Material Control & Accountability and CMS© Software Workshop
Welcome to the Chemical Inventory Management System Workshop

Objectives
• To improve chemical management at your institution
• Use a chemical inventory management system (CIMS) to improve material (chemical) control, tracking, and accountability
• Use & implement the CMS© Software for inventory tracking

Goals:
• Understand cradle-to-grave chemical risk management principles
• Train-The-Trainer: propagate knowledge and practices forward
• Identify challenges/barriers and paths forward
• Develop:
  o Draft SOPs
  o Implementation/Action Plan for CIMS
  o Lesson Plan and Teach Back
Workshop Overview
Workshop Overview

• 5-day training
  o Material Control & Accountability
    ▪ Chemical Risk Management
    ▪ Chemical Inventory Management Systems
    ▪ SOPs
  o CMS© Software instruction and activities
  o Implementation and Action Plan
  o CMS© Software Teach-back
Chemical Management Overview
Integrated Chemical Safety and Security Risk Management

Chemical Safety Management

Chemical Security Management

Chemical Risk Management
Chemical Risk Management

- **Chemical Risk Management** is a system or process to control safety and security risks associated with hazardous chemicals
  - Risks must be managed in every aspect of the chemical life cycle.

![Chemical Life Cycle Diagram]

- Production/Procurement
- Transport/Distribution
- Storage/Inventory
- Chemical Usage
- Waste Management
- Recycling
- Disposal
Key Components of Chemical Risk Management

Assessment

Continual Improvement

Mitigation

Monitor

Continual Improvement
Key Components of Chemical Risk Management

• Chemical Risk Assessment
  o Process of identifying the hazards (or threats) and evaluating the risks associated with the specific process and the chemicals, taking into account the adequacy of any existing controls, and deciding whether or not the risks are acceptable
Important Elements of a Management System

- Top Management Commitment
- Documentation and Document Control
- Planning, Establishing Goals & Objectives
- Teamwork and Communication
- Training and Staff Awareness
Material Control: Chemical Security

Chemical Security: Protect Chemicals (assets) from People

1. Eliminate the threat
2. Block the pathway
3. Protect the assets
The 5 Pillars of a Chemical Security Risk Management System

- Physical
- Material Control & Accountability (highlighted)
- Personnel
- Transportation
- Information

Culture, Procedures, Regulations
Chemical Inventory Management System

• A chemical inventory management system (CIMS) is part of the overarching Chemical Risk Management System.
  o Mitigation strategy to prevent and detect chemical risks
• By definition: it is the system or program that is used to track chemicals at a facility or institution.
• An effective CIMS begins tracking these chemicals at the point of procurement and continues through use and disposal
Chemical Inventory Management System: Program Elements

• Proper chemical risk management program has several essential elements:
  o Recycling of chemicals, containers and packages
  o Procedure for chemical ordering and disposal
  o Source reduction
  o Inventory and tracking
  o Storage in stockrooms
  o Access control
  o Waste management
Benefits of Chemical Risk Management System
Best Practices

• Reduce Costs
  o Make smaller and fewer purchases
  o Use less storage space
  o Reduce waste
  o Surplus sharing

• Save Time
  o Surplus sharing
  o Less searching

• Improve Teaching and Research
  o Track expiration dates
  o Teaches industry standards and expectations
  o Improved Quality Control
Key Principles: Chemical Inventory Management System (CIMS)

- Set of policies, procedures, and tools for chemical inventory management
- “Living” database of chemical inventory
  - Updated with procurement, transport, use, and disposal
- Requires training, maintenance, and inspection
- Control access to materials & information/database
- Ensure control and accountability
  - Designate chemical owners
  - No orphan chemicals
- Meet regulatory and institutional requirements
Fundamentals of Inventory Management
Inventory Management: Overview

• Definitions
• Key Principles
• Inventory Basics
• Inventory Database
• Inventory Reporting
• Inventory Inspections
• Access Control
• Conclusions
Definitions

• Inventory
  o Database that tabulates the chemicals in the lab
    ▪ Can include materials, synthesized products and samples
• Inventory (and tracking) system
  o Procedures and tools to update information and storage locations
• Inventory Management Program
  o Entire process involved in tracking inventory items throughout the life cycle (procurement through disposal) of chemicals
Types of Inventory Tools, Systems, or Programs

- Use and Function - inventory Tracking
- There are three general types:
  
  - Paper-based
  - Computer-based
  - Web-based or Networked System
Types of Inventory Management Tools

Simple log book or paper system
• When would this be adequate?
  o Small laboratory or department
  o Few chemicals (<100 items), low turnover
  o Few or no regulatory/reporting requirements

• Advantages?
  o Very low initial cost
  o No technical support needed

• Disadvantages?
  o Very difficult to maintain, easily bypassed
  o Can only track a limited amount of information
  o Difficult to control access to information
  o Limited productivity and efficiency benefits, and cost savings
Types of Inventory Management Tools

**Spreadsheet or simple computer system**

- When would this be appropriate?
  - Medium size laboratory or department
  - Moderate number of chemicals, moderate turnover
  - Some regulatory/reporting requirements

- Advantages?
  - Low initial cost
  - Can track more information
  - Some productivity and efficiency benefits, and cost savings
    - Use of barcodes?

- Disadvantages?
  - Difficult to maintain, may be bypassed
  - May be difficult to control access to information
Types of Inventory Management Tools

**Advanced computer or web-based system with barcodes**

- **When would this be appropriate?**
  - Large laboratory or department
  - Many chemicals, high turnover
  - Many regulatory/reporting requirements

- **Advantages?**
  - Excellent productivity and efficiency benefits, and cost savings
  - Can track a lot of information
  - Excellent information access control
  - Integration with procurement, disposal, etc.
  - System-generated alerts and automated features
  - Use of barcodes

- **Disadvantages?**
  - High initial cost, and recurring costs in some cases
  - Still requires a commitment to maintain accuracy
Advanced Inventory Systems

• System and database are on a central server
• Protects information
• Users access the system through the internet or internal network
• Can accommodate many users simultaneously
• Extensive database with system-generated alerts and automated features
• Integration with procurement, training, and waste tracking
• There are a number of commercially available inventory systems
  • https://www.cheminventory.net/
  • http://www.safetec.net/what-we-do/chemical-tracking-inventory/
  • http://chemicalsafety.com/chemical-inventory-management-software/
  • https://www.ehs.com/solutions/chemical-management/?utm_source=capterra&utm_medium=ppc&utm_campaign=ehs-management
  • https://chemtracker.org/
  • And more!
Inventory Management: Database

- The Database - information collected and tracked by the inventory system
- Varies from small to large, simple to complex
  - Individual amounts and algorithms to calculate total amounts
- Selection of database system depends on regulations and tracking interests
  - The size of the database may dictate how advanced your inventory management system needs to be

- Examples:
  - For synthesis labs
    - Enter synthesis products into inventory, or
    - just label properly
  - For Numerous Samples or Standards
    - Keep track of individual vials after preparation, or
    - Track batches, or
    - Just label properly
Database Content

- Name
  - IUPAC, common, trade
- CAS number
- Formula
- Ingredient
- Lot number
- Location
  - Facility, building, room, cabinet, shelf
- Owner
  - Organization
  - Individual
- Requester
- Purchaser
- Barcode
- Supplier or producer
- Physical state
- Hazards
  - Compatibility/storage info
  - COC flag
- Safety Data Sheet (SDS)
- Certificate of analysis
- Quantity
- Date purchased or received
- Expiration date
- Status (open or not)
- Use and transfer history

