Biological and Chemical Risk Assessment in a Healthcare Setting

*Presented by: ECU-IH*

Saudi Aramco Medical Services Organization
Environmental Compliance Unit-Industrial Hygiene

2008
Presenters

• Mohammed Almusaher, Senior Industrial Hygienist
• Fred Lomax, Industrial Hygienist
• Patrise Reed, Industrial Hygienist
Objectives:

- Define and understand the concept of health hazards
- Identify and discuss the steps involved in performing chemical/biological risk assessment
- Identify and understand what hazard controls measure or the precautions necessary to control or minimize harmful exposure
- To introduce programs that are necessary to manage biological/chemical risks
Contents

• **Session 1:** Typical Chemical & Biological Hazards in a Healthcare Setting

• **Session 2:** How to Perform a Chemical and Biological Risk Assessment

• **Session 3:** Managing Chemical risks via Occupational Health Programs

• **Session 4:** Review & Assessment
Typical Chemical & Biological Hazards in a Healthcare Setting

Session 1
Chemical & Biological Hazards in a Healthcare Setting

Health Hazards: Are those various environmental factors or stresses that can cause sickness, impaired health, or significant discomfort in workers.
Chemical & Biological Hazards in a Healthcare Setting

Types

- Chemical – gases, vapors and liquids
- Biological – blood, bacteria and viruses
Chemical & Biological Hazards in a Healthcare Setting

- Film fixers and developers used in radiology
- Glues, adhesives, resins used in orthotic and prosthetic workshops
- Waste Anesthetic gases (Nitrous Oxide, Desflurane and Isoflurane)
- Paints and paint thinners
- Water treatment chemicals
Chemical & Biological Hazards in a Healthcare Setting

- Household bleach
- Cleaners and disinfectants
- Isopropyl and ethyl alcohol
- Hydrochloric acid
- Formaldehyde
Chemical & Biological Hazards in a Healthcare Setting

Routes of Entry

- Inhalation
- Skin Absorption
- Ingestion
- Injection
How to Perform a Chemical and Biological Risk Assessment

Session 2
Definitions

- Chemical Risk Assessment
- Hazardous Materials
- Exposure
- Health Hazards
- Risks
Chemical Risk Assessment (CRA)

As defined by Saudi Aramco, it is the comprehensive assessment of the handling and use of hazardous chemicals at Saudi Aramco facilities.
**Hazardous materials/waste**

Materials whose physical, chemical or biological characteristics may pose a risk to staff, patients, visitors, facilities, or the environment if spilled or released in an uncontrolled manner.

Generally, a material/waste is classified as hazardous if it presents a physical or health hazard, or if it contains more than 1.0% of a hazardous material or more than 0.01% of a carcinogen.
Exposure

Being related to the dose (how much), the duration and frequency of exposure (how long and how often), and the route of exposure (how and where the material gets in or on the body).
Acute Exposure vs. Chronic Exposure

- Acute exposure is an exposure to a toxic substance that occurs in a short or single time period.

- Chronic exposure is exposure to toxic chemicals occurring over a long period of time (months to over one year) exposure to a chemical between 1 to 3 months.
Health Hazard

Any material or chemical for which there is statistically significant evidence, based on at least one study, conducted in accordance with established scientific principles; that acute or chronic health effects may occur in exposed employees.
Risk

The probability that something will cause injury or harm

Dangerous driving is a perfect example
6 Steps for Chemical Risk Assessment

• Identification of Hazards
• Hazard Evaluation and Risk Characterization
• Hazard Control
• Development of a Written Action Plan (OHHA)
• Educate, Communicate and Train Employees
• Follow Up
Step 1
Identification of Hazards

- Conducting walk-through surveys
- Identifying all work activities and processes
- Identifying all employees potentially exposed to chemical and biological exposures
- Compiling a chemical Inventory
- Reviewing past studies/historical data
Step 2
Hazard Evaluation
So How Do We Evaluate?

