CSP

CHEMICAL SECURITY ENGAGEMENT PROGRAM

Chemical Safety and Security Officer Training

UAE

September 2011

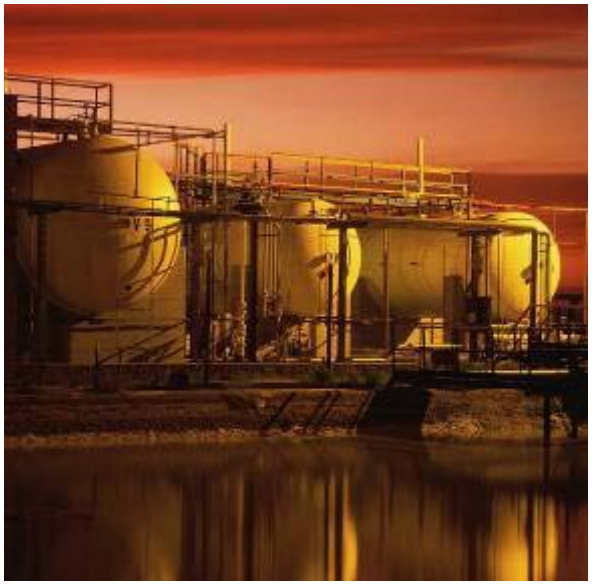
SAND No. 2009-8395P

Sandia National Laboratories

Chemical Safety and Security Overview

Why worry about chemical safety?

- **Chemicals used everyday in labs and factories can be hazardous.**



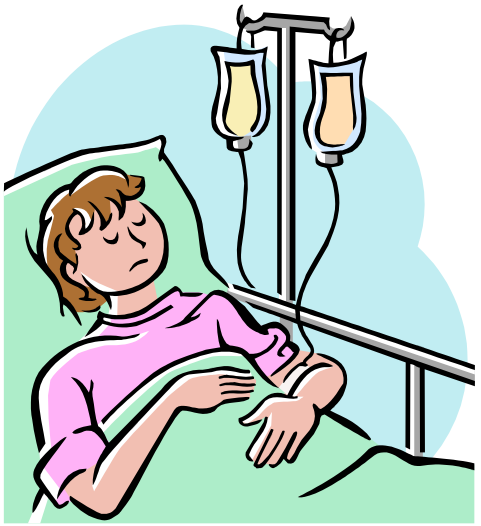
Studies indicate lab chemists *may* have:

- **Shorter life spans, more disease**

  Hoar, S. K. et al, *J. Occup. Med,.* 23, **485 (1981)**

- **Higher cancer incidence**

  Dement J.M. & Cromer J.R., *Appl. Ocup. Environ. Hyg*., 7,**120 (1992)**



Why worry about chemical safety?

- Health of the workers
- Safety of the workers
- Safety of the community
- Safety of the environment

…It's the right thing to do!

Possible chemical health problems

Chemicals

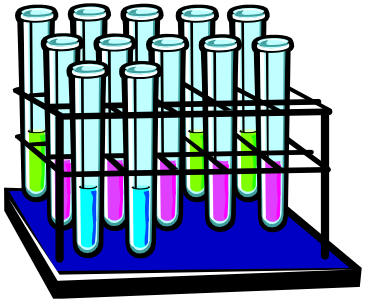
- Vinyl chloride
- Asbestos
- Carbon tetrachloride
- Mercury
- Lead
- Thalidomide
- Methanol
- CO, CS_2

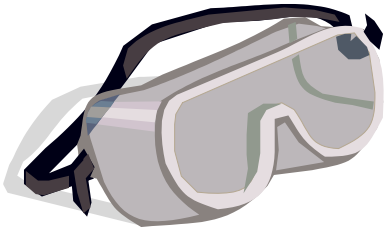
Diseases

- Liver cancer
- Mesothelioma
- Hepatotoxin (jaundice)
- Neurotoxin, CNS, narcosis
- Reprotoxin, birth defects
- Reprotoxin, developmental defects
- Blindness, death
- Hematopoietic, hemoglobin, cynanosis

But disease depends on many factors…

- Genetics
- Specific chemical
- Protection controls used
- Dose
- Concentration
- Duration
- Life style
- Environment





University lab chemical accidents

Incident – Chemical

- **Fire and one death –** t-butyl lithium + pentane
- **Dartmouth, wrong gloves –** methyl mercury
- **Wroclaw Poland, explosion –** dry perchlorates
- **Australia, skin absorption –** hydrofluoric acid
- **Okazaki Japan, explosion –** peroxide by-products in synthesis
- **OSU, US cylinder explosion –** liquid nitrogen cylinder
- **Material science engineering lab explosion –** nitric acid + ethanol explosion

Bhopal: Pesticide plant chemical release

- **One of the greatest chemical disasters in history, December 1984**
- **Union Carbide plant making Sevin released ~40 tonnes of methyl isocyanate in the middle of the night**
- **Low local demand for pesticides meant the plant was only partially running**
- **Some hardware was broken or turned off, including safety equipment**
  - Safety measures and equipment far below US standards
- **Plant in heavily populated area**

* "The Bhopal disaster and its aftermath: a review", Edward Broughton, *Environmental Health: A Global Access Science Source* 2005, **4**:6, http://www.ehjournal.net/content/4/1/6, accessed 12/07

Safety Video: Reactive Hazards

Chemical Laboratory Safety

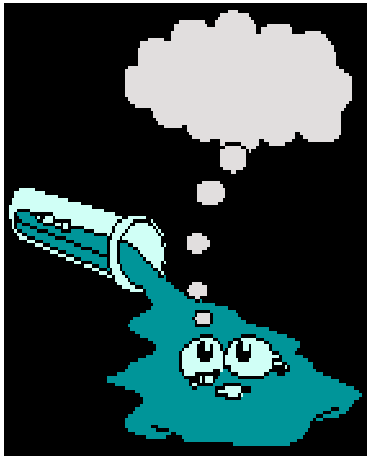
– ***The control of exposure to potentially hazardous substances to attain an acceptably low risk of exposure***

Chemical Laboratory Safety

Hazard – *the potential to harm*

Risk – *the probability that harm will result*

Chemical Laboratory Hazards



- **Chemical hazards**
  - dusts, fumes, mists, vapors, gases
- **Physical hazards**
  - fire, electrical, radiation, pressure vibration, temperatures, noise
- **Ergonomic hazards**
  - repetitive motion (pipetting), lifting, work areas (computers, instruments)
- **Biological hazards**
  - pathogens, blood or body fluids

Chemical Toxicity

Acute (short term, poisons, asthmagens)

cyanide

strychnine

Chronic (long term, carcinogens, reproductive)

vinyl chloride (liver cancer)

asbestos (mesothelioma, lung cancer)

thalidomide (developmental birth defects)

Chemical Toxicity

“Dose makes the poison. All substances have the potential to harm.”