It is possible to keep track of a lot of useful information with a computer/web-based chemical inventory management system
# Inventory Management: Database Examples

<table>
<thead>
<tr>
<th>Barcode</th>
<th>Location</th>
<th>Date In</th>
<th>Name</th>
<th>CAS #</th>
<th>State</th>
<th>Quantity</th>
<th>Units</th>
<th>Container</th>
<th>Hazards/Alerts</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ879816</td>
<td>124/2</td>
<td>2/12/2011</td>
<td>Sulfuric Acid</td>
<td>7664-93-9</td>
<td>Liquid</td>
<td>500</td>
<td>mL</td>
<td>Glass</td>
<td>acid</td>
</tr>
<tr>
<td>AQ879817</td>
<td>122/1</td>
<td>5/24/2003</td>
<td>Ferric Chloride</td>
<td>7705-08-0</td>
<td>Solid</td>
<td>500</td>
<td>gram</td>
<td>Metal Can</td>
<td>toxic, corrosive</td>
</tr>
<tr>
<td>AQ879818</td>
<td>124/3</td>
<td>1/1/2001</td>
<td>Oxygen</td>
<td>7782-44-7</td>
<td>Gas</td>
<td>5</td>
<td>m³</td>
<td>Gas Cylinder</td>
<td>flammable</td>
</tr>
<tr>
<td>AQ879819</td>
<td>121/A</td>
<td>6/24/2005</td>
<td>Acetone</td>
<td>67-64-1</td>
<td>Liquid</td>
<td>1</td>
<td>L</td>
<td>Plastic</td>
<td>flammable</td>
</tr>
<tr>
<td>AQ879820</td>
<td>122/2</td>
<td>2/7/1998</td>
<td>Diethyl Ether</td>
<td>60-29-7</td>
<td>Liquid</td>
<td>1</td>
<td>L</td>
<td>Plastic</td>
<td>peroxide former</td>
</tr>
<tr>
<td>AQ879821</td>
<td>124/1</td>
<td>5/8/1996</td>
<td>Magnesium</td>
<td>7439-95-4</td>
<td>Solid</td>
<td>100</td>
<td>gram</td>
<td>Metal Can</td>
<td>flammable</td>
</tr>
<tr>
<td>AQ879823</td>
<td>121/B</td>
<td>5/30/2005</td>
<td>Pinacolyl Alcohol</td>
<td>464-07-3</td>
<td>Liquid</td>
<td>26</td>
<td>kg</td>
<td>Glass</td>
<td>CWC sch 2</td>
</tr>
<tr>
<td>AQ879824</td>
<td>121/A</td>
<td>10/24/2002</td>
<td>Sodium Cyanide</td>
<td>143-33-9</td>
<td>Solid</td>
<td>5</td>
<td>gram</td>
<td>Glass</td>
<td>toxic</td>
</tr>
</tbody>
</table>

- What information is missing?
  - Expiration date?
  - Owner?
Inventory Management: Physical Inspection

- Inventory Audits/Reconciliation
- Assures accuracy of inventory database
- Provides visual assessment of chemical condition
- Should be done once or twice a year
  - More often for Chemicals of Concern (COCs)

What chemicals would you want to inventory more often in your own labs?
Physical Inspection is Important

Good!

Not as good...
Inventory Management: Reporting

- Use of a computer/web-based system makes reporting easier
- Helps coordinate with emergency responders
- Inventory reports may be required by law or by institution policy
  - Based on location
  - Quantities of chemicals purchased or used
  - Price
  - Expiration
  - Transport
  - COCs

- 1994, California State University, Northridge
  - Magnitude 6.7 earthquake, epicenter a few km from campus
  - Fires in science buildings allowed to burn because chemical inventory/hazards unknown

Image courtesy: P.W. Weigand, California State University Northridge Geology Department, Image source: Earth Science World Image Bank
http://www.earthscienceworld.org/images
Inventory Management: Reporting

• A spreadsheet may not be useful for emergency responders

• Use spreadsheet to create a summary of chemical hazards
  o For Institution
  o For building
  o For individual labs
    ▪ Useful when making hazard door signs
Inventory Management: Access Control

• Different levels of access to inventory system and database
  • Students
  • Faculty, staff researchers
  • Department heads, system administrators
  • Chemical safety and security officers, centralized procurement

• Outsider Threat
  • Restrict access to information about COC locations and physical security

• Insider threat
  • Personnel management
  • Procurement
  • Inventory management
    • Chemical Owner
    • Physical Inspection
    • Data protections
Basics of Access Control

• Access limitations depend on the material or information
  o More control of access if COCs* are present

• Lock areas (rooms, cabinets) or information (systems or documents)
  o Control of keys, combinations, codes

• Label material areas “Authorized Personnel Only”
  o Means of identifying authorized personnel
    ▪ Challenge unfamiliar people in restricted areas

• Authorized personnel
  o Trusted
  o Background check
  o Trained
  o Legitimate need

* COCs = Chemicals of Concern
Inventory Management: Conclusions

• There are a number of administrative and operational controls that can be used to help secure chemicals
  o The use of SOPs is encouraged and will result not only in better security, but also better overall safety, efficiency and management
• The use of an inventory is highly encouraged and will assist not only in better overall chemical security, but also in:
  o Cost savings
  o Time savings
  o Better research
  o Regulatory compliance
• Inventories do require upkeep and maintenance and different types exist
  o Choose the one that works for your lab/facility/institution

What are the main challenges to effective chemical inventory management?
Questions?

“Don’t worry. I know exactly where all the dangerous unlabeled bottles are.”

http://www.newslettercartoons.com/catalog/pages/10labsafetycartoons.html#4647
Group Discussion: Current Inventory Management
Group Discussion: Current Inventory Management

• What is your current inventory management system?

• What improvements would you like to see?

• Please refer to handout:
  o “Group Discussion: Current Chemical Inventory Management System (CIMS)”
Activity: Chemical Management
Scenario, Diphosgene
Activity: Procurement, Storage, Use, and Tracking

- Scenario:
  - You (or your Student) would like to order a chemical, Trichloromethyl Chloroformate, for an experiment to synthesize N-Carboxyanhydrides.
    - **Reaction Scheme 1**: Reaction of an amino acid with Trichloromethyl Chloroformate (Diphosgene) to produce N-Carboxyanhydrides.

- What information do you need to know about the chemical in the above scenario prior to ordering?

