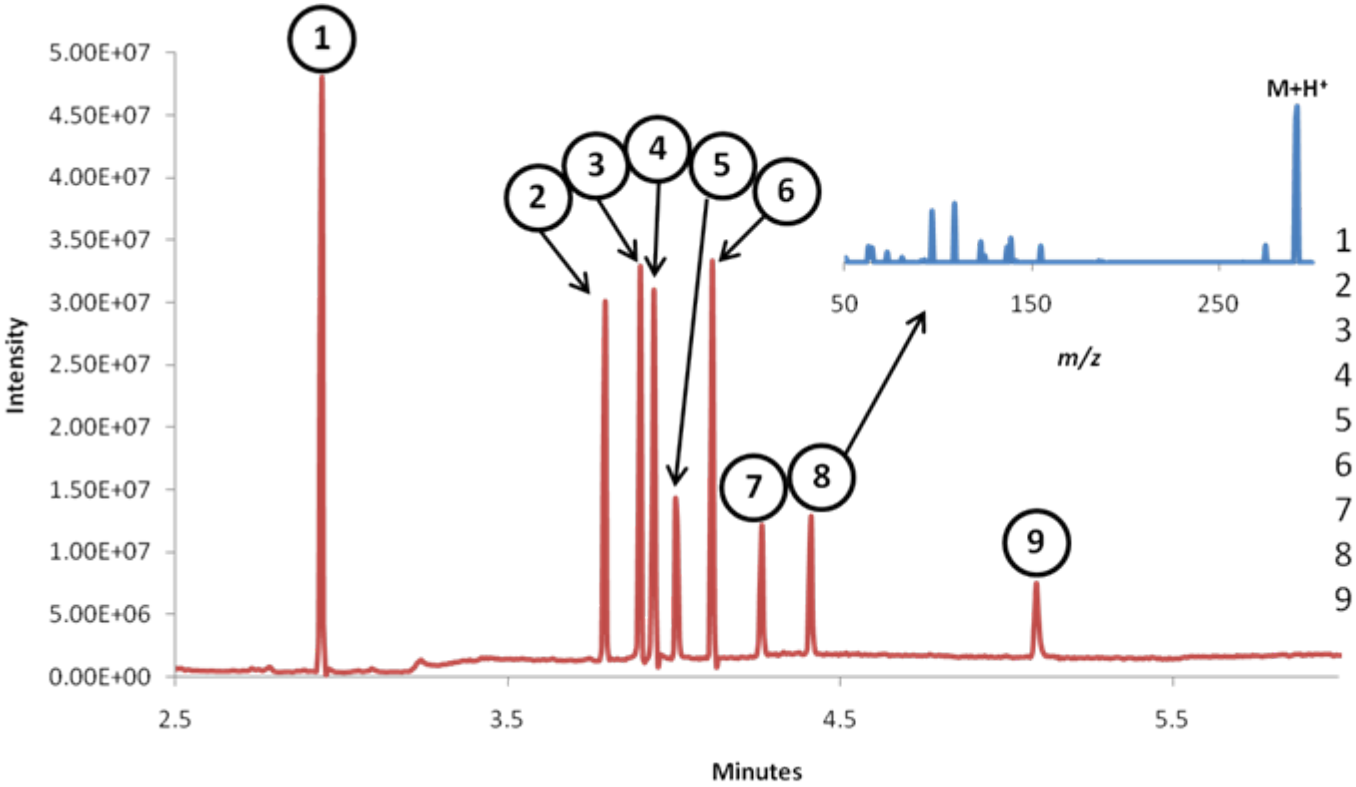


Analysis of Nitroaromatic Mixture using GC/MS



1 4-Nitrotoluene
2 Nitrobenzene
3 2-Nitrotoluene
4 3-Nitrotoluene
5 4-Nitrotoluene
6 1,3-Dinitrotoluene
7 1,3-Dinitrobenzene
8 1,3-Dinitrotoluene
9 2,4-Dinitrotoluene
10 1,3,5-Trinitrobenzene
11 1,3,5-Trinitrotoluene
12 3,5-Dinitro-p-toluidine
13 3,5-Dinitrobenzamine
14 2-Methyl-3,5-dinitro benzenamine
15 Tetryl

Analysis of a Pesticide Mixture using GC/MS



1 O,O,O-Triethylthiophosphate
2 Thionazin
3 Sulfotep
4 Phorate
5 Dimethoate
6 Disulfoton
7 Methyl parathion
8 Parathion
9 Famphur

Conclusions

- Something extremely witty…

The end.

QUESTIONS?