– Paracelsus ~1500 AD

300 mg aspirin = safe*

3000 mg = toxic

***normal, healthy, adult**

Chemical Toxicity

Toxicity depends on:

- Concentration (dose)
- Frequency
- Duration
- Route of exposure

Routes of Exposure

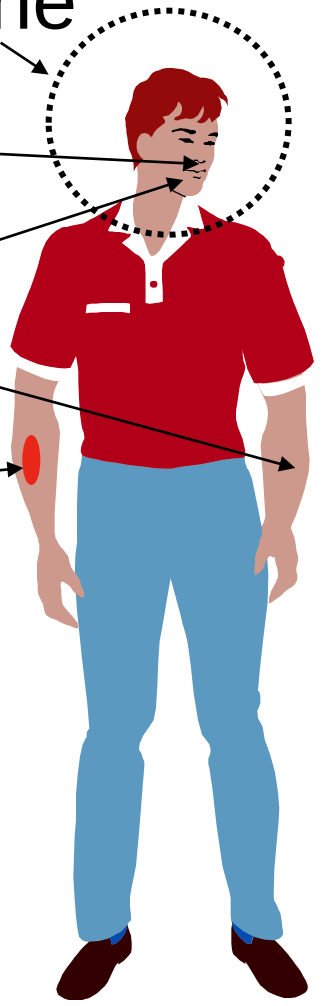
Breathing Zone

Inhalation*

Absorption

Ingestion

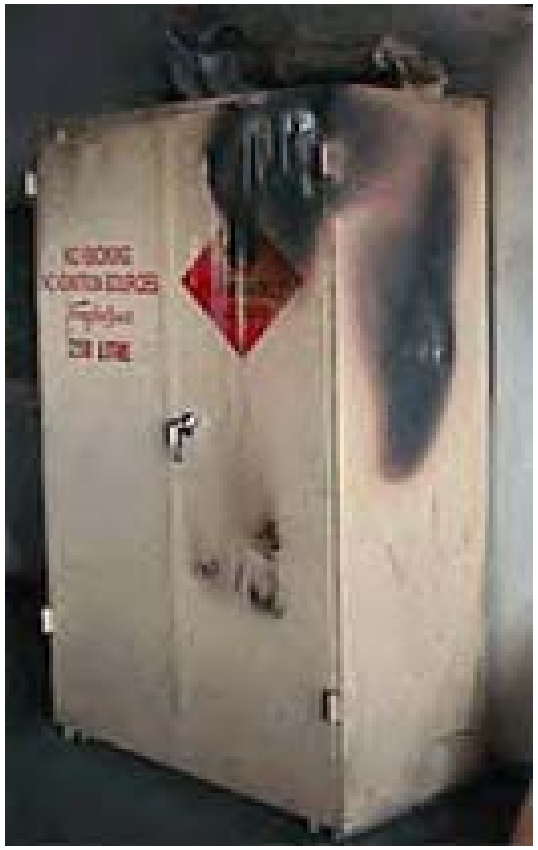
Injection

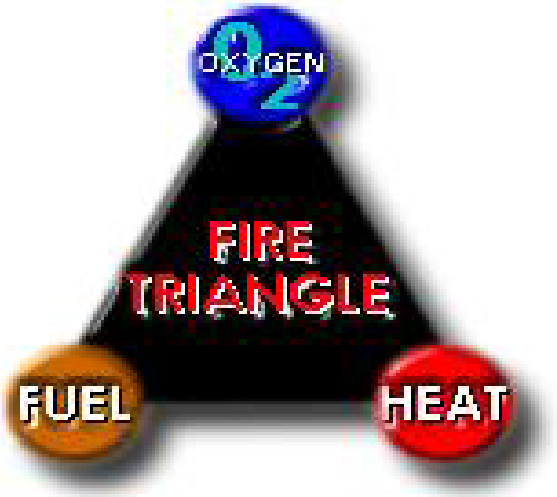


Eyes

*Most important route of entry

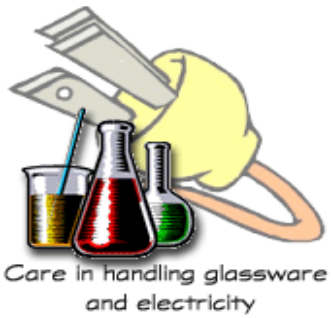
Fire and Explosion Hazards





Physical and Ergonomic Hazards

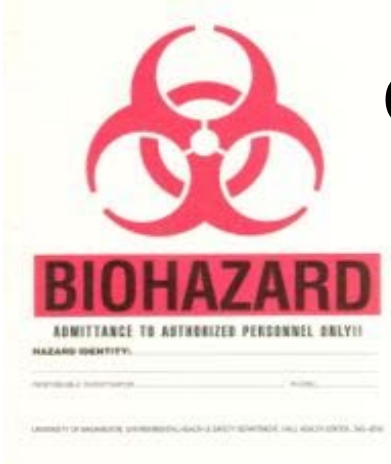
- Moving unguarded parts, pinches vacuum pump belts
- Broken glassware and sharps, cuts
- Pressure apparatus
- Vacuum containers
- Dewar flasks
- High voltage equipment
- Computer workstations
- Slips, trips & falls