- In your groups, answer the questions for each section:
  - Procurement
  - Central Receiving & Storage
  - Transport/Distribution
  - Tracking and Management
Barcodes and Barcode Scanners/Readers
Barcodes

• Old technology from 1950
• An optical, machine-readable representation of data (numbers and letters)
  • Originally - represented data by varying the widths and spacing of parallel lines
    • Bar + codes
  • Dozens of different kinds, but 2 main types
    • 1 dimensional (1D) - Linear
      • Linear black lines
    • 2 dimensional (2D) – Matrix
      • using rectangles, dots, hexagons and other geometric patterns in two dimensions
      • pattern is read both horizontally and vertically, hence the name 2D
  • Became commercially available in 1974 to automate supermarket checkout systems
  • The barcode is **only numbers** until connected to database
1D vs 2D

- Linear barcode representing a number/series of numbers and letters
  - Ability to connect to a dynamic database
  - Limited to number of characters

- 2D matrix barcodes
  - Increase data storage in a barcode because they use patterns and shapes—like hexagons, squares, and dots—to encode data
  - Can print smaller without compromising data storage
  - Not just identify the object, but can store the manufacturer’s website, an image, the item’s history, tracking information and more.
Obtaining Barcodes Labels

• Purchase
  o Some have a chemical-resistant adhesive

• Make/print your own
  o Purchase barcode generator software
  o Find a free barcode generator online
  o Download a barcode font, or use another method for creating barcodes from MS Word or Excel
    ▪ Then print onto adhesive/label paper
      • Helpful hint: once on the chemical container, cover the barcode (and rest of the label) with packing tape to help it resist chemicals
Barcode Readers/Scanners

• Use optical or image technology & software programing to **read and interpret** barcodes
• Many examples, including your iPhone
  o Limited to the software that can read & interpret the barcode
  o Many different styles of barcodes
    ▪ 1D vs 2D
Barcode Readers/Scanners

- **Symbol LI4278**
  - For linear barcodes
  - Cordless (~100m line of sight)
  - Battery charges on cradle
  - Reads barcodes
    - Upside-down
    - Printed or on screens
    - At angles and from curved surfaces

- **Smartphone & QR code**
  - Need to figure out how to connect with database
CMS© Software Overview
CMS© Software:
Intro and Basics

• **1.1 Purpose and Benefits**
  o Promote a fundamental approach to managing chemicals in the laboratory, focused on security and safety
  o Designed for a single central receiving/storage facility with only a limited number of authorized users

• **1.1.1 Roles and Responsibilities**
  o “Administrator” - Default first user login and has full access privileges. Only user that can create & manage new users
  o “Manager” - person responsible for managing daily inventory usage.
  o “Auditor” - designed for institutions that have or use a designated person to audit or check inventory
  o “Viewer” – Can search, view inventory, and some reports

• **1.1.2 Implementation and Maintenance**
  o Requirements include
    ▪ (1) documentation and record keeping
    ▪ (2) assigning roles and responsibilities
    ▪ (3) training new staff
    ▪ (4) reporting
  o SOPs
CMS© Software:
Installation and Basic Features

• Installation
  • Guided Installation and Set-up
  • Software Installation
  • Equipment Installation
  • SDS database
  • User Access set-up
• Basics and Features
  • Software icons
• Refer to CMS© Software “Installation Guide and User Manual” provided
CMS© Software: Installation

- 2.2.1 Software Installation
- 2.2.2 Launching CMS© Software
- 2.2.3 Equipment Installation
CMS© Software:
Setup & Inventory Setup

- 2.3.1 Software Setup
- 2.3.2 Inventory Setup
  - 2.3.2.1 Importing Inventory
  - 2.3.2.2 New Inventory Setup
- 2.3.3 SDS Folder Setup
- 2.3.4 User Access
- 2.3.5 Database Setup
CMS® Software: Basic Features

• 3.1.1 Basic Functionality
• 3.2 “Inventory” Icon
  o 3.2.1 Adding a New Chemical
  o 3.2.2 Updating Items in the Inventory
  o 3.2.3 Removing Items from the Inventory
  o 3.2.4 Safety Data Sheets
  o 3.2.5 Sorting the Inventory
• 3.3 “Search” Icon
  o 3.3.1 Search for a Barcode
  o 3.3.2 Search for a Chemical Name
  o 3.3.3 Search Using Location
• 3.4 “Stock Check” Icon
  o 3.4.1 Inventory Audit
CMS© Software: Advanced Features

- **4.1 “Reports” Icon**
  - 4.1.1 Activity Log
  - 4.1.2 Inventory by Chemical
  - 4.1.3 Inventory by Location
  - 4.1.4 Stock Check
  - 4.1.5 Users

- **4.2 Exporting**

- **4.3 Networking**
  - 4.3.1 Multiple Computer Locations
  - 4.3.2 Sharing the Database

- **4.4 Modification of Software**

- **4.5 Uninstalling CMS©**
Group Discussion: Chemical Management Scenario, Diphosgene
Activity: Procurement, Storage, Use, and Tracking

• Scenario:
  o You (or your Student) would like to order a chemical, Trichloromethyl Chloroformate, for an experiment to synthesize N-Carboxyanhydrides.
    • Reaction Scheme 1: Reaction of an amino acid with Trichloromethyl Chloroformate (Diphosgene) to produce N-Carboxyanhydrides.

  \[
  \begin{align*}
  \text{H}_2\text{N} & \quad \text{O} \\
  \text{R}^1 & \quad \text{OH} \\
  + & \quad \text{Cl} \quad \text{Cl} \quad \text{O} \quad \text{Cl} \\
  \text{Cl} & \quad \text{Cl} \quad \text{O} \quad \text{N} \\
  \text{R}^1 & \quad \text{OH} \\
  \rightarrow & \quad -\text{HCl} \\
  \end{align*}
  \]

• What information do you need to know about the chemical in the above scenario prior to ordering?

• In your groups, answer the questions for each section:
  o Procurement
  o Central Receiving & Storage
  o Transport/Distribution
  o Tracking and Management
CMS© Software:
Inventory Setup, Tracking, Audits, & Removals
Establish Working Groups and Choose Practice Training Topics
Reminders & Adjourn
Standard Operating Procedures (SOPs)
What are SOPs?

• Formalized written instructions used to standardize procedures
  o Provide employees with a reference to common practices, activities, or tasks
  o Written to the level of someone who is doing something for the first time

• Example:
  o The international quality standard ISO 9001 requires that standard operating procedures are used in any manufacturing process that could affect the quality of the product
What is Required to Make SOPs Work?

- A policy from leaders requiring the creation and use of SOPs
- A management system for checking and validating SOPs
- Periodic review and revision of SOPs
- Training on SOPs for students and employees
Possible SOPs for Laboratories and Chemical Facilities

- Visitor access
- Employee training
- Medical surveillance
- Respiratory protection and fit
- Eye protection
- Ventilation system maintenance
- Receipt, transport, and storage of chemicals
- Accident and emergency response
- Spill cleanup
- Waste management
- Hazardous material handling
- Special procedures: radiation, biosafety, lasers...
Types of SOPs for Inventory Management

- Chemical:
  - Procurement
  - Receiving
  - Storage
  - Transfer
  - Transport
  - Use/Handling
  - Waste
  - Audits/Reporting
  - Access Control
  - ....etc.
SOPs Related to a CIMS

- Procurement
  - Surplus sharing
  - Request
  - Authorization and Approval
  - Ordering

- Receiving
  - Labeling and barcodes
  - Entry into database

- Storage of chemicals

- Maintenance & Tracking of chemicals
  - Relocation and other changes
  - Disposal and removal from database

- Audits
  - Including discrepancy follow-up

- Electronic back-ups

- Access Control

- Reporting and Information Sharing
  - Lab users, Emergency responders, Department heads
Example SOPs for Inventory Management

- Please refer to the handouts
  - These and others are also available on the internet:
    - https://ehs.mit.edu/site/sites/default/files/sop_0023.pdf
    - http://ehs.unl.edu/sop/s-gen_chem_guidance_o_r_d_u_s.pdf
Overview of Chemical Procurement Best Practices
Procurement: Key Principles

- Planning
- Substitution
- Source reduction
- Surplus sharing
- Ordering Chemicals
- Receiving Chemicals
Procurement:
How it relates to Inventory Management

• How is procurement involved in inventory management?
  o Planning
  o Ordering Chemicals
  o Receiving Chemicals
  o Surplus sharing
Planning, Authorization, and Approval

- What are important considerations when planning the procurement of chemicals?
  - Need – do you already have enough of this chemical?
  - Availability and amount
  - Cost
  - Hazards
  - Storage considerations
  - Perform Risk Assessment

