Lab Safety Update Training

Fall 2007

Agenda

- Homeland Security's proposed rule
- Waste inspections
- Mercury Cleanups
- Broken glass disposal
- Housekeeping (food, attire, eyewashes)
- Fume hoods
- Vacuum pumps venting
- Liquid nitrogen traps

U.S. Dpt. of Homeland Security

- Chemical Facility Anti-Terrorism Standards (CFATS)
- fast tracked per October 2006
 Congressional directive to establish standards for security of chemical facilities

Terror war at the henhouse door? Farmers scratching their heads



Homeland Security rules would apply to any facilities that store a lot of chemicals.

By Jon Tevlin, Star Tribune Last update: September 09, 2007 – 11:58 PM

In the mid-1980s, Minnesota's Gold'n Plump Chickens gained national attention for television advertisements featuring combat-ready, helmeted birds driving tanks or parachuting from airplanes.

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Background Information

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Details in:

- Chemical and **Engineering News** (June 4, 2007, Volume 85, Number 23, pp. 29-31).
- on the web at http://pubs.acs.org/isub scribe/journals/cen/85/i 23/html/8523gov1.html

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Current Issue

JUNE 4, 2007 VOLUME 85, NUMBER 23 PP. 29-31

HEMICAL & ENGINEERING NEWS

Chemical Security Gone Awry?

Academics say their labs should not be regulated under a new DHS rule

Chemjobs

Lois Ember

Take a look at the photograph on this page. Then imagine having to inventory thousands of these small containers of chemicals in hundreds of laboratories in hundreds of buildings scattered across a vast campus. That's the specter facing institutions of higher learning if a proposed Department of Homeland Security rule on chemical security is not revised

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DHS's rule-making process on regulating security at chemical facilities has been a bit like sausage making: messy and with ingredients you really don't want identified. In all fairness, Congress took nearly five years after Sept. 11, 2001, to enact legislation authorizing DHS to issue the chemical security regulation but then gave the department a mere 180 days to do so.

Over those many years, industry and academic officials understood the intent of any eventual rule to be securing large chemical industry facilities against catastrophic terrorism. They based this perception on comments from legislators crafting the bill and from DHS officials charged with carrying out legislative mandates

DHS issued a risk-based interim final regulation-interim because it expires in three years, on April 2---but without the list of chemicals and their amounts to be regulated (C&EN, April 9, page 13). These specifications would have signaled which facilities would have to comply with the rule's requirements. Lawrence M. Gibbs, Stanford University's associate provost for environmental health and safety, says DHS's "disjointed rule-making process" has turned out to have startling and. perhaps, unintended consequences for the academic community.

To understand why academia was taken by surprise means backtracking a bit. Before promulgating the final rule, DHS, as required by law, issued an advanced notice of proposed rule-making (ANPR) on Dec. 28, 2006. The preamble and language of the proposed rule as well as the department's estimate of the number of facilities affected-about 40,000-led universities and colleges to assume that DHS did not intend for the rule's requirements to apply to them, and so they didn't comment on the ANPR.

That turned out to be a mistaken assumption, which academics only realized when laboratory at Weill Cornell Medical College DHS released a proposed list of "chemicals of interest" on April 9, a week after the final rule was issued. The list mublished for mublishe



Weill Cornell Medical College COUNT OFF Typical chemical storage at a research

What has to be done to comply?

First

- Determine if the facility may be covered
- Register the facility on the DHS website
- Complete a "Top-Screen" self-evaluation

And, if found to be a "high risk" facility:

- Prepare a Security Vulnerability Assessment (SVA); and
- Prepare a Site Security Plan (SSP).



Chemical Facility Anti-Terrorism Standards Proposed Appendix A: DHS Chemicals of Interest

This proposed list of chemicals was open for comment through May 9, 2007.