Biohazards

- **Blood borne pathogens**

  AIDS, HIV, hepatitis, clinical chemistry labs



- **Recombinant DNA**

  Genetic engineering, cloning

- **Work with animals**

  Zoonoses,

  diseases from animals

Radiation Hazards

Ionizing Radiation:

alpha α, beta β, gamma γ,

X-rays, neutrons

Radioactive isotopes:

tritium, H-3, carbon, C-14, sulfur, S-35,phosphorus, P-32/33, iodine, I-135

Radiation Hazards

Non-Ionizing Radiation:

Ultraviolet (UV spectrometers)

Magnetic (NMR, MRI)

Lasers

(eye protection required)

Special Chemical Substances

Controlled Substances:

regulated drugs, psychotropic (hallucinogenic) substances, heroin

Highly Toxic Chemicals:

nerve gas, phosgene, riot control agents, chemical warfare agents

Chemical Laboratory Safety

based on the principle of

Industrial Hygiene

– *The **anticipation, recognition, evaluation** and **control** of health hazards in the work environment to protect workers health and well-being and to safeguard the community and the environment*

Chemical Laboratory Safety

Industrial Hygiene Principles

Anticipation

Recognition

Evaluation

Control

Chemical hazards

Physical hazards

Ergonomic hazards

Biological hazards

Anticipation

Risk Analysis

- Which chemicals?
- How much?
- Special equipment needed?
- Who does the work?
- Staff properly trained?
- Can the experiment go wrong?
- Do you have an emergency plan?

Recognition

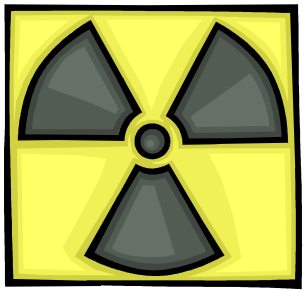
Types of lab hazards:

chemical toxicity

fire / explosion

physical hazards

biohazards



radiation

special substances

Recognition & Evaluation

What are the anticipated risks?

- Are the equipment & facilities adequate?
- Are staff properly and sufficiently trained?
- Risks if experiment goes wrong?
- Is there a plan for this?

Control

How are the risks controlled?

- **Engineering controls:**
  - enclosure / isolation
  - ventilation / hoods

- **Emergency Plan**
- **Personal Protective Equipment (PPE)**

Evaluation & Control

– **Administrative practices**

organizational policies

– **Operational practices**

work practices

– **Engineering controls**

ventilation, barriers

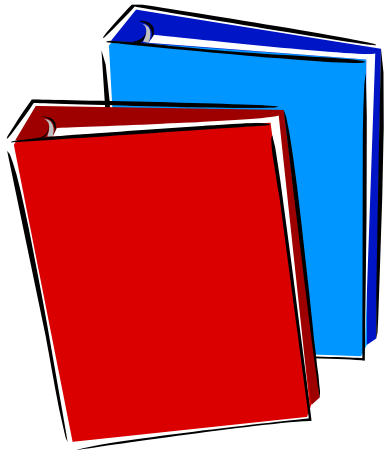
Prioritization of Controls

- **Engineering controls**
- **Administrative controls & Operational work practices**
- **Personal protective equipment**

Administrative Lab Safety Policies

❖ Have a Safety Manual

- Never work alone, especially after hours.
- Specify when eye protection & PPE is required.
- Specify operations that require hood use.
- Specify required training.
- No mouth pipetting.
- No long hair or dangling attire.



Lab Safety Policies

- No eating, drinking, smoking in laboratories
- Label all chemical containers
- Label refrigerators, No Food
- Label explosion safe refrigerators
- Require periodic fire drills

Lab Safety Policies

- **Schedule routine, periodic maintenance and inspection of hoods.**
- **Schedule routine, periodic maintenance of safety showers and eye wash stations.**
- **Post restricted areas with proper signs:**
  - radiation, biosafety, carcinogen, high voltage, lasers, authorized personnel only, etc.

Operational Practices

Safe Laboratory Procedures:

- Packages opened only in labs, not receiving
- Receiving staff trained to look for signs of breakage and/or leaking shipments
- Receiving area has spill kits
- Mailroom/receiving alert for suspicious shipments

Safe Laboratory Procedures

- **Schedule routine maintenance, calibration and inspection of all hoods and safety equipment.**

- **Schedule and participate in routine fire drills.**
- **Train personnel in emergency response.**

- **Wear PPE <u>properly</u>, don't just have it.**

Safe Laboratory Procedures

Use hoods properly:

- Work 6” (15 cm) in from sash
- In center of hood
- Work with hood sash at ~18” (45 cm) high
- Close sash when not in use
- Don’t use for storage

Safe Laboratory Procedures

Safely transport chemicals:

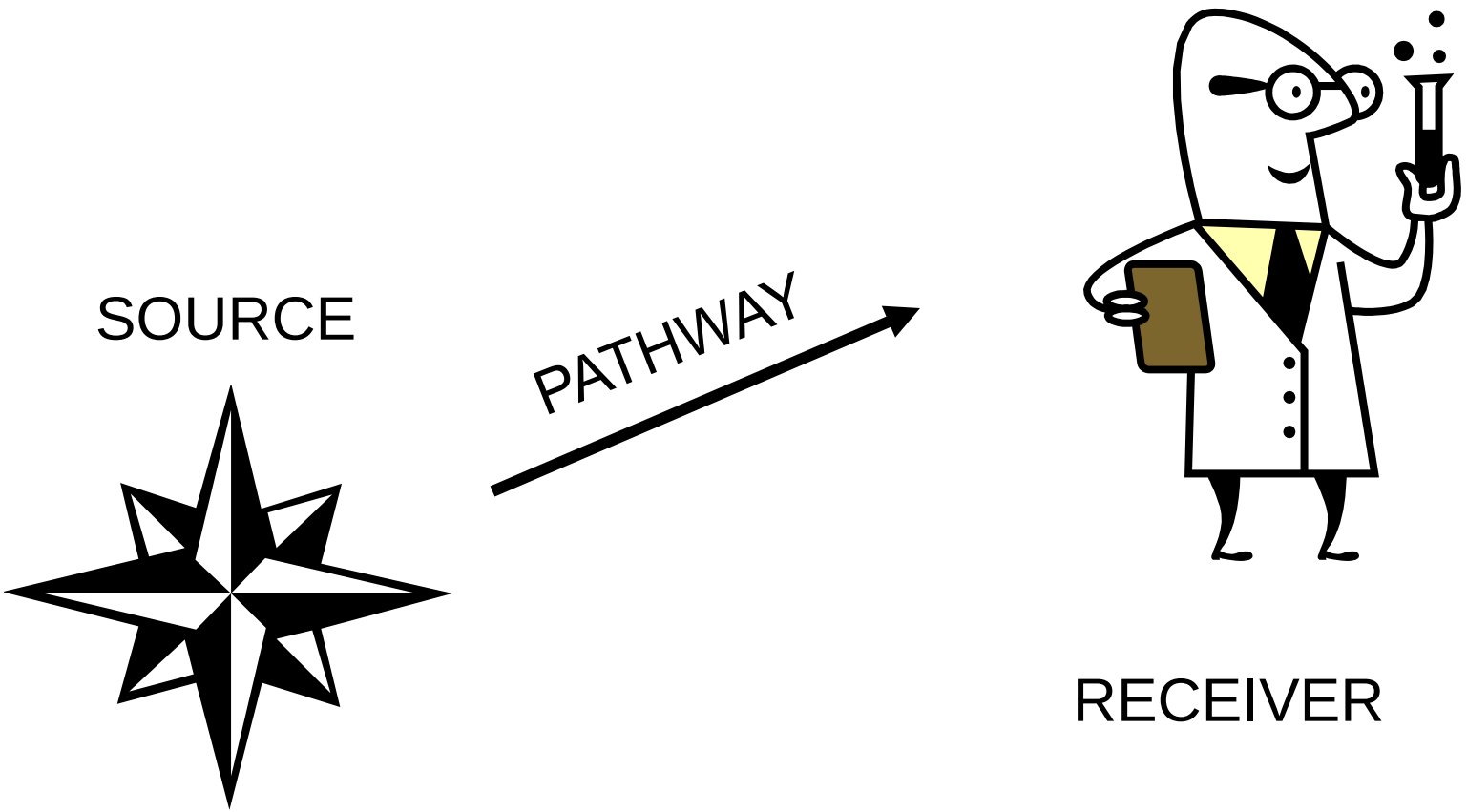
- Use container in a container concept
- Label all containers
- Inform driver of hazards
- Provide contact names, phone numbers
- Provide MSDS

Safe Laboratory Procedures

Housekeeping:

- label all containers
- clean-up spills
- eliminate trips hazards
- proper storage

Engineering Controls



Laboratory Containment Principles

Concept

Source → **Path** → **Receiver**

Control Used

Engineering Control → **Operational Practices** → **PPE**

Engineering Controls

1. Change the process

eliminate the hazard

2. Substitution

non-hazardous substance for hazardous

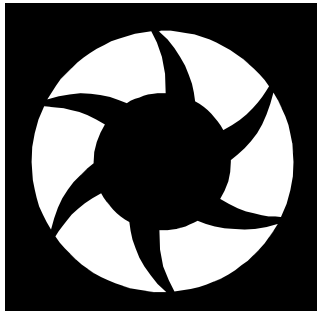
(e.g. - toluene for benzene)

Engineering Controls

3. Isolate or enclose the process or worker

Use a barrier

4. Ventilation



Dilution (general ventilation) - Not good

Local exhaust ventilation (LEV) - Preferred

Engineering Controls

Properly functioning & used correctly!

Laboratory hoods and ventilation are the basis of engineering controls.

Engineering Controls

- **Special barrier facilities**

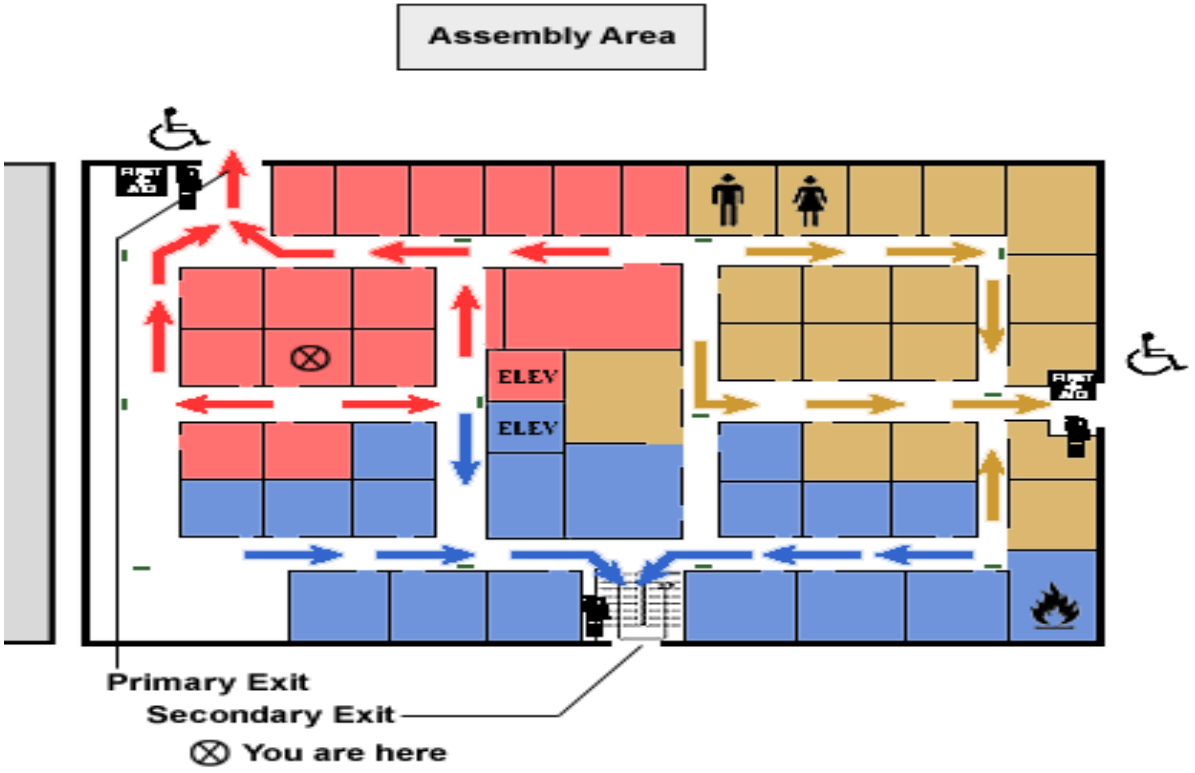
  clean rooms, carcinogen rooms, weighing rooms

- **Safety shields**

  radiation shields, hood sashes, splash guards

Emergency Planning & Response

Have an evacuation plan and POST IT!



