

Mistaken Identity and the Totality of Circumstances

**Integration for Hazardous Response Teams Conference
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**Produced by the Alabama Department of Public Health
Video Communications and Distance Learning Division**

Faculty

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FBI and Powders

- **Experience**
 - **Processing of numerous crime and search scenes involving Anthrax and Ricin**
 - **Daily communication with the field regarding powder incidents**

FBI and Powders

- **Perspective**
 - **Crime scene processing, evidence recognition, collection, and preservation**

Hazards of Handling Spores

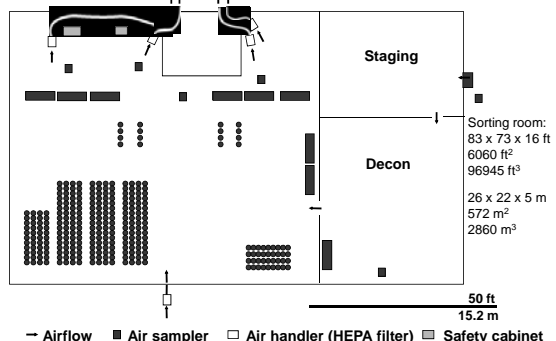
Large-scale Mail Search Springfield, Virginia

- **Task**
 - **Search for “Daschle-like” letter in quarantined mail packed in 642 plastic bags in 230 drums (55 gal)**
- **Method**
 - **Microbiological sampling (swabs) and culture in hotzone**

Large-scale Mail Search Springfield, Virginia

- Seek only heavy contamination

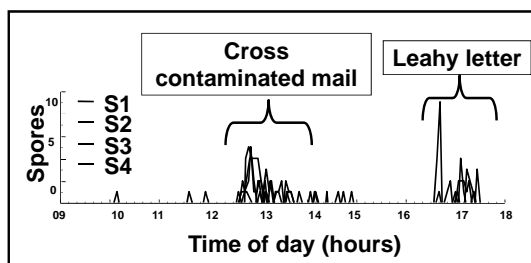
Containment Facility Constructed



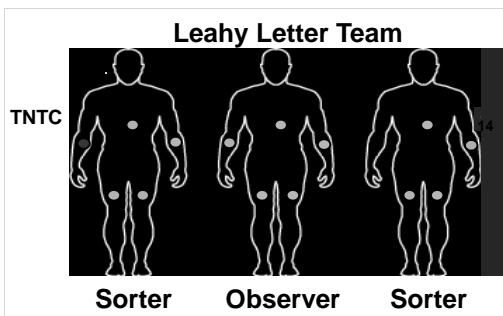
Airborne Spore Contamination

- All personnel touching cross contaminated mail became contaminated themselves
- Up to 8 million spores removed from outside of cross contaminated envelopes

Airborne Spore Contamination



Airborne Spore Contamination



HMRU Perspective on Field Analysis of Powders

- Uses up or contaminates valuable forensic evidence
 - Public health and safety ALWAYS outweighs evidence considerations

HMRU Perspective on Field Analysis of Powders

- Powdered pathogens are **MANY** times more dangerous than any chemical in powdered form
- Manipulation of biological powder will greatly amplify contamination of the scene and personnel

Evidence Awareness and Sampling

- Sampling the area **AROUND** visible biological powders will provide more than enough material for laboratory identification

Evidence Awareness and Sampling

- Sampling **AFTER** the visible powder is collected

Protein and pH Test

- Rationale
 - Biological agents contain protein
 - Detect protein – possible biological agent
 - Don't detect protein – no biological event
 - Caveat: protein is everywhere

Protein/pH Tests: Caution

- From BioCheck™ FAQ Sheet
 - Protein
 - “Some safe substances (i.e. yeast, whole wheat flour) will test positive for protein. These substances have not normally caused citizens to call 911.”