- Look at a chemical’s physical state
- Review the technical data (MSDSs): e.g., toxicity, PEL/TLV
- How the chemical is used
- Review Packaging Labels
- Medical Surveillance
- Perform IH sampling
Sampling Instruments

- Passive dosimeters
- Direct Reading Instrument
Sampling Instruments
Technical Data
**BLEACH**

**MATERIAL SAFETY DATA SHEET**

<table>
<thead>
<tr>
<th>1. Product</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Emergency Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleach</td>
<td>Clear, light, yellow liquid with chlorine odor</td>
<td>The Clorox Company</td>
<td>Medical Emergencies: U.S. Poison Center: (800) 222-1222</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Health Hazard Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes substantial but temporary eye injury. May irritate skin. May cause nausea and vomiting if ingested. Exposure to vapor or mist may irritate nose, throat, and lungs. The following medical conditions may be aggravated by exposure: bronchitis, emphysema, conditions of the upper or middle respiratory tract, or chronic lung disease. Furthermore, conditions such as asthma, chronic bronchitis or obstructive lung diseases. Under normal consumer use conditions, the likelihood of any adverse health effects are low.</td>
</tr>
</tbody>
</table>

**FIRST AID: EYE CONTACT** - Immediately flush eyes with plenty of water. If irritation persists, see a doctor. **SKIN CONTACT** - Remove contaminated clothing. Wash area with water. **INGESTION** - Drink a glassful of water and call a physician. **INHALATION** - Breathing problems develop, remove to fresh air. **OTHER** - None.

<table>
<thead>
<tr>
<th>3. Hazardous Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredients</td>
</tr>
<tr>
<td>Sodium hypochlorite</td>
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</table>

None of the ingredients in this product are on the LARG, NTP, or ACGIH carcinogen lists. Occasional clinical reports suggest a low potential for sensitization upon exposure to sodium hypochlorite, skin damage (e.g., irritation) occurs during exposure. Routine clinical tests conducted on irritation with Clorox Liquid Bleach found no sensitization in the test subjects.

<table>
<thead>
<tr>
<th>4. Special Protection</th>
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<tbody>
<tr>
<td>Hygiene Practices: Wear safety glasses. With repeated or prolonged use, wear gloves.</td>
</tr>
</tbody>
</table>

**Engineering Controls** - Use general ventilation to minimize exposure to vapor or mist. **Work Practices** - Avoid eye and skin contact and inhalation of vapor or mist.

<table>
<thead>
<tr>
<th>5. Special Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep out of reach of children. Do not get in eyes or on skin. Wash thoroughly with soap and water after handling. Do not mix with other household chemicals such as toilet bowl cleaners, rust removers, vinegar, or ammonia containing products. Store in a cool, dry place. Do not store empty container, rinse container and put in trash or recycle.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>6. Spill/Leak Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small quantities of less than 5 gallons may be flushed down drains. For larger quantities, wipe up with an absorbent material or drop and dispose of in accordance with local regulations. Dilute any remaining amount with water to minimize oxidizing effect on spilled surface.</td>
</tr>
</tbody>
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<thead>
<tr>
<th>7. Reactivity Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable under normal use and storage conditions. <strong>Strong exothermic agent</strong>. Reacts with other household chemicals such as toilet bowl cleaners, rust removers, vinegar, or ammonia containing products to produce hazardous gases, such as chlorine and other chlorinated species. Prolonged contact with metal may cause pitting or decoloration.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>8. Fire and Explosion Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not flammable or explosive. In fire, cool containers to prevent re-ignition and release of sodium chloride.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>9. Physical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Point</td>
</tr>
<tr>
<td>Specific Gravity</td>
</tr>
<tr>
<td>Flash Point</td>
</tr>
</tbody>
</table>

*Date Prepared: 9/8/98*
Use Evaluation Form to Characterize Risk

1. Determine the Hazard Severity
2. Determine Probability
3. Rate the risk
4. Proceed to step 3, Hazard Controls
Additional Evaluation Tools

**OSHA Healthcare E-Tool**

The OSHA Healthcare computerized graphical e-Tool to help employers identify and address potential occupational hazards in hospitals. This is done through a comprehensive safety and health program approach.
Additional Evaluation Tools

**OSHA Healthcare E-Tool**

**Hospital eTool**

Click on the area for more specific information.
Step 3
Hazard Control Measures

*Engineering Controls*
Chemical substitution, ventilation (fume hoods, BSC), change process.