Chemical of Interest	Chemical Abstract Service (CAS) Number	Screening Threshold Quantity (STQ) (lbs)
1,1,3,3,3-pentafluoro-2-(trifluoromethyl)-1-propene	382-21-8	Any Amount
1,1-Dimethylhydrazine	57-14-7	11,250
1,2-bis(2-chloroethylthio)ethane	3563-36-8	Any Amount
1,3-bis(2-chloroethylthio)-n-propane	63905-10-2	Any Amount
1,3-Butadiene	106-99-0	7,500
1,3-Pentadiene	504-60-9	7,500
1,4-bis(2-chloroethylthio)-n-butane	142868-93-7	Any Amount
1,5-bis(2-chloroethylthio)-n-pentane	142868-94-8	Any Amount
1-Butene	106-98-9	7,500
1-Chloropropylene	590-21-6	7,500
1H-Tetrazole	16681-77-9	2,000
1-Pentane	109-67-1	7,500
2,2-Dimethylpropane	463-82-1	7,500

Top Screen Deadline

- Facilities will have 60 calendar days after the upcoming publication of the final Appendix A in the Federal Register to complete the Top Screen.
- Failure to timely complete the Top Screen could result in:
 - Being classified by DHS as "presumptively high risk"
 - And, if there is additional delay, possible fines, shut-down orders and other penalties.



What is happening?

- DHS is trying to get the final Appendix A to OMB
- Higher learning represented in Congressional hearing July 24, 2007
- Academic Representatives ACE, NACUBO, AAU, COGR & CSHEMA et al formed a working group and have been meeting with DHS
- September report to CSHEMA members:
 - Appendix A will be tightened and common materials removed
 - No more "any amounts" thresholds
 - Some risk categories will have thresholds for container size

Working Group Report

- DHS aiming at November 16th for Appendix A
- DHS believes changes will remove small and medium institutions from the rule
- 60 days remains but will accommodate reasonable extension
- Schools can approach top screen in way that works: for entire campus, or building or department or by lab!
- If school can reasonably predict they do not exceed thresholds, no screen required

Working Group Plan

- Develop a template for requesting extensions
- Develop "best practices" for Top Screen survey mechanisms and pro's and con's of campus vs building vs laboratory
- Develop template for Alternate Security Plans for DHS review

Bottom Line

- Large institutions will need to respond
- We will request extension
- Worst case: all PIs will have to submit inventory of chemicals in Appendix A
- More likely: Depending on the final list, will reasonably predict that certain departments or buildings are unlikely to have chemicals above STQ
- Good faith effort for remaining departments
- Chemistry department 'worst-case' scenario – test case for U of MN

U of MN DEHS

- Identified existing tools to provide potential compliance strategy
- SPACE database to identify lab locations by department, as a potential universe of respondents to query
- Sponsored Programs supplied list of PIs, subject to amendment by Lab Safety Plans
- Office of Measurement Services has survey tool that integrates x.500 entries

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 Chemistry faculty will be asked to complete this inventory for approximately 160 chemicals remaining on the DHS Appendix A list.

Hazardous Waste Inspections: Overall Exception Rate of 29.5%

- 350 Labs inspected
- 2,356 Containers Inspected
- 523 Contents not listed or not in plain English
- 148 Containers undated
- 112 Without words "Hazardous Waste"
- 90 Liquid waste not in containment tray
- 28 Open Containers
- 17 Waste containers not stored in work area
- 11 Near drain without containment
- 5 Unlabeled containers
- 1 Containers not in good condition

Closer Look at Trend

- Of the 523 containers "Contents not listed or not in plain English," 85% were cited for using
 - chemical symbols (MeOH, EtOH, NaOH, HCI, CuSO4, K3Fe(CN)6, CHCl3)
 - acronyms (PBS, DMSO, DAB, TEAA, PMSF, SDS, EGTA, NNKOAc, ACN)
- 2006 Hennepin County cited "BME" for beta-Mercaptoethanol
- Rule: "...a description that clearly identifies its contents to employees and emergency personnel"

Sent Out Reports to RSOs and Started the Re-inspection Program

- To date: Hasselmo, MCB, Lions/TRF, Jackson; Shepherd, Amundson, Tate, Mech Engineering
- Overall Exception Rate is 21.8%
- Chemicals not in Plain English remains the main problem (95% of listing citations are for this issue)
- Hennepin County WILL INSPECT U of MN before the end of 2007 – so be prepared!