Chemical Exposures to Eyes or Skin

Centrally locate equipment

- **Remove contaminated clothing**
- **Thoroughly flush with water**
- **Follow chemical specific procedures (i.e.. HF)**
- **Seek medical assistance**

Chemical Spills

Centrally locate spill kits for quick access

Clean-up spill only if you know the chemical hazards, have appropriate equipment and are trained to do so!

- **Alert colleagues and secure area**
- **Assess ability to clean-up spill**
- **Find spill kit**
- **Use appropriate PPE and sorbent material**
- **Protect sinks and floor drains**
- **Clean-up spill, collect/label waste for disposal**
- **Report all spills**

Emergency Planning & Response

Centrally locate, inspect and maintain:

- First aid kits
- Special chemical antidotes, if necessary
- Respirators
- Specially train emergency personnel, if necessary
- Post date of last inspection on equipment, including hoods.

Why worry about chemical security?

- Long history of people deliberately using chemicals to harm others.
- Information on how to acquire and deliver them is easy to get:

Aum Shinrikyo: Matsumoto and Tokyo, Japan

- **Sarin attack on Judges in Matsumoto, June 1994**
  - Sarin sprayed from truck at night
  - 7 deaths, 144 injuries

- **Sarin attack on Tokyo subway, March 1995**
  - 11 bags with 600 g each on 3 main subway lines
  - 12 deaths, 3938 injuries

- **Hydrogen cyanide attacks on Tokyo subway, May 1995**
  - Bags of NaCN and sulfuric acid
  - No deaths, 4 injuries

Photo of wanted poster from Wikipedia commons

Aum Shinrikyo: Tokyo, Japan

Aum Shinrikyo: Matsumoto and Tokyo, Japan, cont'd.

- Recruited young scientists from top Japanese universities.
- Produced sarin, tabun, soman, VX.
- Purchased tons of chemicals through cult-owned companies.
- Motives: proof of religious prophecy, kill opponents, interfere with legal proceedings and police investigations.

Safety and Security Issues are similar

Variables

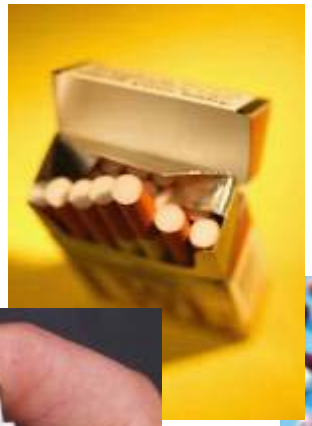
- **Many different chemicals with:**
  - different properties
  - different hazard
  - different applications
- **Many different ways to misuse chemicals**
  - chemical weapons
  - poisons

Protect

- **Workers**
- **Facility**
- **Community**
- **Environment**

Chemical dual-use awareness

Dual use chemicals: Chemicals used in industry or everyday life that can also be used in bad ways.



Dual-use chemical example: Pseudoephedrine

- Pseudoephedrine is a common ingredient in cold medicines
- Precursor to crystal methamphetamine
- Recipes for conversion available on web

- Clandestine meth labs in US during 2002
  - Caused 194 fires, 117 explosions, and 22 deaths
  - Cost $23.8 million for cleanup
  - Dumped chemicals led to
    - deaths of livestock
    - contaminated streams
    - large areas of dead trees and vegetation

US DEA, http://www.deadiversion.usdoj.gov/pubs/brochures/pseudo/pseudo_trifold.htm, viewed Dec 2007

Dual-use chemical example: Cyanide

Therence Koh/AFP/Getty Images

- Widely used in mining and metal plating industries, but is also a well known poison.
- Product tampering*
  - Tylenol capsules
    - laced with KCN
    - 7 deaths, fall 1982, Chicago, Illinois, USA
    - Led to tamper-proof product packaging
- Popular with criminals and terrorists because it is relatively easy to obtain
- HCN is CW agent AC

* "Tylenol Crisis of 1982." *Wikipedia, The Free Encyclopedia*. 22 Nov 2007, 06:04 UTC. Wikimedia Foundation, Inc. 28 Nov 2007 <http://en.wikipedia.org/w/index.php?title=Tylenol_Crisis_of_1982&oldid=173056508>.

Dual-use chemical example: Pesticides

- **Widely used in homes and agriculture, but also used to poison people.**

FIGURE. Package of Chinese rodenticide implicated in the poisoning of a female infant aged 15 months — New York City, 2002

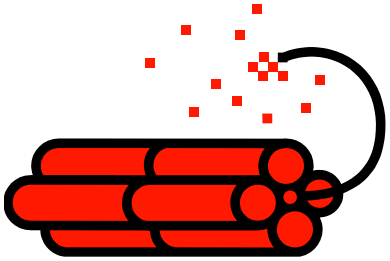
Photo/New York City Poison Control Center

- **Dushuqiang (Strong Rat Poison)**
  - **Outlawed in China in the mid-1980s, but was still available**
  - **Nanjing, China, Sept. 2002**
    - **38 people killed by poison in snack-shop food, >300 sick**
    - **Jealously by rival shop owner**
  - **Hunan, China, Sept. 2003**
    - **241 people poisoned by cakes served by school cafeteria**
    - **Motive and perpetrator unknown**
  - **Tongchuan City, Shaanxi, China, April 2004**
    - **74 people poisoned by scallion pancakes**
    - **Motive and perpetrator unknown**
  - **5 other incidents reported between 1991 and 2004**