*Administration*
Rotating personnel, limit time and unnecessary use of chemicals.

*Personal Protective Equipment (PPE)*
Respirators, gloves, eye goggles, aprons, etc.
Engineering Controls

Include all control measures that isolate or remove a hazard from the workplace, such as sharps disposal containers, lab hoods, and self-sheathing needles.
**Airborne Infection Isolation (A.I.I.) Rooms**

- Must be under negative air pressure
- Should be exhausted from healthcare facility
- Must have HEPA filtration if air can re-enter the healthcare facility
- Must be provided with at least 12 air changes per hour
- Should be constructed of impervious material
Assessing A.I.I. Rooms

• Physical structure of the rooms and the HVAC system
• To determine the ACH of a space,
  ▪ Need to measure the airflow and
  ▪ Calculate the room volume
• Items that should be checked include
  ▪ the exhaust and supply airflow rate
  ▪ negative pressure, and
  ▪ exhaust duct termination location
Calculating Air Changes Per Hour

Only two things are needed

1. The amount of air (in cubic feet per minute or CFM) being exhausted from the room
2. Room Volume in cubic feet

\[ \text{ACH} = \text{CFM} \times 60 \text{ minutes per hour} \]

room volume
Helpful Hint

But … suppose you know the volume of the room, but do not know how much air needs to be exhausted from the room. Utilize the following calculation:

\[
\text{CFM required} = \frac{\text{Desired ACH}}{60 \text{ minutes per hour}} \times \text{Room volume}
\]
Engineering Controls and PPE
Control of Bio-Hazards
Personal Protective Equipment (PPE)
Step 4
Developing an Action Plan

Occupational Health Hazard Assessment Program

This will be explained in detail in
Session 3
Step 5 – Education and Training

- Communicate with employees about their specific job risks and the steps that need to be taken to prevent accident or injury
- Ensure employees are familiar with current health and safety policies
Step 6: Follow-up

Purpose:

- To ensure hazard was resolved
- To ensure actions taken did not create new hazards
- Control hazards must be checked at regular intervals
- Monitor workers at regular intervals
Managing Chemical & Biological Risks via Occupational Health Programs

Session 3
Occupational Health Programs

- **OHHA**: Occupational Health Hazard Assessment
- **HAZCOM**: Hazardous Materials Communication Program
- **Hazards specific to your area**: Industrial Hygiene Assessment
- **Medical surveillance**
OHHA

A proactive and structured program to identify and evaluate occupational health hazards in the workplace.
<table>
<thead>
<tr>
<th>AREA</th>
<th>BLDG NO.</th>
<th>Location</th>
<th>Evaluation Needed</th>
<th>Due Date</th>
<th>ECU</th>
<th>Surveyor</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhahran</td>
<td>62</td>
<td>Microbiology</td>
<td>Test and certify biological safety cabinet and check room pressure</td>
<td>6-Jan-08</td>
<td></td>
<td>MRM and FL</td>
<td>Completed.</td>
</tr>
<tr>
<td>Dhahran</td>
<td>60</td>
<td>Radiology Hot Lab</td>
<td>Test and certify the biological safety cabinet</td>
<td>6-Jan-08</td>
<td></td>
<td>MRM and FL</td>
<td>Completed on Jan. 9, 2008. Due for testing by Jan. 9, 2009.</td>
</tr>
<tr>
<td>Dhahran</td>
<td>60</td>
<td>Radiology Hot Lab</td>
<td>Test and certify fume hood and check room pressure</td>
<td>6-Jan-08</td>
<td></td>
<td>MRM and FL</td>
<td>Completed.</td>
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</table>
HAZCOM

A comprehensive & structured system for communication of the chemical hazards to employees.
Components of a HazCom Program

1. Written program
2. Inventory
3. Material Safety Data Sheets
4. Labels
5. Storage
6. Training
The Written HazCom Program

- Required to state the policies and procedures for chemical hazard awareness
- Includes inventory of hazardous materials, MSDSs, Labeling, and storage and training
- Needs managerial support and commitment
The Inventory