Protein/pH Tests: Caution

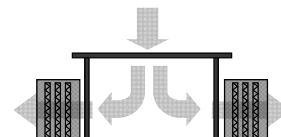
- pH
 - “Materials that may contain dangerous bioterrorism agents are likely to be of a neutral pH”
 - If anthrax is present: “the solution in the pH tube should not change color, remaining a pale yellow”

Protein Test: Pentagon/Skyline

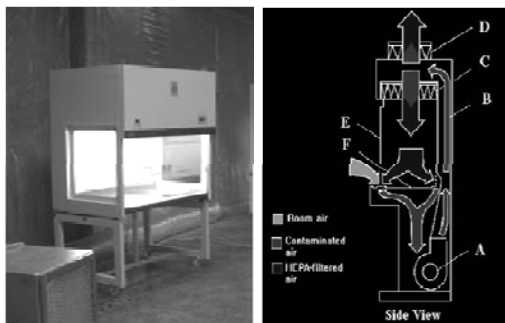
- Monday pm
 - Pentagon “positive” from 1 of 4 filters on Thursday
 - No positives on Wednesday or Friday
 - Skyline: positive “20/20 protein” and “alarm”

Protein Test: Pentagon/Skyline

- Tuesday pm
 - HMRU/HMRT on scene at Pentagon and Skyline
 - Report at Skyline: Positive 20/20 and “anthrax alarm” of particle counter



Class II BSC



Class II Type A Biological Safety Cabinet

PCR – Anacostia Mail Facility

- Contractor tests filters at mail handling table for anthrax
 - 1st test: “weak positive” on 1 of 8 filters
 - 2nd test: “weak positive”

PCR – Anacostia Mail Facility

- 3rd test at USAMRIID: “weak positive”
 - FBI involvement
 - Sample to LRN for confirmation
 - No more sample!

Anacostia Consequences

- Three jurisdictions affected
- Hundreds of thousands of dollars
- National antibiotic stockpile mobilized
- 11 postal facilities shut
- Worker and community fear

PCR: Powder in Truck

- HazMat team requested to aid search of truck suspected of containing explosives
- Protocol-based Level A response calls for full testing of powder found on floor or trailer
- PCR identifies anthrax, ricin, and smallpox in one sample

PCR: Powder in Truck

- Ensuing conference call begins at midnight and lasts 6 hours
- Results taken at face value at scene
- Considering the totality of circumstances permits logical interpretation

Fourier Transform Infrared Spectroscopy (FTIR)

- Representative instruments



Hazmat ID
Smiths Detection

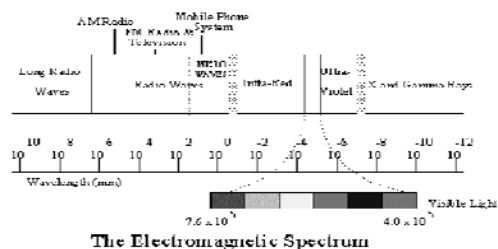


TruDefender FT
Ahura Scientific

Infrared Spectroscopy

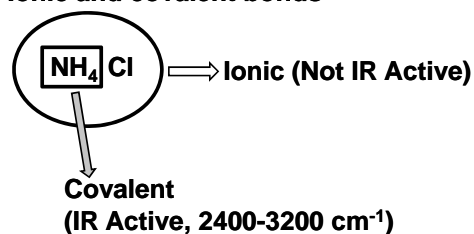
- An instrumental method that determines energy absorption in the Infrared (IR) region
- IR absorption can be correlated with the presence or absence of covalent bonds within a molecule
 - Each molecule has a characteristic IR spectrum or “fingerprint”

