Laboratory Risk Assessment - or – Who Needs a Hood?

Ralph Stuart, Univ of Vermont
Robin Izzo, Princeton University

The Challenge of Deciding "Who Needs a Hood?"

- Ever-evolving chemical selection and processes
- Lab walls are getting thinner, both figuratively and literally
- Increased use of clean rooms – positive vs. negative
- Turnover – 20% per year in academia
- The educational culture honors risk
- The pressure of energy costs

Going Back to Basics: Applying Industrial Hygiene to Laboratory Situations

- Identify
- Evaluate
- Control

Identification and Evaluation: Chemical Risk Assessment

- Flammability – flashpoint and LEL
  - Concentrations of concern tend to be a few percent by volume
- Corrosivity – use vapor pressure and pH to assess potential reaction products
  - Remember that particles (splatter) with kinetic energy are much harder to control than vapors
- Reactivity – assessment requires a specific literature review both the chemicals and the processes involved
- Toxicity – how to select exposure limits with so many unknowns
  - Concentrations of concern range from 1000 ppm to 0.5 ppm to ALARA
- An emerging challenge: particle size issues associated with nanoparticles and nanomaterials

Protection Strategies

- Change the chemical
- Engineering controls
- Administrative Controls
  - 20% turnover/year in academic labs
- Personal Protective Equipment
  - Of value only in emergencies

Selecting among Ventilation Engineering Controls

- General dilution ventilation
- Chemical hoods
- Ventilated storage cabinets
- Biosafety Cabinets
- Glove Box (positive or negative pressure)
- Downdraft table
- Elephant trunk
- Slot hood
- Clean bench
- Recirculating Lab Hood

An alternative approach: Control Banding

- Determine standard control strategies and apply them based on expected hazards of the chemical in the specific process
- http://www.coshh-essentials.org.uk/ links generic process description and chemical identification to risk and safety phrases and provides control recommendations
- Move from “Ready, Aim, Fire” to “Ready, Fire, Aim”

Chemical Safety Levels and Lab Design

- Original CDC paper was designed to move BSL understanding to chemical laboratory issues
- Beta proposal
  - CSL-1: no ventilation
    (e.g. cold rooms and warm rooms)
  - CSL-2: general ventilation
    (X air changes/hour)
  - CSL-3: local ventilation
    (equipment-specific or generic i.e. hoods)
  - CSL-4: isolation systems
    (e.g. glove boxeswith specific control procedures)

But we can’t forget the other pieces of the puzzle associated with CSL’s:

- Administrative controls
  - Training
  - Oversight
    - Housekeeping
    - Chemical management (storage and labeling)
    - Emergency preparedness
  - Special concerns
    - Working alone
    - Unattended operations

Some Technical Questions for the small groups to consider

- Are generic risk assessments possible?
- Who can do it?
- Who will do it?
- Can CSL be used to specify training, oversight and PPE as well as lab design parameters?
- What situations won't this apply to? (e.g. odoriferous chemicals)

To wrap up,
some strategic questions for
the whole group to respond to

Are you comfortable that laboratory ventilation practices at your institution provide an appropriate level of protection to lab workers?

1. Always
2. Yes, in most lab buildings
3. Yes, on most days, except for unusual events
4. No, at night, I wonder what the next episode will involve

Has your institution's administration begun to assess the value received for the costs associated with laboratory ventilation?

1. Yes, primarily in terms of money
2. Yes, for environmental reasons
3. Yes, for both 1 and 2
4. No, operating high cost lab buildings is considered a cost of being a research institution

Based on your observations of lab practices, do a majority of lab workers conduct chemical risk assessments before conducting their work?

1. Our observations suggest the majority don’t
2. They probably do them informally but don’t document them
3. They use EHS supplied forms to conduct generic assessments for their work
4. Our observations suggest that most lab people follow best practice by doing them “before starting a new process, when a process changes, or annually”

Could your EHS office develop and use a lab classification system for risk management purposes?

1. We have one in place
2. We talk about it, but haven't been able to make it happen
3. We're open to the idea, but can't move forward with our current resources
4. The concept is interesting, but the practical reality is too complicated

In your opinion, would improved risk assessment lead to better selection of protection strategies?

1. I suspect that people will continue to rely on the traditional combination of lab ventilation and personal protective equipment as the generic lab protection strategy
2. I believe that the financial costs associated with operating laboratory facilities will require an awareness of this challenge to develop in laboratory management
3. Turnover and diversity in the laboratory population is too high to speak in general terms in this respect
4. I expect that laboratories will continue to be designed for the worst case scenario in order to maintain maximum adaptability