- Chemical procurement authorization and approval
  - Who needs to know?
    - Lab Manager, Department Head, Institution Head
  - What should they check?
    - Laws and regulations
    - Storage and Use conditions
    - Training required
    - Legitimacy of request and supplier

What else might be important to your institution?
Procurement: Surplus Sharing

• How it works
  o Extra chemicals in good condition are posted to a list
  o Procurement requests go first to the surplus list
  o If in stock, requester gets option of taking surplus chemicals for free

• Barriers to surplus sharing
  o Requires coordination with centralized procurement
  o Chemical collecting, hoarding
  o Requires training

• Benefits
  o Reduces cost, waste, and hazards

• Do you currently use a surplus sharing method in your lab, department, institution?
Procurement: Ordering Chemicals

Ordering Procedure
• Centralized system
  o Ensure proper planning
  o Tracking and accountability

Things to Consider
• Costs
  o Purchase
  o Handling
    ▪ Human
    ▪ Monetary
  o Receiving
  o Storage
  o Disposal

Who can/does order chemicals for your lab, department, or institution?
Procurement: Ordering Chemicals

• Know your suppliers
  o Chemical Integrity
    ▪ Storage and Shelf-life
    ▪ Assay expiration, impurities
    ▪ Hazardous decomposition
      • Peroxide-forming chemicals
  o Legitimate/licensed source
  o Company reputation
    ▪ Customer satisfaction
    ▪ Delivery
Procurement Security

• Examples from Academia
  • 2013 – University chemistry researcher arrested for making explosives\(^1\)
  
  • 2011 - Chemistry graduate student accused of running meth lab\(^2\)
  
  • 1991 – University researcher arrested for attempted murder using toxic chemicals purchased through the university, added them to nasal spray\(^3\)

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\(^1\) http://www.sacbee.com/2013/01/25/5139868/uc-davis-researcher-accused-of.html


\(^3\) "Researcher Awaits Fate in 'Mad Scientist' Case," The Los Angeles Times (14 July 1991): A8.
Procurement Security

• “Red flags” – potential signs that chemical purchase may be for illegitimate purpose
  • Volume/amount, frequency, type not consistent with usual purchases or work being done
  • Request for rush delivery or shipping to unusual location
  • Request to falsify documentation or circumvent normal procurement process
  • Vague or inconsistent reasons given for any of the above
Draft Chemical Procurement SOP
Writing Draft SOPs

• Use the format provided to write a draft SOP that can be implemented at your institution for chemical procurement
  - Incorporate use of the CIMS database tool when useful

• Remember, there is more to a Chemical Inventory Management System (CIMS) than just the database tool
  - A CIMS is a set of policies, procedures, and tools for chemical management
  - Multiple Standard Operating Procedures (SOPs) will be required to support an effective CIMS
Standard Operating Procedures (SOPs): Procurement

• Procurement:
  o Ask yourself: Who, What, Where, When, and How
  o What other topics might be covered in this SOP:
    ▪ Receiving
    ▪ Inventory tracking
    ▪ Approvals and CSS checks

• Fill out the SOP – procurement outline:
  o Purpose
  o Scope
  o Responsibility
  o Procedure
Reminders

• This is the start, not the finish
  o A beginning draft of the SOP

• Be specific
  o SOPs should be written at the level of someone who is doing something for the first time

• Review and make updates regularly
  o Every 6-12 months

• Employees require training on SOPs

• You will have a chance during this workshop to test and revise your draft SOPs
CMS© Software Practice Exercise
Overview of Chemical Storage
Best Practices
Chemical Storage and Use in Laboratories: Overview

- Key Principles of chemical storage and use
- Related to inventory management
  - Storage Basics
  - Chemical Use
  - Access control
  - Location Examples
Key Principals of Chemical Storage and Use in Laboratories

• Prevent Accidents/Harm
• Prevent Environmental Exposure

• Requirements:
  o Labeling and Chemical segregation
  o (Material) Safety Data Sheets (SDS)
  o Personal Protective Equipment (PPE)
  o Emergency Equipment
General Storage Guidelines

- Large containers on bottom shelves
- All containers properly labeled and closed
- Keep area and containers clean
- Fasten shelves, storage cabinets to wall or floor
- Shelves have a lip and/or rod
Chemical Storage in Laboratories: Basic Concepts

- **Storage Location(s)**
  - Design facility to:
    - Minimize contamination
    - Maximize containment

- **Storage type and design**
  - Flammable cabinet, vented cabinet, chemical resistant shelving, self closing doors, refrigerated storage

- **Segregation**
- **Labeling**
- **Access Control**
Chemical Storage in Labs:
Location and Accessibility

• **Should be close enough to working area yet far enough away from additional hazards**

• **Overall Considerations:**
  o Indoors vs. outdoors storage
  o Room ventilation
  o Air flow direction
  o User traffic patterns
  o Hazards
    ▪ Monitoring and alarms
    ▪ Ventilation
    ▪ Emergency systems
    ▪ Compatibility & segregation
  o Close to working area, yet separated from additional hazards
  o Egress
Chemical Storage in Labs: Basic Guidelines

- Suggested properties for chemical storage:
  - Chemical resistant
    - Shelf, joints, walls, locks, etc.
  - Sealed
    - Vapor or liquid-tight
  - Shelf lips or cross bars
  - Self closing doors
  - Lockable doors
  - Wall or floor anchors
  - Secondary containment
Chemical Storage in Labs: 
Storage Types and Design

- Many types are available
  - Flammable cabinet, vented cabinet, explosion proof refrigerators and cabinets, corrosive/acid cabinets
  - Determine chemical properties to select appropriate storage

- Flammable vs. Combustible liquids
  - Need for flammable storage is driven by:
    - The class of flammable or combustible liquid present,
    - The total quantity, and
    - Location of these liquids

*The National Fire Protection Association (NFPA)*
Vented Cabinets: Other Uses

- **Corrosive/Acid vented cabinets**
  - Vented to prevent rusting and corrosion
  - Connecting to an existing exhaust such as a fume hood is strongly recommended
  - PVC is the best material for venting of corrosives
  - Constructed in Wood or Polyethylene
    - Polyethylene recommended-can be welded at the seams to provide better spill protection
  - Metal cabinets are the final option
  - Acids should generally not be stored in a Flammable Storage Cabinet due to the corrosion of the cabinet and incompatibility with organic solvents
  - Typically Blue in color

- **Poison/Toxic Chemical Storage Cabinets**
  - Must be lockable
  - Secondary containment
  - Some should not be vented outdoors due to potential health hazards
  - Refer to the MSDS and/or manufacturer for storage requirements as well as EPA regulations and restrictions
  - Most often green in color
    - However, poison storage cabinets are most often white or gray

Compressed Gas Cylinders

- Keep cylinders outside and pipe into lab
- Store cylinders in lab
- Secure (chain/clamp)
- Screw down cylinder caps
- Store in well-ventilated area
- Separate and label empty cylinders
- Separate incompatible gases
- Transport safely
Chemical Storage in Labs: Refrigeration

- Refrigerator Types
  - Household refrigerator/freezers
    - NOT safe for flammables
  - Flammables-safe refrigerator/freezer
    - May contain flammables, but NOT safe to be in areas with flammable vapors
  - Explosion-proof storage