Infrared Spectroscopy

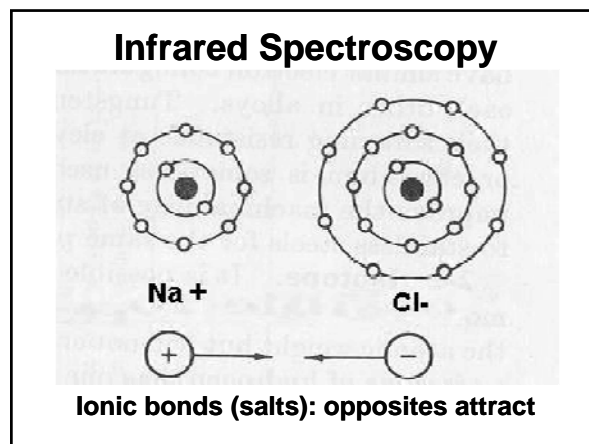
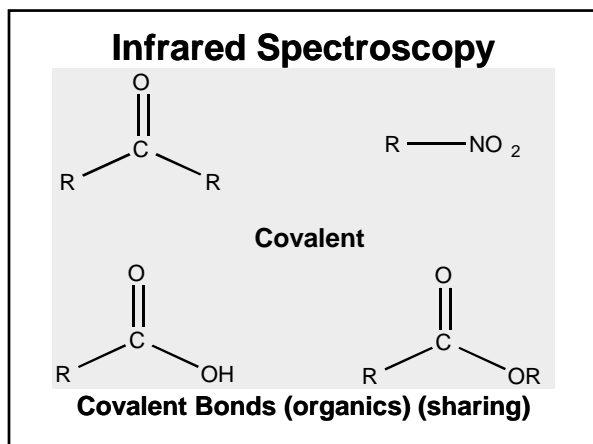


Infrared Spectroscopy

- Salts of Polyatomic Ions have both ionic and covalent bonds

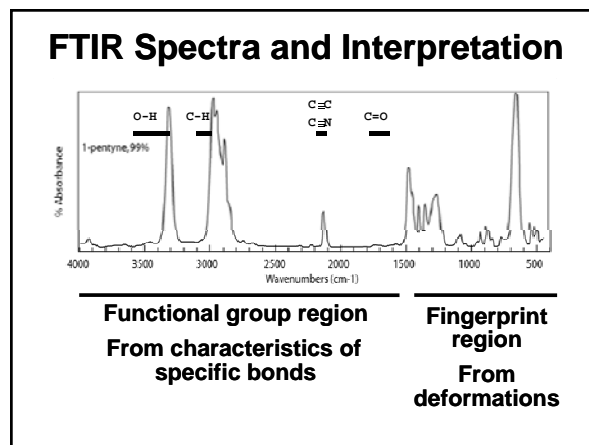


- Other examples: NaCO_3 , KCN , KNO_3



FTIR Spectra and Interpretation

- Identify functional groups (bond types) to narrow down the type of molecule
- Note fingerprint bands to further specify molecule type
- Compare fingerprint region with spectra of known molecules (library)



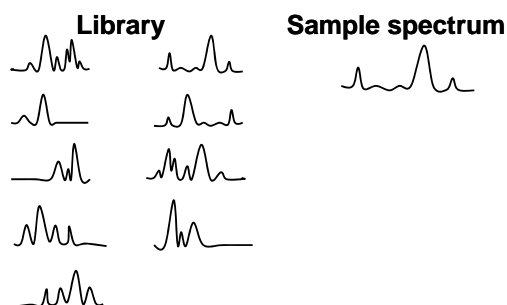
Library Comparisons to Identify Unknowns

- FTIR instruments compare the spectrum of the unknown sample to a library of reference spectra
- Each library spectrum is assigned an overall score for how well it matches the spectrum of the unknown, then a list of reference spectra are provided with their scores

Library Comparisons to Identify Unknowns

- A list will be provided whether the unknown is in the library or not
- Advantage
 - Many are quickly searched
- Disadvantage
 - Wrong ID if unknown is not in library

Library Comparisons to Identify Unknowns



Goodness of Fit Score

- FTIR instrument software compares the sample spectrum with the spectra in its library
- It measures how much two lines from one another along the y axis at each point on the x axis and computes an overall "goodness of fit" score

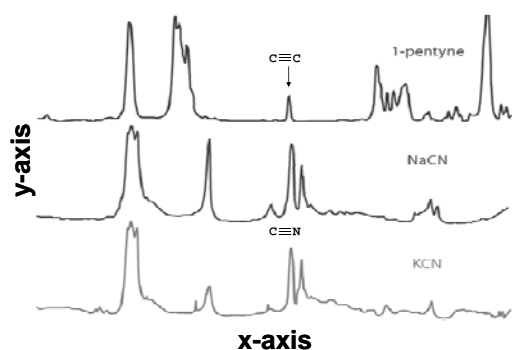
Goodness of Fit Score

- The score is a ratio between 0.0 (no similarity) and 1.0 (a perfect match)
- The instrument does not give information about % purity or recognize mixtures