- Lists chemicals and quantities
- Updated annually or as needed
- Lists locations where chemicals are used
Material Safety Data Sheets

- Enforced by law in the U.S.
- Informs the user about the chemical
- Must accompany existing and newly purchased hazardous materials
- Can be located at http://www.msdssearch.com/ or numerous other websites
A standardized binder is useful for storing Material Safety Data Sheets (MSDSs).
Labels

- Required on each container to identify hazards and risks
- Vary in sizes
- Develop a standardized labeling system (e.g., NFPA 704 labeling system)
HAZCOM Labels

HYDROFLUORIC ACID

DANGER
4 HEALTH HAZARD
EXTREMELY CORROSIVE. AVOID ALL CONTACT WITH LIQUID OR VAPOR

0 FLAMMABILITY
NON-FLAMMABLE

3 REACTIVITY
WILL REACT WITH STRONG OXIDIZERS AND ORGANIC MATERIALS. ATTACKS GLASS AND METALS.

FIRST AID: Remove to fresh air. Get medical aid immediately (Call 110). USE SHOWER AND EYEWASH. Flush eyes with large amounts of water for at least 15 minutes, lifting eyelids occasionally. Wash skin thoroughly with water, removing contaminated clothing and shoes.

POPF
21-434-199
21-434-269
21-432-376
21-434-744

CHB 045

For further information call Industrial Hygiene: 273-2022 (OIT), 273-4961 (E&T), 273-5653 (ASDQ), or 506-2217 (TE). Hazard Rating: 0 = Negligible, 1 = Mild, 2 = Moderate, 3 = High, 4 = Extreme RCV 3

Dr. Jones Flanagan 213

warning: Flammable!
NFPA Label
<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
</table>
| 0.     | **NO SIGNIFICANT HEALTH HAZARD:**  
Materials which will *produce toxic effects only with overwhelming dosage.* |
| 1.     | **SLIGHT HEALTH HAZARD:**  
Materials which on exposure cause irritation but only *minor, reversible injury.* |
| 2.     | **MODERATE HEALTH HAZARD:**  
Materials which on intense or continued exposure could cause *temporary incapacitation or injury.* Includes allergens. |
3. **EXTREME HEALTH HAZARD:**

Materials which on brief or intense exposure or repeated low level exposure can cause serious temporary or permanent injury. Includes potent sensitizers.

4. **DEADLY HEALTH HAZARD:**

Materials which on brief intense exposure or repeated low Level exposure could cause death or major injury.
Chemical Storage

• Compatibility
• Organize your chemicals and stored them properly (e.g., not above eye level, on top of each other)
• Approved storage cabinets
• Ensure storage area is well ventilated
Flammable Storage Cabinet
Compressed Gas Cylinder Storage
HazCom Training

- Must be received by workers handling hazardous materials within specific time of their recruitment (SA requires 15 days)
- When there is a new chemical, new worker, new equipment or new work process
- Attendance is mandatory
- Must be documented
Review and Assessment
Session 4
Review and Assessment

- Session 1: Review

Definition of a health hazard
Examples of health hazards: formaldehyde gas, ETO, bleach, etc.
Routes of entry: inhalation, skin absorption, ingestion and injection
Types of health hazards: chemical, biological, physical and ergonomics
Review and Assessment

• Session 2: Review

How do we assess the risks of chemical/biological agents in the hospital?

What controls measures are necessary to prevent harm and/or exposure?

Definitions – chemical risk assessment, hazardous materials, exposure, health hazards, and risks

6 Steps – hazard identification; hazard evaluation & risk characterization; hazard control measures; OHHA; education and training; and follow up
Review and Assessment

• What Programs are Necessary to Manage Biological/chemical Risks?
• What is the OHHA Program?
• Components of a HazCom Program – written; chemical inventory; MSDSs; labels; storage; and training
References

• OSHA Hospital E-tool

• Trojan 3000 Class II Type B1 Biological Safety Cabinet Video
  http://www.youtube.com/watch?v=3EfcFfyJeHQ

• Prevention through Design: Addressing Occupational Risks

American Industrial Hygiene Association
www.aiha.org

ATSDR, Routes of Exposure
THANK YOU