- Proper refrigerator/freezer signage

- Precautions
  - Provide stable/backup power
  - Not all refrigerants are completely safe
    - Toxicity, flammability, and physical hazards
  - Do not store peroxide-formers in refrigerators
  - Defrost occasionally to prevent trapping chemicals in ice formations
Chemical Storage in Labs:
Location and Segregation Examples

**STORAGE GROUPS**
Store chemicals in separate secondary containment and cabinets

A  Compatible Organic Bases
B  Compatible Pyrophoric & Water Reactive Materials
C  Compatible Inorganic Bases
D  Compatible Organic Acids
E  Compatible Oxidizers including Peroxides
F  Compatible Inorganic Acids not including Oxidizers or Combustible
G  Not Intrinsically Reactive or Flammable or Combustible
J  Poison Compressed Gases
K  Compatible Explosive or other highly Unstable Material
L  Non-Reactive Flammable and Combustible, including solvents
X  Incompatible with ALL other storage groups

Cabinet 1

Cabinet 2

Cabinet 3

Outside Storage Cabinet 4

Shelf 1
Chemical Storage in Labs: Labels & Signage

- Segregation and secondary containment
- Shelf labels
- Door Signage
  - “Flammable—Keep Fire Away”
- Hazard identification
Signs and Labels

- **Door Signs**
  - “Flammable—Keep Fire Away”

- **Hazard identification**
  - For emergency responders

- **Segregation and secondary containment**

- **Cabinet and shelf labels**

- **Container Labels**
Container Labels

Symbols (Hazard Pictograms)

ToxiFlam (Contains: XYZ)

Danger! Toxic If Swallowed, Flammable Liquid and Vapor

Do not eat, drink or use tobacco when using this product. Wash hands thoroughly after handling. Keep container tightly closed. Keep away from heat/sparks/open flame. Store in a cool, dry, well-ventilated area. Grounding/earthing equipment must be used. Take precautionary measures against static discharges.

Product Identifier and ingredient disclosure

Signal word: "Danger" for the more severe hazards, and "Warning" for the less severe hazards

Hazard Statement

If swallowed: Immediately call a poison control center or doctor/physician. Rinse mouth.

Supplemental Information

Chemical, CO₂, or "alcohol" foam.

Precautionary Statement (prevention, response in cases of accidental spillage or exposure, storage, and disposal)

Supplier Identification
Container Labels
Chemical Use in Labs: Basics

• What should have a barcode vs. a label?
  o Secondary/Transfer container(s)
  o Piping/tubing with chemicals
  o Sample preparation
    ▪ Standards
    ▪ Synthesized samples
• Empty, disposal, transfer reporting
• Chemical Sharing or donating
• Quantity tracking
• Access Control
Empty, disposal, transfer reporting: Example Form

**CHEMICAL TRANSFER/REMOVAL FORM**

The barcode label stays with the chemical container throughout the life of the container.

Chemical container(s) to be THROWN AWAY as empty or REUSED, or otherwise DISPOSED of:
Remove barcode from container and attach to form or write or type the barcode number in the left column of the table below. Enter or write "disposed" in the right column of the table below.

Chemical container(s) to be TRANSFERRED from one location to another:
Write or type the barcode number in the barcode field and the new location in the space provided.
Only report permanent chemical moves. Do not report short time lends/borrows. If a chemical is delivered to the wrong location and later moved to the correct location, use this process to inform GIS of the new location.

<table>
<thead>
<tr>
<th>Barcode or Barcode Number</th>
<th>Chemical Name and CAS</th>
<th>Transfer: Enter new location (Bldg/Rm)</th>
<th>Barcode or Barcode Number</th>
<th>Chemical Name and CAS</th>
<th>Removal: Enter disposal location (Bldg/Rm)</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Name: ____________________ Dept: ____________________
Phone Number: ____________________ Bldg/Rm: ____________________
Chemical Storage in Labs: Access Control

• What items should have controlled access?
  o Highly toxic
  o Expensive
  o Potentially dangerous
  o Chemicals Of Concern or Chemicals Of Interest
  o Chemical Weapons Convention control chemicals

• What might you add to this list?
Safe and Secure Storage Facilities

- Store bulk chemicals in buildings with few people
  - Access restricted to trained, trusted, and responsible personnel
  - Divide into chemically compatible groups
  - Provide safety equipment and alarms
  - Spill protection and secondary containment
Chemical Containment and Defense in Depth

- Concentric circles of protection for safety and security
  - Facility grounds
  - Building
  - Laboratory
  - Storage Cabinet
- Maximize containment/separation
- Access becomes increasingly controlled
  - Redundancy is key
Access Control

• Access limitations depend on the material or information
  o More control of access for dual-use or other chemicals that present a security concern

• Lock areas, rooms, cabinets
  o Control of keys, combinations, codes

• Label areas “Authorized Personnel Only”
  o Means of identifying authorized personnel
    ▪ Challenge unfamiliar people in restricted areas

• Authorized personnel
  o Trusted, background check
  o Trained
  o Legitimate need
Maintain an Accurate Inventory of Stored Chemicals

- Maintain Accountability
- Chemical storage inspections
- Inventory Audits

- **Prevent Orphan Chemicals**
  - Does not have an owner
  - Does not have an apparent use or purpose
  - Surplus or waste
  - Sometimes not labeled or identified
    - Unknown orphan
Draft Inventory Storage SOP
Standard Operating Procedures (SOPs): Chemical Storage

• Waste and Disposal Procedures:
  o Ask yourself: Who, What, Where, When, and How
  o What other topics might be covered in this SOP:
    ▪ Labeling and barcodes
    ▪ Transportation
    ▪ Inventory tracking
    ▪ Storage
    ▪ Audits and reporting

• Fill out the SOP – Chemical Storage Template
  o Purpose
  o Scope
  o Responsibility
  o Procedure
Chemical Deliveries or Central Receiving: Basic Considerations

• Basic Considerations
  o Trained personnel
  o Storage requirements
  o PPE
  o Emergency Equipment
    ▪ First aid, spill kit, etc.
  o Inventory control and tracking
  o Transport within the facility
    ▪ Use outer protective container
Chemical Deliveries or Central Receiving:

Advantages

- Centralized location
  - Easier chemical tracking
  - Easier reporting
- Permanent employees (less turnover)
  - Proper training, experience, and knowledge
- Coordination for emergency response
- Adequately equipped to handle different types of chemical deliveries
- Equipment for local transport and distribution
- Access control
- Safety equipment/facilities maintained
Integration and Communication with Procurement

- Verification of delivery
  - Track pending and completed deliveries
  - Verify delivery matches order upon receipt
    - Procedure for communication with ordering/purchasing personnel

- Inventory tracking
  - Items could be entered into a chemical inventory database
  - And/or database could be kept by the end-users/purchasers
Training for Personnel that Receive Chemical Deliveries

- Basic First Aid and CPR
- Hazard Communication
- Chemical/Biological Health Effects
- Hazard/Emergency Response
- Biosafety and biosecurity
- Spill Response
- Forms of PPE and Appropriate Use
- Fire Prevention/ Fire Fighting
- Ergonomics/Equipment for Safely Moving Materials
- Safe and Secure Transport of Chemicals for Internal Distribution
Central Receiving for Chemical Deliveries

• Set up to handle different delivery methods
  o Domestic mail, commercial delivery, express mail, direct shipment, bulk shipment

• Areas specially equipped to take chemical deliveries
  o Safety equipment and PPE
  o Prevent and clean-up spills
  o Temporary storage requirements
Equipment for Chemical Receiving

• Spill kits
  o Types and size/quantity appropriate for the deliveries that take place