Goodness of Fit Score

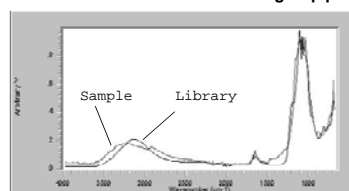
- This process is strictly mathematical, not logical
 - The spectra are just squiggly lines to the computer
- Cannot pick out functional groups

Goodness of Fit Score

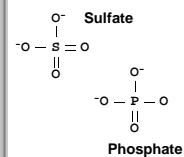


FTIR – Spectrum Interpretation

Threat letter from *bona fide* terrorist group postmarked in Puerto Rico

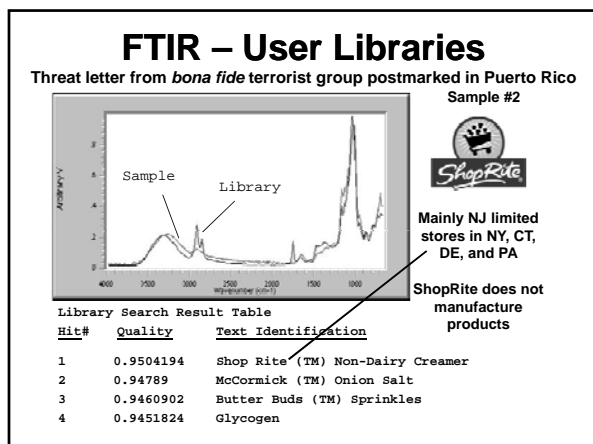


Sample #1



Library Search Result Table

| Hit# | Quality | Text | Identification |
|------|-----------|-------------------------|------------------------|
| 1 | 0.9531584 | Ferric subsulfate | Reddish brown liquid |
| 2 | 0.9307759 | Indium sulfate | White powder |
| 3 | 0.9294747 | Aluminum phosphate | White powder |
| 4 | 0.8906369 | Ferric sulfate | Grayish white powder |
| 5 | 0.8799586 | Aluminum sodium sulfate | Colorless/white powder |



Nationwide Stevia Letters

- Numerous rambling letters demanding that FDA approve Stevia as a food additive
 - Currently classified as a “dietary supplement”
- Numerous Hazmat responses and field analyses

Nationwide Stevia Letters

- Most determined the powder was not hazardous and released scenes
- At least one identified a hazardous substance
 - Declared a criminal act
- NONE identified the actual substance despite the fact that the letters said exactly what it was

Nationwide Stevia Letters

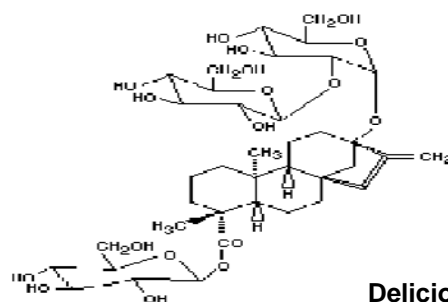
- Glycosides
 - Molecules in which a non-sugar group is attached to sugar groups
 - Very common and varied, often with complex structures reflecting numerous bonds

Nationwide Stevia Letters

- Some types of glycosides:
 - Alcoholic, Anthraquinone, Coumarin, Cyanogenic, Flavonoid, Phenolic, Saponins (detergents), Steroidal or Cardiac, Stevial, Thioglycosides

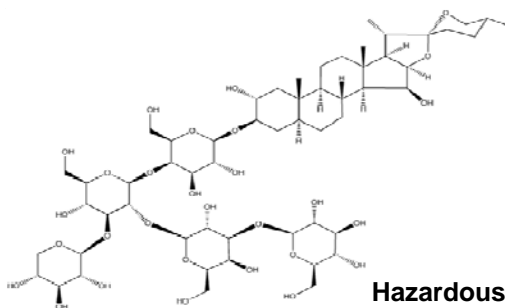
Nationwide Stevia Letters

Stevioside (glycoside sweetener)



Nationwide Stevia Letters

Digitonin (glycoside detergent)



