Chemical Stockroom Management:

Lessons Learned Ten Years In

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Our Students

Undergraduate Program

- ~340 Declared majors in 12 concentrations
- ~50 to 70 Students performing undergraduate research with 13 faculty members

Degrees Awarded

- Graduated Fiscal Year:
  - 2010-2011: 36
  - 2011-2012: 32
  - 2012-2013: 33
  - 2013-2014: 40
  - 2014-2015: 52

- Level:
  - Undergraduate
Stockroom Mission

- To service
  - ~1200 students/semester in the Intro Chemistry labs (40 to 50 sections)
  - ~400 students/semester in the Organic Chemistry labs (20 sections)
  - assist with all other teaching labs as needed
- To manage 2000 – 2500 chemical containers safely at any given time
- To provide instructional mentoring for 3-6 students per term
- To support research faculty and undergraduate research
Safe operation of a chemical stockroom that supports teaching and undergraduate research involves managing various “assets” using a variety of “tools”
Assets & Tools

- People
- Space
- Technology (Hi tech and Lo tech)
- Time
- Specialized equipment
What is Involved in the Safe Daily Operation of a Chemical Stockroom?

- Managing operations:
  - Tools & Assets: chemicals, equipment, people, technology, & time

- Managing chemicals & equipment:
  - Tools & Assets: people, technology, space, & time

- Managing personnel:
  - Tools & Assets: people, time, & technology
Our Personnel

- **Director of Stockroom & CHO**
  - Scheduling, Ordering, Training

- **Stockroom Manager**
  - Technology (Chematix, MSDS Online, Vernier Equipment)

- **Stockroom Technician**
  - Daily Student Supervision, Monitoring Consumables

- **Student Workers**
  - Solution Prep, Cleaning, Lab Set up
Our Time

- Director is full time 12 month faculty. Stockroom time is typically 30 hours per week.
- Manager is full time staff with $\frac{1}{2}$ time teaching assignment. Time is, “until the job is done”, typically 40 hours/week.
- Technician is full time staff, strict 40 hours/week.
- We typically have 30 hours/semester of student help.
Our Space

- Main Stockroom ~ 1800 sq ft, 3rd floor
- Satellite Accumulation Area ~ 60 sq ft for Organic labs, 4th floor
- Three closet/storage areas ~ 60 sq ft ea, 3rd floor
- 180 day storage hood in the stockroom
- Blowout Room – 180 day storage & compressed gas cylinder storage ~ 200 sq ft, 1st floor
- No service elevator
MANAGING CHEMICALS

Stockroom Organization: Function, Safety, & Security
Inventory System (Technology)

- Chematix w/ Intermec barcode printer
- MSDS Online
- Several scanners w/ tablets for users to reconcile
Inventory Systems

- People are in charge of any inventory system and in my experience an inventory system is only as good as the people entering the data and using it.
- While an inventory system can tell you what the hazards are, and where a container is, it cannot tell you the container condition or if it is being stored correctly.
Ordering (People, Time, Technology)

- Could be the most important part of managing chemicals
- Consideration for safe storage and use should be given *prior to ordering*
- *Taking advantage of promotions/discount memberships (NAOSMM)*
- Time:
  - Determining need/obtaining quotes/price comparison/follow-up/talking to reps
- People:
  - receiving/entering/storing/notifying or delivering/scanning packing slips
- Technology:
  - Inventory control, SDSs
Space
Pre-Renovation

- 3000 to 4000 chemical containers
- Chemicals were stored with very little segregation on very questionable shelving wooden “library shelving” or in flammable cabinets
- There was very little capability to segregate solvents from general storage
- Function was hampered by poor organization
- Security was non existent
- All faculty had key access to the space
Space Post-Renovation

- Chemical inventory was dropped to ~2000 – 2300 containers
- Chemicals have low visibility from outside
- Chemicals are now stored with physical segregation based on correct hazard classes
- Solvents are in a 2 hour solvent room
- Organization that optimizes function
- Security measures in place (card reader /camera surveillance/locking cages)
- Only faculty with need (and training) have access to the space
Before
Secure Niches for Various Things

Small, secure cabinets for reactive acids
LESSONS LEARNED
The Person in Charge of Operations

- **This person must** –
  - Be someone that has, or is willing to develop a vested interest in operations
  - Have strong organizational skills and be very detail oriented
  - Understand chemistry and chemical hygiene
  - Be able to communicate with various stakeholders
  - Take responsibility when things go wrong
  - Have well-developed problem solving skills
  - Be able to keep personnel working in goal time on important tasks to keep operational flow proactive
Ordering

- Currently, I do all the ordering of items <$1500
- Just in time ordering requires more time
- Ordering should be assigned to someone
  - with a chemistry background and strong chemical hygiene knowledge
  - that has basic accounting skills
  - with strong scientific communication skills
  - with some institutional knowledge of the department
  - who can constantly balance need/use/space vs. hoarding/want/cost
Managing people is more difficult than managing time, space, equipment, technology or chemicals.
Security features have to be engaged or operational to be of any use
Student Workers