• Fire suppression
  o Sprinkler system and/or water hose
  o Fire extinguishers
  o Smoke and heat alarms

• First aid kits

• Eye wash and shower

• Personal Protective Equipment (PPE)
  o Types appropriate for the chemical deliveries that take place
Central Receiving and Storage

**Small Facility**
- 1- 50 Deliveries per day
- Few locations
  - Department or building
  - Delivery to labs
- Fewer manager and employee support
- Smaller quantity of chemical storage

**VS.**

**Large Facility**
- 50+ deliveries per day
- Varying locations and deliveries
- May require additional vehicle transportation
- Many employees and managers with varying training and experience
- Large quantity of chemicals
- More diverse chemical property requirements
- Extensive emergency response training required
Basic Considerations for Chemical Receiving

- Where, how, who opens shipment?
  - Should package be opened in a fume hood?
- Is the material hazardous?
  - Radioactive, flammable, reactive, explosive, etc.
    - Is it labeled properly?
    - Is it packaged properly?
    - Has the vendor provided SDS?
- Is monitoring equipment needed?
  - Toxic gases
  - Radioactive materials
- Is special storage needed on receipt?
  - Example: refrigeration
  - Separation of incompatible items
Chemical Deliveries or Central Receiving: Storage Location

When determining the location of the central receiving and storage areas consider these items:

• Safety features designed into facility
• Location of the facility relative to common deliveries
• Accessibility
  o Location within the facility
  o Access Control/Restriction
  o Delivery requirements/types - Loading dock, ramp
• Nature of chemical operations/storage
  o Storage requirements for chemicals
• Building and fire codes
• Laws and Regulations
• Personnel expertise and training
Chemical Deliveries or Central Receiving:

Storage

• Depending on University layout and size
  • Decide type/size and location of the central receiving/storage facility

• Annual Training for **ALL** Employees
  • Understand guideline for ordering and receiving chemical
    ▪ Loading dock, receiving room, laboratory and clerical personnel
Chemical Deliveries or Central Receiving: Chemical Storage and Containment

- Spill protection & secondary containment:
  - Recessed noncombustible floors,
  - Containment so a leak from one container does not contact other containers,
  - Raised steel or fiberglass grating,
  - Removable grating and supports for clean up of any leaked material
  - Separate secondary containment to prevent mixing of spilled/leaked materials

- Store large volumes of chemical waste in buildings with few people
  - Access restricted to responsible personnel
  - Divide into chemically compatible groups
  - Provide safety equipment and alarms
Chemical Deliveries or Central Receiving:
Storage of Bulk Chemicals

- **Bulk Chemical Deliveries**
  - Solvents, fuels and other hydrocarbons common
    - Delivered by railcar or tanker truck
  - Transfer equipment should be intrinsically safe
    - Transfer personnel should have special training
    - Proper electrical grounding and bonding of equipment
  - Have a designated delivery location or facility
    - Locate away from general employee population
    - Fire suppression system or fire response team
    - Inspect equipment periodically, replace as needed
    - Outdoors and well ventilated
Chemical Deliveries or Central Receiving: General Storage Basics

- Separate incompatible chemicals
- Separate flammables and explosives from ignition sources
  - Flammable storage cabinets
- Large containers on bottom shelves
- All containers properly labeled and closed
  - Label with compatibility group
- Use secondary containment
- Wipe-off outside of container before returning to storage area
- Secure Chemicals Of Concern (COC)
- Fasten shelves to wall or floor
- Shelves have a lip and/or rod
Chemical Deliveries or Central Receiving: Compressed Gas Cylinders

- Keep cylinders outside and pipe into lab
- Store cylinders in lab
- Secure (chain/clamp)
- Screw down cylinder caps
- Store in well-ventilated area
- Separate and label empty cylinders
- Separate incompatible gases
- Transport safely
Chemical Deliveries or Central Receiving: Hazard Signs

- Hazard Signage
  - All chemical storage areas require appropriate hazard signs:
    - Entrance, cabinets, shelves, etc.
  - Entrances to building and rooms require emergency response signage
    - What hazards are present
    - Whom to contact in case of emergency
    - Fire and police response phone numbers
Chemical Deliveries or Central Receiving: Storage Labeling and Packaging Basics

- Clearly state hazard
  - Label (GHS) – bottle and package

- Protect sample integrity
  - Label (fragile, Etc.)
  - Bump, shock, drop

- Elements/Nature
  - Temperature
  - Moisture/Humidity
  - Sunlight
Chemical Deliveries or Central Receiving:
Labeling Basics

• Manufacturer's Chemical bottle label
• In-use sample/reaction glassware
• Transfer/Secondary storage containers
Central Receiving and Storage:

Transport Labels

- Identify material
  - Proper, full chemical name
  - ID codes (e.g., UN number)
  - Quantities, concentrations, number of containers
- Hazard class according to regulations
  - Transport symbols
  - Proper universal symbols
- Emergency information
- Contact names and phone numbers
- Languages
Chemical Deliveries or Central Receiving: Transporting and Packaging

- Container within a container
- Specific requirements depend on material and other factors

External/Shipping Packaging

Hand Carry Example
Other Special Considerations

- Example: Dry Ice (Solid Carbon Dioxide)
  - Used to ship biological materials/samples
    - Dry ice is part of the packaging for some shipments
      - Remove before placing in freezer (asphyxiation hazard)
  - Commonly used in chemical research
    - Dry ice is the material being shipped
      - Can cause contact frostbite
Chemical Deliveries or Central Receiving: Internal Transportation

- Determine the safest route and mode of transportation
  - Hand carry, cart, dolly, automobile
- Secondary containment
- PPE and emergency equipment
Chemical Deliveries and Internal Transport or Distribution
Chemical Deliveries or Central Receiving

- Are chemicals stored permanently or temporarily at the same facility that receives deliveries?
  - Requirements for safe and secure storage
Chemical Deliveries or Central Receiving:
Access Control and Security

- Depends on risks
- Label areas “Authorized Personnel Only”
  - Means of identifying authorized personnel
- Authorized personnel
  - Trusted, background check
  - Trained
  - Legitimate need
    - Example: reputable, trusted delivery company and personnel
- Control Access
- Continuous monitoring
  - Cameras, sensors, lighting
- Security system and personnel
- Response plan for specific incidents
Draft Chemical Receiving SOP
Standard Operating Procedures (SOPs): Chemical Deliveries or Central Receiving

• Storage:
  o Ask yourself: Who, What, Where, When, and How
  o What other topics might be covered in this SOP:
    ▪ Receiving
    ▪ Labeling and barcodes
    ▪ Transportation
    ▪ Inventory tracking
    ▪ Audits and reporting

• Fill out the SOP – Storage outline
  o Purpose
  o Scope
  o Responsibility
  o Procedure
Overview of Chemical Inventory Auditing Best Practices
Inventory Audit

• Assures accuracy of inventory database

• Provides visual assessment of chemical condition

• Should be done once or twice a year
  • More often for dual-use chemicals or other chemicals that present a security concern
Physical Inspection is Important

Good!

Not as good...
Inventory Audit Process

1. Physically locate (see) each chemical container in the location being audited
2. Compare list of chemical containers found to the database
3. Note discrepancies
4. Follow up to address discrepancies
Common Discrepancies – What are the Likely Explanations?

• Missing chemicals
  o Item not removed from the database when completely used and/or disposed of as waste
  o Location and/or owner has changed but the database was not updated
  o Lost or stolen
Common Discrepancies – What are the Likely Explanations?

