Baystate Health

Chemical Exposure Monitoring in Healthcare

Part 1
Developing a Monitoring Program

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2016 All-Day Industrial Hygiene Conference & Exhibition
A little history

- 1970 – The OSHA Act is signed into law by Richard Nixon
- 1970 - 38 worker deaths a day
- 1972 - Worker injuries and illnesses are at 10.9 incidents per 100 workers
- 1974 - NIOSH published the first “Pocket Guide”
- 1989 – Subpart Z is published
- 1992 – Formaldehyde revised
When I came to Baystate....

- Healthcare was still in a fee for service model, HMOs and cost containment were still new.
- Lots of guidance, but few standards.
- Understanding of chemical usage and exposure was very limited and compartmentalized.
- Unlike many manufacturing operations, chemical exposure in healthcare is like James Michener’s description of the South Platte River, “a mile wide and an inch deep”.

- **Centennial**
  "A hell of a book... While he fascinates and engrosses, Michener Boise educates." —Los Angeles Times
Assessment

• Survey the facility, department by department
• Establish directory of high use products and processes
• Risk assess processes for exposure routes
• Develop a sampling strategy
  • Active
  • Passive
Departments and Contaminants

- Pathology
  - Acetic Acid
  - Acetone
  - Ethanol
  - Formaldehyde
  - d-Limonene
  - Toluene
  - Methanol
  - Xylene
- Radiation Therapy
  - Cadmium
- LDRP
  - Nitrous oxide
- Surgery
  - Halogenated anesthetics
- Central/Sterile Processing
  - Ethylene Oxide
- Physician Offices
  - Glutaraldehyde
- Other
  - Radon
Management Aspects

• Use an AIHA Accredited Laboratory;
• Manage to the most protective guidance: PEL, TLV, REL, WEEL, STEL regardless of the exposure time;
• Utilize environmental samples as a QC/QA.
• PPE needs to be the last choice with the caveat of multiple hazards (hygiene, BBS);
• Data is widely shared with employees, managers, Employee Health;
• Provides an opportunity to education;
• Provides an opportunity to review for product substitution.
What have we learned....

• In general, people think their exposure is much higher than it actually is;
• There’s a lot to be said for technique;
• People don’t get ventilation;
• To many, Physics is smoke and mirrors;
• Not all physicians are scientists;
• Product substitution can be a good thing for the most part, however;
• Not everything can be monitored (o-phththalaldehyde);
Indoor Air Quality

• On average, we respond to about two dozen indoor air quality complaints per year.

• Employee reports are split Building Related Illness and Sick Building Syndrome.
  – BRI - a clinically diagnosable disease or condition (as Legionnaires' disease or an allergic reaction) caused by a microorganism or substance demonstrably present in a building.
  – SBS - a condition affecting office workers, typically marked by headaches and respiratory problems, attributed to unhealthy or stressful factors in the working environment such as poor ventilation.
Indoor Air Quality

- Baystate has a standard “package”: Temperature, humidity, carbon dioxide, nuisance dust, formaldehyde, and, 2-butoxyethanol, and often, bioaerosols.
Indoor Air Quality

The electronic data set will provide information on ventilation efficiency and efficacy, temperature control and identify chronic low humidity conditions.
Indoor Air Quality

The laboratory analyzed samples provides information on common stressors that are the result of off-gassing from man-made furniture components, floor cleaning or poor housekeeping.

### FORMALDEHYDE VAPOR ANALYSIS REPORT

<table>
<thead>
<tr>
<th>SAMPLE NO</th>
<th>SAMPLING DATE</th>
<th>NAME</th>
<th>EXPOSURE TIME</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD7726</td>
<td>05/19/16</td>
<td>Rm 17/1</td>
<td>7:30 - 15:00 = 7.50</td>
<td>0.03 ppm</td>
</tr>
</tbody>
</table>

Daly OR

- **Lab ID: 1600751-03**  
  Sample ID: FD3219  
  Sample Description: Blank  
  Date Sampled: Not Provided  
  Matrix: 3M 3520 OVM  
  **Analyte**  
  2-Butoxyethanol  
  **Total Mass**  
  < 9.0 µg

- **Lab ID: 1600751-04**  
  Sample ID: 927-1168  
  Sample Description: C Level Office  
  Date Sampled: 03/18/2016  
  **Air Volume:** 880 Liters  
  **Matrix:** PVC Filter - preweighed  
  **Analyte**  
  Total Particulates  
  **Total Mass**  
  < 100 µg  
  **Concentration**  
  < 0.11 mg/m³

Baystate Health
Indoor Air Quality

Mold is a popular culprit for air quality complaints.

In reality, the indoor environment is considerably less contaminated with bioaerosols than outdoors.

Baystate uses Trypticase Soy agar as a general growth medium.

Four sample minimum: complaint area, non-complaint area, outdoors, blank.

Results are calculated as colony forming units per cubic meter, CFU/m³.

50-200 CFU/m³ are common and not problematic.
Questions?

Part 2
Case Study: Chemical Exposures in the Morgue
BAYSTATE MEDICAL CENTER CASE STUDY:
CHEMICAL EXPOSURES IN THE MORGUE

By: Elizabeth Guyette, MSM
Senior Safety Engineer
Overview

- Floor plan
- Autopsy defined
- Why lung inflation
- Formaldehyde hazards
- Respiratory vs. Skin Exposure
- Workstation configuration
- Vapor Monitoring
- Hierarchy of Controls & corrective actions
Building History

- Springfield Hospital
- Constructed in 1930
Always has been a Morgue
2015 Renovation
Down Draft Table

- Pulls vapors down and away
Reason for Autopsy

An autopsy is a medical procedure that consists of a thorough examination performed on a body after death, to evaluate disease or injury that may be present and to determine the cause and manner of a person's death.
Lung Inflation

- Helps to mimic breathing
- Expands lungs
- “Fixes” Organs
Formaldehyde vs. Formalin

- **Formaldehyde:**
  - Consists of 37% formaldehyde to 100 mL of water.

- **Formalin:**
  - 3.7% formaldehyde mixed with a buffer and water to reduce corrosivity but still maintains its’ fixative properties.
Hazards of Formaldehyde

- Sensitizing agent
- Carcinogen
- Acute Exposure
  - Irritation: eyes, nose, and throat
- Chronic Exposure
  - Asthma-like symptoms
  - Skin irritation/dermatitis
Skin vs. Respiratory Exposure

- **Minimal Skin exposure**
  - Scrubs
  - Cover-all’s
  - Gloves
  - Eye Protection

- **Respiratory Exposure**
  - PAPR w/ Formaldehyde Cartridge.
  - Adequate Ventilation pulling away from process
Sampling Methodology

- Both active and passive
- Personal and environmental samples
Creating a workstation to fit the employee

- Employee Height
- Flow Control
- Ventilation
Visual Queues

- Green means GO
- Red means STOP
- Programmed to notify Engineering when not working
Vapor Monitoring Post-Modifications

- Sample 1
- Sample 2
- Sample 3
- Sample 4

- 2.0 ppm – OSHA STEL
- 1.0 ppm – OSHA Action Level

Height < 62"
Questions?