Follow Up vs Initial Inspection

•	21.8%	Overall Exception Rate	29.5%
•	19.2%	Contents not listed or not in plain English	22.2%
•	3.8%	Containers undated	6.3%
•	4.0%	Without words "Hazardous Waste"	4.8%
•	1.1%	Liquid waste not in containment tray	3.8%
•	0.5%	Open Containers	1.2%
•	0.0%	Waste containers not stored in work area	0.7%
•	0.6%	Near drain without containment	1.2%
•	0.3%	Unlabeled containers	0.5%
•	0.2%	Containers not in good condition	0.2%

Laboratory Poster – Take Many With You Today!

(Satellite Storage) Chemical Waste UNIVERSITY OF MINNESOTA

- Dispose all chemical waste through the Chemical Waste Program.
- Keep track of chemicals collected on label or in log nearby.
- Do not accumulate more than 55 gallons of waste. If you do, document with weekly inspections.
- Store waste in immediate work area or document weekly inspections.





Chemical Waste Program Department of Environmental Health and Safety www.dehs.umn.edu Spills 9-1-1 or (612) 626-6002

Forms, labels, questions Phone: (612) 626-1604 E-mail: hazwaste@umn.edu

Call EHS for Hg Clean-up



- Much spilled mercury discovered during lab cleanouts / renovations in Kolthoff
- Please do not clean up mercury spills
- Instead, call DEHS (6-6002) and well-trained staff with proper equipment will clean and check to ensure air concentrations are not hazardous.
- No charge for spill response!

Prevent Mercury Spills

- Thermometer Exchange
- DEHS will continue to replace your mercury lab thermometers with non-mercury ones AT NO COST!
- Program: <u>http://www.dehs.umn.edu/hazwaste_mercthemo</u> <u>m.htm</u>
- U Stores #s:

http://www.dehs.umn.edu/PDFs/Mercury%20Th ermometer%20Exchange%20form.pdf



Broken Glass Boxes



- Regular trash for paper, lids etc.
- Any glass containers should be clean and dry – no residues or caps
- Unbroken, clean, dry chemical containers can be recycled



Housekeeping – food etc.

Absolutely

no food, beverages or related containers in laboratories!

- Refreshments only in separate rooms (doors and full walls)
- P.I.s responsible for enforcement - set a good example!



 Cover food and beverages if you must move them through the laboratory to an office

Housekeeping - cleanliness

- Respect shared spaces
- Clean up after yourself
- Spill paper makes this task easier



Housekeeping – Protective Equipment

- Cover exposed skin (use gloves, but don't forget legs and feet)
- Protect your eyes (goggles REQUIRED in teaching labs)









Fume Hood Work Practices

- 1. Do not use perchloric acid in a hood not specifically designed for use with perchloric acid.
- 2. Prior to using hood, verify that the exhaust fan is operating and sufficient air is being exhausted from hood.
- 3. Never put head into hood while contaminants are being generated.



Proper Setup

- 4. Locate equipment as far to the rear as possible, without blocking the lower slot in the rear baffle, in recessed portion of work surface.
- 5. Never operate equipment closer than 6" behind the plane of the sash!



Fume Hood Work Practices

- 6. Do not place electrical receptacles or other sources of ignition in hood when flammables are present.
- 7. Use a safety shield if there is a possibility of a small explosion or runaway reaction. This hood is not designed for explosion protection.
- 8. Do not obstruct slots in rear baffle.
- 9. Do not remove bottom deflector vane nor block off opening between the underside of the deflector vane and the work top.