Ann. Emerg. Med., Vol. 45, pg. 609, June 2005

Dual-use Chemicals: Explosives

- Theft of conventional explosives
  - Chemical suppliers
  - Users such as mines or construction sites
- Diversion of industrial or laboratory chemicals
  - Chemical suppliers
  - Chemical factories
  - Academic teaching or research laboratories
  - Disposal sites



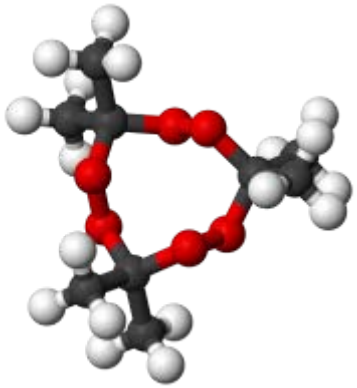
Theft / manufacture of explosives: Fertilizer Bomb

Photo: US DOD

- Ammonium nitrate fertilizer and fuel oil (diesel, kerosene)
- Used to bomb Alfred P. Murrah building in Oklahoma City, OK, USA
  - with nitromethane and commercial explosives
  - 168 dead, including children
  - April 1995
- Favored by IRA, FARC, ETA, etc.

Theft / manufacture of explosives: TATP

- Triacetone triperoxide (TATP)
- Invisible to detectors looking for N-based explosives
- Made using acetone, hydrogen peroxide, strong acid (HCl, sulfuric)
- Favored by terrorists “Mother of Satan”
  - Sept 2009 arrest of N. Zazi, NY and Denver
  - July 2005 London suicide bombs
  - 2001 Richard Reid “shoe bomber”
  - 1997 New York subway suicide bomb plot



CAS 17088-37-8

Wikipedia downloaded Oct 2009
http://en.wikipedia.org/wiki/Acetone_peroxide

Diversion of industrial / laboratory chemicals: Sodium azide

- Widely available from older automobile airbags
  - 1980s to 1990s
- Poisonous
- Reacts explosively with metals
  - Biological laboratory drains have exploded from discarded waste solutions containing NaN_3 as a preservative.
- Has been found in possession of terrorists

Diversion of industrial / laboratory chemicals: Bali bombing

- Amrozi purchased chemicals used to make bombs
- One ton of potassium chlorate* purchased in three transactions from the Toko Tidar Kimia fertilizer and industrial chemicals store in Jalan Tidar, Surabaya, owned by Sylvester Tendean.
  - Claimed he was a chemical salesman.
  - Obtained a false receipt saying he purchased sodium benzoate.
  - Tendean lacked proper permit to sell this chemical, didn't know the chemical would be used to make a bomb.
- Details of Aluminum powder purchases not known

* Some press reports state potassium choride, but this is clearly an error

http://www.smh.com.au/articles/2003/06/09/1055010930128.html

http://www.thejakartapost.com/news/2002/12/18/amrozi-owns-possessing-chemicals.html

Chemical Security Questions

- Is your facility secure?
- How easy would it be for someone to steal chemicals?
- Are the chemistry workrooms, stockrooms, classrooms and labs always locked and secure?
- Is someone always there when these rooms are open?
- Do you check your orders when chemicals arrive to be sure some chemicals are not missing?

Components of Chemical Security

- Physical security of site
- Personnel management
- Information security
- Management of chemical security activities
- Allocation of chemical security responsibilities
- Development of emergency plans
- Chemical security training

Goal: Ensure that you don't accidently help a criminal or a terrorist get dangerous chemicals

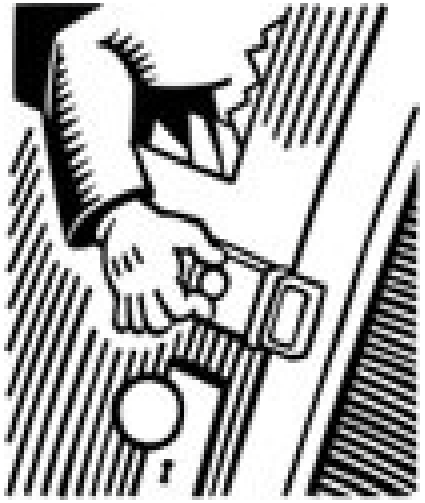
Chemical Security: Physical Site

LOCK UP!!

Controlled drugs

Chemical Surety Agents

Highly toxic chemicals



Chemical Security:
Personnel Management

- **Guard against both *Insider and Outsider* threat**
- **Who checks people entering the building?**
- **Who has keys? How do they get authorized?**
  - Building
  - Stockroom
  - Individual Labs

- **When someone leaves, do you make sure they turn in keys?**
  - Don't want people making duplicate keys

Chemical Security: information security

- How do you track chemical inventory?
  - Is the information secured so unauthorized people can't read it or alter it?

- Would you know if:
  - some toxic chemicals disappeared overnight?
  - some toxic chemicals didn't arrive?
  - someone was ordered chemicals in the name of your institution but diverted them?

Relationships Between Chemical Safety and Security

- **Chemical safety:** Protect against accidents

- **Chemical security:** Protect against deliberate harm

Many practices are the same for chemical safety and security, but there are a few areas of conflict.

Good Practices for Both Chemical Safety and Security

- **Minimize use of hazardous chemicals.**
  - Replace with less-hazardous chemicals, if possible.
  - Reduce scale of experiments.

- **Minimize supply of hazardous chemicals.**

- **Restrict access to hazardous chemicals.**
  - Know what you have.
  - Know how to store, handle and dispose of what you have.
  - Know who has access to materials, knowledge and expertise.

- **Plan what to do in an emergency.**

Conflicts Between Chemical Safety and Security: Information Sharing

Science generally means sharing information widely, but this may not always be advisable.

- **Safety**
  - Label everything so people can recognize hazardous chemicals.
  - Let community and especially emergency responders know what chemical dangers are there.
  - Share knowledge about chemical hazards so people know to be alert.
- **Security**
  - Labels help identify targets for theft or attack.
  - Sharing locations of chemicals can publicize targets for theft or attack.
  - Sharing knowledge of chemical hazards could inspire harmful behavior (copy-cat criminals).