Dead Birds at Subway Stations

- Numerous dead birds at 5 stations across DC Metro system
- Hazmat and investigative response
- Apparent bird seed at several stations tested using HazMat ID FTIR

Dead Birds at Subway Stations

- FTIR reports from Metro stations with dead birds
 - Location 1 (presented as a list of ingredients)
 - Rawolfia serpentina
 - Xanthan gum • Cream of Wheat
 - Arabinic acid • Cake mix
 - Alfredo sauce • Garlic powder

Dead Birds at Subway Stations

- Location 2
 - Glyoxal
 - Chloroacetate
 - Formalin
 - Yellow liquid
 - Clear or white crystals
 - Clear liquid

Dead Birds at Subway Stations

- Location 3
 - 91% beta-cyclodextrinhydrate
 - Used to bind odorants and cholesterol

Dead Birds at Subway Stations

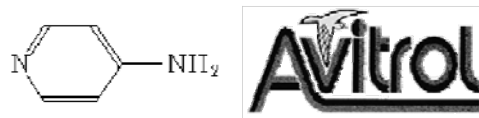
- Examples of:
 - User library
 - Inconsistent physical characteristics
 - Misstatement of fit value

Dead Birds at Subway Stations

- Resolution of incident after “logical investigation”
- Interview with Metro manager reveals contractor pest control activities that morning
 - Actual material: Avitrol grain bait
 - Active ingredient: 4-aminopyridine
 - Concentration in grain: 0.5% or 1%

Dead Birds at Subway Stations

- Problems with FTIR analysis in this case
 - Product is a mixture
 - Concentration below detection limit of instrument



Radiological Mistaken ID

- Gamma Spectroscopy
 - Each radioisotope has a unique “fingerprint”
 - Measure energy peaks of gamma radiation emitted from source
 - Compare peaks to library and identify rad material
 - Sounds simple.....right?

Why Is It difficult?

- Approximately 3,800 radioisotopes
 - Good news is we are only concerned with ~20
- Some isotopes can emit 30 different energy gammas with varying probabilities
- Most instruments have low resolution
- Software may take a “best guess”

Case: NJ Garbage Truck

- April 20, 2005
 - Trash truck en-route to NJ from Pennsylvania trips radiation alarm at dump site
 - NJ Department of Environmental Protection (DEP) conduct survey with Field Spectrometer and get:
 - Nuclide listing 9 Nuc. Pu-239

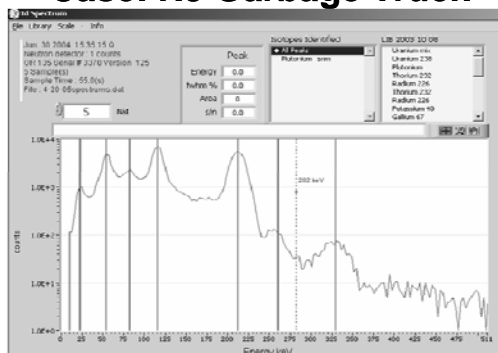
Case: NJ Garbage Truck

- HMRU is contacted for technical advice
- Conduct radiation survey of truck using GR-135
 - No neutrons detected
 - Dose rate 330 uRem/hr
 - “Not identified” on analysis

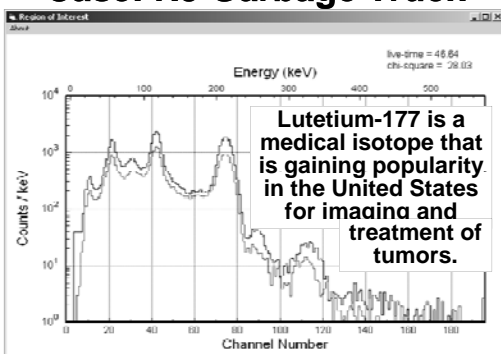
Case: NJ Garbage Truck

- The GR-135 data is sent to HMRU and DOE for further analysis

Case: NJ Garbage Truck



Case: NJ Garbage Truck



Best Uses of Instrumentation

- Confirmation or comparison of suspected materials
- Rule out specific material
 - Cyanides, drugs, etc.
- Operator proficiency and prior planning are key elements to success
- One part of overall assessment