- We require potential workers to submit their resume and interview for a position – we always have a waiting list (and it is not for the pay!)
- Students are trained to HAZCOM for stockroom work as opposed to the Lab Standard that they train to for work in the research lab
- They are very closely monitored and mentored. We assign tasks that are simple at first, and allow them more challenging assignments as they learn about the operations
- They are required to use a card reader to monitor their time and fill out bi-monthly timesheets
- They are required to log their daily activities in a lab notebook
Through stockroom work I gained a lot of knowledge that wasn’t taught in other laboratories or classes.

Although a lot of specific safety information necessary for a position is acquired through job training, it is still important to have a solid background. Understanding safety regulations not only helps with job duties, but also in securing a job.

Questions regarding a candidate’s knowledge of safety arises in applications where it is used to weed out unqualified applicants; it is also integral in interviews where candidates are asked to explain what safety regulations, equipment, etc. they have experience with.
The stockroom also taught me how to store chemicals, which wasn’t something that was really taught but learned while working.

I think it is important for chemical storage to be taught because it can help prevent incidents from ignorance.

For example storing nitric acid separately from other acids, keeping ammonia out of hoods used to store [broken]Hg thermometers, or how acetone can dissolve certain plastics.
Tool time is the time one spends on a task using technology that does not increase the quality of the result. Think of it as time spent working, but to no apparent benefit (decreased efficiency).

Goal time is the time one spends in direct pursuit of the specific end product or goal. Goal time always improves the quality of the result (increased effectiveness).
Technology Should

Goal

Time

Tool

Time
Example – Secondary Labels

**Hexanes**

**DANGER**
Highly flammable liquid and vapor
May be fatal if swallowed and enters airways
Causes skin irritation
Causes serious eye irritation
Suspected of damaging fertility or the unborn child
May cause damage to organs through prolonged or repeated exposure

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Technology that facilitates operations in goal time improves operational effectiveness (the right things are being done) and efficiency (they are being done correctly)
Saving Time (Technology)

Save time by batch scanning empty barcode labels (higher tech)

Experiments by week at a glance (low tech)

Great jobs for student workers
Understand the Difference Between Urgent Tasks & Important Tasks

- **Urgent tasks require immediate attention (Reactive)**
  Obviously, things such as spills fall in this category. More commonly – not having a needed chemical, incorrectly numbered unknowns, or full hazardous waste containers, etc.

- **Important tasks contribute to the operational mission of the unit (Proactive)**
  Important tasks in the stockroom involve monitoring the integrity of chemicals on a schedule, ordering, washing glassware, preparing solutions and unknowns, and maintaining equipment.
"What is important is seldom urgent and what is urgent is seldom important." – Dwight D. Eisenhower

**Urgent Tasks vs. Important Tasks**

**URGENT**
- Spills
- Full Waste Containers
- Solutions Incorrectly Prepared
- Setting up labs

**IMPORTANT**
- Cleaning
- Solution & Sample Preparation
- Checking Eyewashes
- Planning Vacations

**URGENT**
- Emails and Phone Calls
- Preparation of Something for a Researcher

**NOT URGENT**
- Time Bandits
- Interrupting Flow
- Engaging in Tool Time

**Eisenhower Decision Matrix**
Operations where people are working proactively on important tasks with tools that improve product or service quality (goal time) are both effective and efficient.
Never Overlook An Opportunity to Teach
Transporting Chemicals Through Doorways
Things I would not want to live without and worth paying for!

ESSENTIAL TOOLS (REAL)
Tote Storage Unit

Organization value added = time saved!
Secondary Containment & Segregation

- Protect chemical shelves while segregating
- In laboratory use for protecting counters and containing spills
- Organizing student samples

Features Include:
- Acid resistant
- One-piece polyethylene construction
- 1", 1.5", or 2" containment lip
- Coved corners
- Impact resistant
- Dishwasher safe
- Over 250 sizes

Scientific Plastics, Inc.
Labeling System

- Labels can be printed in numerical series quickly
- Labels are easy to remove and re-stick
- Multiple tape sizes and colors
- Chemical resistant label material
- Operates w/ or w/out PC connection

Brother P-Touch Printer
Card Reader

- Track employee or student worker time
- Enter student breakage charges as they occur
Ecofunnels

EPA approved, but not student proof.

(Signage is required to get them not to dump on the lid)
For operations to be both effective and efficient, it is critical to have the right person in doing the right job.

The person ordering chemicals needs to be closely tied to the operations.

For safe operations, the space must be able to accommodate the required chemicals and operations.

There must be enough personnel to keep operations in flow.

Students are learning and should be taught (not just labor).

Chemical containers cannot move themselves.