Conflicts Between Chemical Safety and Security: Facility Exits

- **Locking exit doors is secure, but not safe.**
  - **For safety, people need to be able to leave the facility quickly and by many routes.**
  - **For security, you want to control exits as well as entrances so chemicals (or equipment) are not taken.**

International chemical control groups

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Chemical weapons convention

The Australia Group

Export controls

UN Security Council Resolution 1540

Chemical Weapons Convention (CWC)

- International treaty which bans the development, production, stockpiling, transfer and use of chemical weapons
  - Entered into force in April 1997 with 87 State Parties participating
  - Today: 183 nations have joined, 5 others have signed, only 7 have not taken any action.
    - Each nation enacts appropriate laws
    - Each nation agrees to assist other Member States

Tea Break

Chemical Safety and Security Plan

Chemical Safety and Security Program Purpose

- Help establish a safe and secure workplace.
- Help safeguard the environment.
- Prevent/reduce release of hazardous chemicals and operations.
- Prevent/reduce exposure to staff.
- Reduce stress.
- Enhance community relations.
- Comply with regulations.
- Crisis management

First step: Collect information

- **Writing a good CSS plan requires a lot of information**
- **Assessment questionnaires can be used to collect such information**
- **Distribute to:**
  - **PIs**
  - **Management**
  - **Facilities**
  - **Security**
  - **Medical**

Assessment Questionnaire

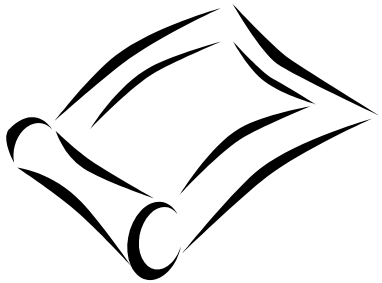
- **Who is responsible for CSS compliance?**
  - Criteria for exposure control
  - Developing exposure control measures
  - Exposure monitoring
  - Identification of hazardous materials
  - Limited access policy
  - Ventilation maintenance
  - Safety equipment
  - Personal protective equipment
  - Training
  - Hazardous waste management
  - Medical surveillance
  - Emergency response

Assessment Questionnaire, cont'd.

- List individuals (managers, PIs, professionals, technicians) with Safety & Security responsibilities; indicate SO, CSSO, BSO, RSO, etc.
- Who maintains CSS records?
- Is there a Safety/Security Committee?
  - Responsibilities
  - Who are the members?
  - How often do they meet?
- Is there a CSS Manual, Plan?
- Are there CSS policies?
- Is there an Emergency Response Plan?
- Are routine CSS inspections conducted?
  - By whom
  - Details

Chemical Safety and Security Plan

- Includes CSS Policy Statements from senior management.
- Describes the entire Program.
- Describes the organization of the Program.
- Explains everyone's responsibilities.
- Describes in general terms policy and who, what, where and why a safety or security task or job is performed.
- Includes references, if necessary.



Parts of a Chemical Safety and Security Plan

- Policy statement from Senior Management
- Safety & Security Organization
  - Management
  - Responsibilities
    - Management
    - Administration
    - CSSO staff
    - Facilities Management
    - Principal Investigators
    - Staff
    - Contractors
- General housekeeping
- Eating, smoking areas
- Signs & labels
- Emergency procedures
- Chemical storage
- Personal protective equipment
- Respirator protective program

Parts of a Chemical Safety and Security Plan, cont'd.

- Engineering Controls
  - Ventilation
  - Laboratory hoods
- Waste Management
- Training
- Record keeping
- Fire Prevention & Protection
- Location of emergency equipment
- Evacuation plans
- Personal and environmental monitoring
- Inspections
- Medical surveillance
- Administration
  - Purchasing chemicals
  - Purchasing safety equipment

Standard Operating Procedures (SOP)

- **An SOP explains *concisely and precisely* how, where and who performs a task.**
- **It does *not* explain why the task is done.**
- **The Safety and Security Plan explains policy and why a task is performed**

Standard Operating Procedures (SOP), cont'd.

- **SOPs are:**
  - **Dated**
    - **When issued**
    - **When reviewed**
    - **When revised**
  - **Have: subject, title and identification code**
  - **Officially reviewed by management**
  - **Signed by all responsible parties**
  - **May include forms**
  - **Written in a consistent and official format with numbered pages**

Standard Operating Procedures (SOP)

Consider written SOPs on:

- Security clearance and visitor access
- Employee training
- Medical surveillance
- Respiratory protection and fit
- Eye protection
- Ventilation system maintenance
- Storage, receipt, transport and shipping of hazardous materials
- Accident and emergency response including natural disasters
- Spill cleanup
- Waste management
- Hazardous material handling
- Special operations, radiation, biosafety, lasers, infectious agents

Plan and SOP Revision Guidelines

- **Health and Safety Plan** → **As needed, every 5 years**
- **(M)SDS** → **As received**
- **Laboratory Hoods** → **Quarterly**
- **Training records** → **Yearly, and as needed**
- **Medical Surveillance records** → **As needed, and every 12-18 months**
- **Exposure monitoring**
- **Waste records**

As needed

Record Retention Recommendations

- **Personal records kept by Human Resources for the duration employment + 30 years.**
- **Medical records are *confidential* and should be kept by the examining physician for duration of employment + 30 years.**
- **Most other records (e.g., routine monitoring, should be kept for 5 years after date of performance).**

Chemical Safety and Security Officer Duties

Surveys
Job Hazard Analysis
Inspections
Training
Medical Monitoring
Investigations