- 10. Place equipment with large flat surfaces parallel to hood face on legs 2" to 3" high.
 - . While working at hood, keep sash lowered to the minimum opening required for access to working area. During other times, keep sash closed.
- 12. Wear gloves and other protective clothing if skin contact with airborne contaminants is a hazard.

Additional Fume Hood Practices

- A. Remove all materials from hood which are not needed for the immediate work.
- B. Do not store chemicals in hood.
- C. Avoid making rapid movements while working at hood.
- D. Minimize personnel traffic past hood.
- E. Avoid creating air currents in the laboratory which affect the air flow patterns into hood.
- F. Use good housekeeping in hood at all times. Clean up spills immediately.
- G. Test the performance of hood at least once every six months.
- H. In models with removable sash, always replace sash before operating.



Vacuum Pump Cabinets

- A few hoods equipped with insulated cabinets to reduce vacuum pump noise
- However, solvent accidentally drawn into pump through dry trap my be exhausted into cabinet.
- Solvent vapors may build up to flammable/ explosive concentrations



Vacuum Pump Cabinets

 Do not confine vacuum pumps in cabinet unless the cabinet is modified and the pump is properly exhausted





Ports for

- vacuum tubing,
- exhaust tubing; and
- Passive cabinet ventilation

Vacuum Pump Cabinets

Failure to follow

these instructions may result in fume hood damage or destruction!!





Chemical Storage Cabinets

 Flammable cabinets have self-closing doors





 Ensure doors close completely to protect chemicals from fire

Liquid Nitrogen Hazards



- Liquid nitrogen traps are commonly used on vacuum lines
- boiling point of -195.8°C
- Volume of expansion liquid to gas (at 15°C, 1 atm.) = 682.1
- severe burn-like damage upon skin contact, comparable to boiling water.
- vapor also can cause damage to softer tissues *e.g.* eyes and lungs but may not affect the skin during short exposure.
- Skin can freeze and adhere to liquid nitrogen cooled surfaces causing tearing on removal.
- Soft materials *e.g.* rubber and plastics become brittle when cooled by liquid nitrogen and may shatter unexpectedly.
- Thermal stress damage can be caused to containers because of large, rapid changes of temperature.

SOP Template

http://www.dehs.umn.edu/Docs/AppI%20SOP%20Template.doc



 Assess chemical/physical hazards, toxicity and exposure potentials to characterize overall risk of a procedure

Risk → Written Control Plan (SOP)

- The risk will dictate the necessary controls, which may include:
- Engineering controls
- Personal protective equipment
- Decontamination procedures
- Administrative controls
- Emergency plan



Risk → Written Control Plan (SOP)

- Explosion
 - provide pressure relief such as a <u>bubbler</u>.
 - Condensed gases may convert back to vapor.
 - Runaway reactions always provide a source of pressure relief!
 - If heating, open to a bubbler for pressure relief
- Implosion due to an unseen star crack or stress if the materials you are using are <u>flammable</u> or <u>pyrophoric</u> - watch out!
- Liquid oxygen
 - If condensed in the trap can react violently with most organic substances, including Teflon tape, vacuum grease, and organic solvents.
 - If warmed back to vapor, can generate enough pressure to shatter the line.
 - If you observe a pale blue liquid, immediately replace the trap, close the sash and back away. Consult your supervisor IMMEDIATELY. Warn others of the danger, posting signs if possible.

http://www.ilpi.com/inorganic/glassware/vacline.html

Liquified gas explosion



- Solvent transfer under vacuum
- Receiving flask left under passive vacuum
 1 hr Mistake
- Researcher noticed liquid (condensed air due to leak?) in receiving flask (at -196 °C),
- Isolated receiving flask; removed liquid N₂ -Mistake
- Closed hood sash Good!
- Explosion (1 min. later) left 10+ quarter-sized divots in safety glass





Think Safety!!

