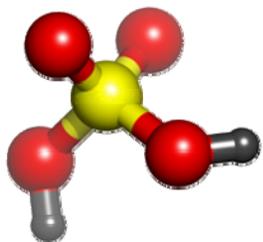


# Chemical Safety and Security An Overview

SAND No. 2012-1606C

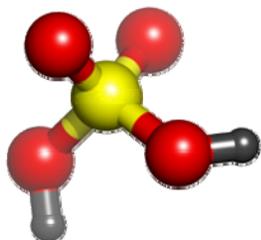
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States  
Department of Energy's National Nuclear Security Administration  
under contract DE-AC04-94AL85000.





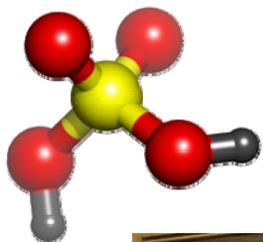
## Summary of Presentation

- ▶ Chemical safety incidents
- ▶ Safety regulations and standards
- ▶ Chemical security incidents and threats
- ▶ Cyber security threats
- ▶ International security resolutions and organizations
- ▶ Relationship between chemical security and chemical safety



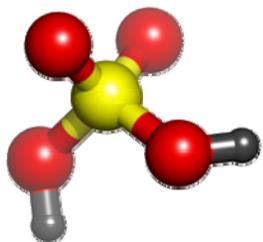
# Chemical Safety Incidents

- ▶ Recent accidents in U.S. research laboratories
  - University of California Los Angeles
    - Scale up of flammable chemical (t-butyl lithium)
    - Quantities of flammables stored in lab exceeded U.S. regulations
    - Improper personal protective equipment
  - Texas Tech University
    - Scale up of nickel hydrazine perchlorate from 300 milligrams to 10 grams
    - U.S. Chemical Safety Board (CSB) investigated
      - Physical hazards of chemicals not assessed or controlled
      - Insufficient chemical safety management
      - Lessons from previous incidents not *learned*



# Texas Tech University Accident





# Industrial Safety Incidents

## Catastrophic process incidents:

- ▶ 1976 Seveso Italy
- ▶ 1984 Bhopal India
- ▶ 2005 Texas City Texas

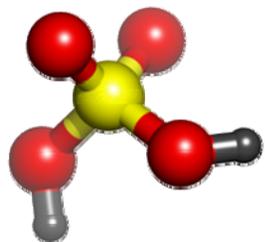
## More recently:

- ▶ 2009-Fertilizer tank collapses
  - 2 critically injured
  - Responders exposed to ammonia
  - ~760,000 liters of fertilizer released
  - River contaminated
- ▶ 2007-Fire and Explosion
  - Filling ethyl acetate storage tank
  - Equipment not bonded and grounded



Photo credit. U.S. Chemical Safety Board.

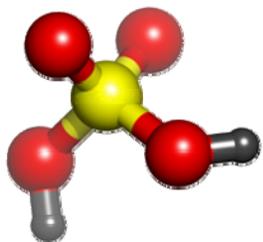
<http://www.csb.gov/>



# U. S Chemical Safety Board Video



CSB Video - Reactive Hazards 20 minutes  
Reactives\_clipped.mpg



# Regulations and Standards

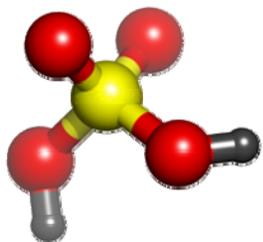
- ▶ Individual country regulations
  - European Union REACH
  - U.S. Occupational Safety and Health Administration
    - Process Safety Standard
  - U.S. Environmental Protection Agency
    - Risk Management Program
- ▶ International chemical & labor organizations
  - International Council of Chemical Associations
    - Responsible Care Program
  - International Labor Organization
- ▶ International standards
  - ISO 14001:2004
  - OHSAS 18001
  - United Nations–Globally Harmonized System
  - Strategic Approach to International Chemical Management



**International  
Labour  
Organization**



**International  
Organization for  
Standardization**

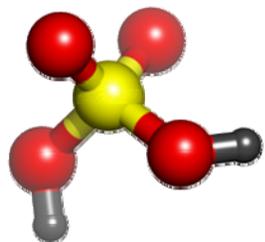


# Center for Chemical Process Safety

- ▶ Anyone can subscribe
- ▶ Delivers monthly process safety messages to plant operators and other manufacturing personnel.
- ▶ Presents a real-life accidents, lessons learned, and practical means to prevent accidents at your plant.
- ▶ Published in 29 languages,
  - <http://www.aiche.org/CCPS/Publications/Beacon/index.aspx>



Photo credit: Center for Chemical Process Safety

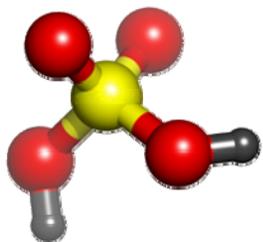


# What about chemical security?

- ▶ Chemical theft
  - Precursors for drugs
  - Precursors for chemical weapons
  - Dual-use chemicals
    - Flammable or toxic gases
    - Fertilizers/pesticides
    - Chlorine gas
    - Reactive materials
- ▶ Plant sabotage
  - Deaths, injuries
  - Economic and environmental impacts



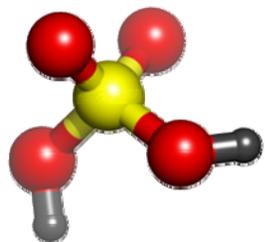
Abandoned Bhopal Plant  
Photo credit: AP/Saurabh Das



# What are the threats to chemical security?

- ▶ Unlimited access to facilities
  - Chemical storage areas
  - Analytical laboratories
  - Waste storage
  - Construction sites
- ▶ No controls or security checks on chemical procurement
- ▶ Shipping and receiving areas not protected
- ▶ Recruit young chemists
  - Tokyo subway Sarin attack

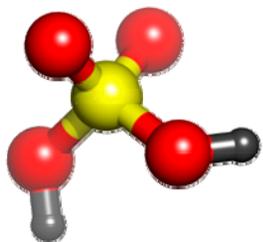




# Threats to Cyber Security

- SCADA control software is used by one-third of industrial plants
- Security technology may not work on plant proprietary networks
- Attacks may result in:
  - Loss of process control
  - Loss of production
  - Process safety incidents
- Examples:
  - 2005-Zlob worm shuts down 13 Daimler Chrysler plants
  - Queensland, Australia sewage control system



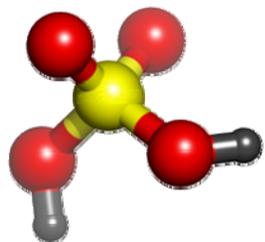


## International Resolutions & Organizations

- UN Security Council Resolution 1540
- Australia Group
- Organization for the Prohibition of Chemical Weapons
- American Chemistry Council

*Responsible Care Security Code*



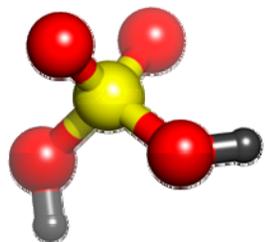


# How are chemical safety and chemical security related?

## Both Ensure Protection of:

- ▶ Workers
- ▶ Plant facilities
- ▶ Plant processes
- ▶ Community
- ▶ Environment
- ▶ Business assets





## Reflect and Consider

**What chemical safety and security practices are required at your facility or university?**

**...Are they effective?**

**...Could they be improved?**

**...How?**