- Chemical containers are present which are not in the database
  - Not entered in to the database when purchased
  - Present because of borrowing or sharing
  - Location and/or owner has changed but the database was not updated
Common Discrepancies – What are the Likely Explanations?

• Some other information about the item is incorrect such as name of chemical, owner, hazards, container size, etc.
  
  o Information was entered into the database incorrectly at the beginning
  
  o Failure to update the database to reflect a change
Follow Up

• Contact chemical owner

• Report to the proper authorities

• Track discrepancy trends

• Determine the root cause of the discrepancy

• Review and revise policies and SOPs accordingly
Inventory Reporting:
International Regulations

- **OPCW CWC**
  - Advance notification and annual of exports of Schedule 1 chemicals to other state parties
    - “CY 2013 Annual Declaration on Anticipated Activities (ADAA)”
    - Must report all exports of any quantity of a Schedule 1
  - CWC End-Use Certificate Report for non state parties
  - Production of Intermediate Schedule 1 Chemicals Declaration
    - More than 100 grams aggregate of Schedule 1 chemicals in a calendar year
  - **Global Chemical Industry Compliance Program (GC-ICP)**
  - Schedule 2: “Persons (including plant sites and trading companies) that imported or exported in excess of the following quantities of a Schedule 2 chemical “
    - 1 kg of BZ;
    - 100 kgs of PFIB or Amiton (and corresponding alkylated or protonated salts); and
    - 1 mt of Schedule 2B chemicals.
  - Schedule 3: “Persons (including plant sites and trading companies) that exported or imported in excess of 30 metric tons of a Schedule 3 chemical”

- **REACH**
  - Manufacturers/Importers:
    - Substances manufactured/imported above 1t/y on its own or in preparations
    - Substances in articles if present above 1 t/y and intended for release (for example, ink a pen);
    - Monomer substances if present at a concentration above 2% in a polymer (for polymers, monomers shall be registered)

**NOTE:** Your country reporting requirements may be different than those above.
Inventory Reporting
Example US Regulations

• Environmental Protection Agency (EPA)
  o Emergency Planning and Community Right-to-Know Act (EPCRA) hazardous chemical storage reporting
• Department of Homeland Security (DHS)
  o Chemicals of Interest (COI)
• Centers for Disease Control and Prevention (CDC)
  o Select agents and toxins
• Drug Enforcement Agency (DEA)
  o Controlled Substances and List I & II regulated chemicals
• International Building Code
  o Flammable material and other storage limits
• Local Fire Department Requirements
  o Flammable material storage limits
• Veterans Administration (VA)
  o Inventory audit report every 6 months for VA-funded researchers
Inventory Reporting:
Local and National Regulations

• Do you know of local or national regulations for inventory reporting?

• Does your institution require inventory reporting?
Draft Chemical Inventory Auditing SOP
Standard Operating Procedures (SOPs): Auditing and Reporting

• Audit and Reporting Requirements:
  o Ask yourself: Who, What, Where, When, and How
  o What other topics might be covered in this SOP:
    ▪ Inspections

• Fill out the SOP – Chemical Audits and Reporting outline
  o Purpose
  o Scope
  o Responsibility
  o Procedure
CMS© Software Practice Exercise
Reminders & Adjourn
Day 3
CMS© Software Practice Exercise
CMS© Software Exercise: Reporting

- Use each of:
  - Reporting Threshold Chart, and
  - The “Mock Inventory” on the computer

- Perform the following:
  - Report the chemical quantities to your department based on the ‘mock’ regulations in the chart.
  - Based on the Reporting Threshold Chart and the quantities in the “Mock Inventory”, what chemicals are required to be reported?

### Reporting Threshold Chart

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Chemical Name</th>
<th>Reporting Threshold</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>63905-10-2</td>
<td>Sulfuric Acid</td>
<td>50 L</td>
<td>Ban All Acids act of 2012</td>
</tr>
<tr>
<td>76-06-2</td>
<td>Trichloronitromethane</td>
<td>1 g</td>
<td>Right to Know Act of 1995</td>
</tr>
<tr>
<td>464-07-3</td>
<td>Pinacolyl Alcohol</td>
<td>100 L</td>
<td>1980 Control of Dangerous Alcohols</td>
</tr>
<tr>
<td>464-07-3</td>
<td>3,3-Dimethyl-2-butanol</td>
<td>5000 kg</td>
<td>Right to Know Act of 1995</td>
</tr>
<tr>
<td>143-33-9</td>
<td>Sodium Cyanide</td>
<td>10 g</td>
<td>1919 Poisons Control</td>
</tr>
<tr>
<td>26628-22-8</td>
<td>Sodium Azide</td>
<td>10 L</td>
<td>1919 Poisons Control</td>
</tr>
<tr>
<td>110-54-3</td>
<td>N-Hexane</td>
<td>50 L</td>
<td>Right to Know Act of 1995</td>
</tr>
<tr>
<td>67-64-1</td>
<td>Acetone</td>
<td>100 L</td>
<td>1980 Control of Dangerous Alcohols</td>
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SOP Evaluations

• Evaluations are needed regularly
  o Are the procedure(s) or steps clear?
  o Are there steps missing?
  o Are the procedures specific enough to accomplish the task properly by ALL employees?

• Re-evaluate
  o Has the procedure(s) changed?
CIMS Implementation
CIMS Implementation: Overview

- What is an implementation plan
- CIMS Implementation plan - outline
- Implementation Phase/Stage
- Main Elements used to create an CIMS Implementation Plan
- CIMS Action plan
What is an Implementation plan?

What Now?
What Next?
Definition of an Implementation Plan

• A formalized document that:
  o Includes detailed listing of activities, costs, expected difficulties,
  o Schedules that are required to achieve the objectives of the strategic plans

• Internal to business
  o New method for improved production/formulation
  o New policies/procedures

Little of Why, **lot of How**
## Implementation Phases

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<th>Phase/Stage General Descriptions:</th>
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<td><strong>Initial/start-up phase</strong></td>
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<td><strong>Early/trial phase</strong></td>
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<td><strong>Development/adoption phase</strong></td>
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<td><strong>Post-test expansion phase</strong></td>
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<td><strong>Broad integration phase</strong></td>
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<td><strong>Mature phase</strong></td>
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<td><strong>Outreach phase</strong></td>
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You are here.
Main Elements of an Implementation Plan

- Policies & Processes
- Assign Roles & Responsibilities
- Establish Authority/Structure
- Train CMS© Software Users & Staff
- Physical Inventory: Chemical Inventory and Storage Areas
- CMS© Software Promotion/Awareness
- Action Plan
CIMS Policies/Processes (P&Ps):

- CIMS policies & processes (P&Ps)
  - Ordering
  - Audits
  - Changes/Removal
  - Access/authorizations
  - Other (varies with organization)
- Integrate with other P&Ps
  - Other P&Ps for safety and security
  - Cost accounting
  - Shipping and storage
  - Communications, password management, and IT systems
  - Change management and incident/discrepancy follow-up
  - Periodic performance evaluation
  - Other (varies with organization)
Assign Roles & Responsibilities

- CIMS Managers, Auditors, Committee
- CMS© Software Users
  - Laboratory staff
  - Storage/Stock room personnel
  - Ordering or receiving personnel
- CSSO or SS Official
- CSS Committee
- CIMS investigator/official
Establish Authority/Structure

Example:

- CSS Committee
- CSSO, SS Official, ESH, etc.
- Lab Managers
- Professors/PIs
- Students
- Technicians/staff
- Department Admin
- College Admin
Training Users & Staff