CSSO Duties

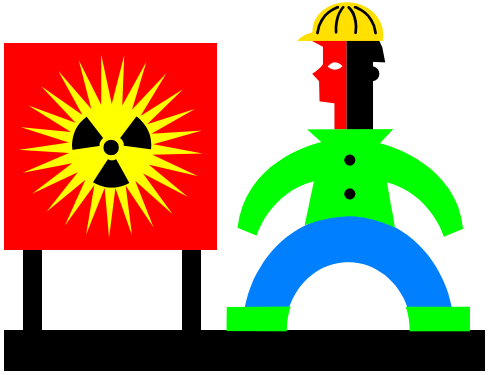
- Oversee procurement, use, storage & disposal of hazardous materials
- Set criteria for exposure levels
- Write and revise CSS Plan
- Trains, documents and ensures training is performed
- Performs risk assessment and monitoring
- Conducts audits and inspections
- Investigates and reports on accidents, incidents
- Interacts with staff to correct deficiencies
- ***Follows up*** to ensure correction and resolution of issues

CSSO
Duties

- Consult/advise project management on CSS concerns
- Coordinate with Principal Investigators
- Coordinate and facilitate medical surveillance
- Coordinate record keeping
- Coordinate with BSO, RSO, facilities, administration, security

Hazard Survey

- **Baseline**
- **Periodic (inspections)**
- **Identify potential job hazards, material hazards, and process hazards**

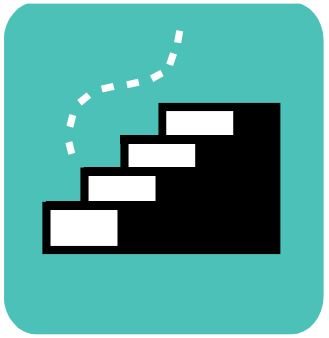


Hazard Survey Process

- **Prepare survey form**
- **Walk-through**
- **Take measurements**
  - Sample if necessary, monitor exposure (e.g., formaldehyde, radiation)
- **Data analysis**
- **Write and deliver report**

Job Hazard Analysis (JHA)

Hazards associated with a particular task become apparent from a brief survey:



- **Compile steps needed to complete job.**
- **Analyze each step in detail.**
  - **Could exposure occur?**
  - **Could an accident occur?**
  - **Could a change in practice / process could create hazard?**
- **Develop recommendations on precautions to eliminate/minimize hazard.**

Periodic Lab Inspections

- Done by CSSO
- Coordinate with lab supervisor/Chief/PI/occupants/safety representative
- Team may include:
  - Peers
  - Facilities representative
- Frequency determined by hazards present and local practices
  - 2 - 4 times/yr
- Look for:
  - Good and bad practices
  - new hazards
  - new security issues

Training Program

- Determine if training is needed, e.g., JHA
- Identify needs
- Identify Goals & Objectives
- Develop training activities
- Identify resources
- Conduct training
- Evaluate effectiveness
- Improve program

Employee Training Topics

- New employee orientation
- Specialized laboratory equipment and procedures
- Recognize Occupational Exposure Limits (OEL) for hazardous chemicals; (M)SDS
- PPE use, storage and maintenance (especially respirators)
- Fire safety and fire extinguisher use
- Emergency plans, evacuation procedures & routes
- Ionizing radiation
- Non-ionizing radiation, lasers, microwaves
- Special exposure, e.g., formaldehyde
- Biosafety, Bloodborne pathogens
- Facility security requirements
- Animal Care facilities - use and techniques

Training Documentation: Sample

- **Employee name: _____**
- **Department: _____**
- **Date: _____**

- **Training Subject: _____**
- **Training Date: _____**
- **Re-instruction date: _____**

- **Employee Signature: _____**
- **Date Signed: _____**
- **Supervisor's signature: _____**
- **Date: _____**

Medical Surveillance Program

- Baseline screening
  - Medical history
  - Past illnesses, exposures and diseases
  - Comprehensive physical exam
  - Assessment of limitations
    - Respirator use and other PPE
- Treatment
  - Emergency
  - Non-emergency (e.g., first aid)
- Periodic Medical exam
- Termination exam
- *Confidential* record keeping
  - Physician, employee

Biological Monitoring Program

- **Identify employees with potential exposure to specific hazardous chemicals, biological agents, working conditions.**
  - **Specific signs and symptoms of chemical exposure.**
  - **Use of respirators.**
    - **Cardiovascular, hearing (perforated tympanic membrane), neurological (e.g., epilepsy), psychological disorders**
  - **Working in noisy areas.**
  - **Working in Biosafety risk areas.**
    - **Bloodborne pathogens**
      - **e.g., Human blood and body fluids, hepatitis B (HBV), HIV, AIDS**
    - **Infectious agents**
      - **e.g., Zoonosis, animal care, recombinant DNA**
- **Determine extent of personal and environmental exposure.**
- **Take actions to eliminate/minimize exposure.**
- ***Confidential* record keeping .**

Medical Surveillance *vs.* Biological Monitoring

Medical Surveillance

- General program
- Establishes baseline
- Evaluates employees before potential exposure
- Documents past exposure and existing conditions
- Simpler, cheaper, less invasive medical testing
- May be used in conjunction with biological monitoring

Biological Monitoring

- Chemical specific signs and symptoms
- Known exposure levels
- Documented exposure
- Documented amounts of personal exposure
- Documented environmental exposure
- Most specific, most expensive, more invasive

Guidelines for Incident Investigation

- **Description/report of incident**
- **Review of organizational policy**
- **Start of investigation**
- **Cause of incident**
  - Emphasis is prevention, ***NOT*** blame
  - Timely report with recommendations to all responsible parties including senior management
- **Timely response to recommendations**
  - Correction
  - Follow-up
  - Action taken
  - Training

Incident Investigation Form: Sample

- **Date of accident/incident_____**
- **Time reported_____**
- **Location_____**
- **Type of incident: fire, explosion, spill, employee exposure, theft, intruder, near-miss _____**
- **Date of investigation_____**
- **Investigation team members_____**

Nature of Incident

- **Incident description, include people, task, chemicals, etc. involved**
- **Nature of injuries, exposures, illnesses, damages, losses**
- **Determination of potential causes**
- **PPE worn at the time**
- **Hazard control or access control measures in use**

Incident Investigation Form, cont'd.

- **Organizational polices, procedures, etc. that apply**
- **Was training proper and up-to-date?**
- **How could incident been prevented?**
- **Has similar incident occurred in past, when, where, circumstances?**

Team recommendations to prevent reoccurrence of such incidents:

LUNCH