- Design CIMS training program
  - Training responsibilities, types, schedule, requirements, etc.
  - CMS® Software training
- Designate roles & responsibilities
  - For CIMS/CSS training
- Determine resources/support needed for training
  - Consumables (barcodes, forms, etc.); equipment (barcode readers, computers, etc.); staff (admin, trainers, etc.)
- Apply for funding/grants
- Create CIMS training materials
- Training
  - Train Trainers (initial trainers)
  - Identify trial stage trainees
  - Train trial stage users/admin
  - Evaluated and Periodic training review/updates
  - Periodic refresher trainings and any new users
  - Create new training (expanding CIMS to new departments, etc.)
Chemical Inventory and Storage Areas

- Survey storage areas of designated labs/stores
  - Check/fix bottle labels
  - Check/assign storage groups to chemicals and store properly
  - Determine dates/age of chemicals
  - Identify/assess orphan chemicals
  - Dispose of old/unknown chemicals responsibly
  - Assign owners to each chemical container
  - Identify/label all hazards for each chemical
  - Barcode chemicals & enter into CMS© Software

- Assess storage areas and improve as needed
  - According to storage groups, central vs. lab stores, labs/users, etc.

- Enter new chemicals into CMS© Software as they are received
CIMS Awareness of Benefits

• Purpose
• Benefits
  o Reduce operating costs, increase safety & security, improve research/quality/efficiency, professional development (staff & students), institutional leadership & controls. Simple/free CMS© Software for ease of use & open platform/software. Adaptable to institution structures/policies

• Limitations
  o Vigilant updating needed, dependent on user input & training, “starter kit” with fundamental features only

• Grant/funding/collaborative opportunities
  o CSP, International organizations, Ministries, professional societies, small/medium business
Chemical Inventory Management System: Implementation

How to implement a CIMS at your institution?
How would you eat a dinosaur?
Chemical Inventory Management System: Implementation

- How to implement a CIMS at your institution?
- One bite at a time!
CIMS Action Plan
## Example of Action Plan: Table

<table>
<thead>
<tr>
<th>Lead Person</th>
<th>Task Item</th>
<th>Description</th>
<th>Timeline</th>
<th>Completion/revision date</th>
</tr>
</thead>
</table>
| Organization      | Structure    | Create an organization structure relating how the CIMS administrators fit into this structure | • Draft – 2 months  
• Final 4 months                                    | • Jan 2015  
• March 2015                           |
| CIMS pilot        | Find a lab to pilot the CIMS and document the comments and suggestions | • Find pilot lab(s)  
• Train pilot lab(s)  
• Monitor CIMS pilot  
• Survey users  
• Summarize survey/comments and write report  
• Update CIMS | Start March 2015                           | Completion estimate Dec 2015 |
| Policies and SOPs |              |                                                                            | • Draft – 1 months  
• Final 2 month                                    | • Dec 2014  
• Jan 2014                           |
| Educate Leaders   | Create presentation to educate leader of the benefits of a CIMS and how to get it going in your institution | • Outline  
• Draft presentation/speech  
• Final presentation/speech  
• Presentation date |                                                        |
| Others.....       |              |                                                                            |                                                        |
Example of Action Plan: Chart

- **Timeline & commitment:**
  - initiate & complete actions, ongoing actions, persons responsible

<table>
<thead>
<tr>
<th>Lead Person(s)</th>
<th>Item</th>
<th>Description</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(name)</td>
<td>(##) Description</td>
<td>January</td>
<td>February</td>
</tr>
<tr>
<td>Kalid ibn Yazid</td>
<td>1 Chemical Storage &amp; Inventory:</td>
<td>check current inventory/storage (physical a reconciliation)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>b remove spent/orphan chemicals</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>c separate into compatible groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d chem's into secondary containment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hans Fischer</td>
<td>2 CIMS Pilot</td>
<td>a input chemicals into CIMS and barcode</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b user survey/feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c improvements (from feedback)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marie Curie</td>
<td>3 Collect MSDS info</td>
<td>a organize master file/records</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b distribute copies to lab areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jabir ibn Hayyan</td>
<td>4 Finish Developing SOPs</td>
<td>a Procurement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b Storage and Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c Adding/Removing</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>d Transportation</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>e SOP Reviews &amp; updating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al Einstein</td>
<td>5 Training:</td>
<td>a General Lab orientation/new lab users</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b CIMS Administrator/User Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Develop Training curriculum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 CIMS Full Launch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CIMS Action Plan

• Information collected from the creation of an implementation plan is used to create a chart or table
• Should demonstrate a quick look at all the items/tasks that need to be accomplished for CIMS implementation, the persons responsible for tasks, and the overall timeline of implementation
Next steps

First Steps

Second Steps

Implementation

Start

Finish

• Training
• Draft SOP
• Pros and cons

Lets break this down
CIMS Action Plan Exercise

• Use the lists you created for First – Third Steps
• Consider other tasks that will need to be done
  o Break down all tasks to sub-tasks and milestones
• Designate the persons/teams responsible for seeing the tasks are done
• Identify the resources needed to perform the tasks
• Consider interdependencies between other tasks, approvals, collecting resources, etc.
• Determine the times for each task/subtask:
  o When to begin,
  o How much time is needed,
  o If repeated... how often and when,
  o When to be finished.
• Create a chart/table/diagram of Action Plan
  o Show all information and interdependencies
First Steps

• Think about what you will need to do when you get back to your institution.

• What are your **First** steps to implement CIMS?
  o Think about **YOUR** institution structure

• Make a list of all your first steps then try to order them from 1\textsuperscript{st} - n\textsuperscript{th} task. Compare and discuss with your group
Example First Steps

- Promote CIMS to Department Head
- Draft Timeline
- Draft Implementation Plan
- CIMS Pilot Study
- Promote CIMS to Lab Managers/Professors
- Draft Training Material
- Pilot Lab User Training
- Design Roles & Responsibilities
- Chemical Inventory Policies
Second Steps

• Think about what you will need to do when you get back to your institution.

• What are your Second steps to implement CIMS?
  o Think about YOUR institution structure

• Make a list of all your second steps then try to order them from 1\textsuperscript{st} - n\textsuperscript{th} task. Compare and discuss with your group
Example Second Steps

- Promotion to Department Head
- Draft Action Plan
- Draft Implementation Plan
- Pilot Study Evaluation
- Promote CIMS to Lab Managers/Professors
- Draft Training Material
- Apply for grant opportunities
- Chemical Inventory Survey
- Establish CIMS Admins
Activity Discussion

• Did you notice that some of your first steps are also part of your second steps?

• Did you (or might you) repeat any of the steps later on?
“Swim Lanes” Activity: Part 1

- List your first and second step items in the provided chart
- Add any third steps you can think of

<table>
<thead>
<tr>
<th>Implementation Focus</th>
<th>First steps (phase one)</th>
<th>Second Steps (phase two)</th>
<th>Third Steps (phase three)</th>
<th>Future...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policies and SOPs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate Leaders (promotion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others.....</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### “Swim Lanes” Activity: Part 2

- Shade or mark the areas

<table>
<thead>
<tr>
<th>Implementation Items/Focus</th>
<th>First steps (phase one)</th>
<th>Second Steps (phase two)</th>
<th>Third Steps (phase three)</th>
<th>Future...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Structure</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Policies and SOPs</td>
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</tr>
<tr>
<td>Educate Leaders (promotion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Creation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Implementation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Inventory</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Reminders & Adjourn
CMS© Software Teach-Back - prepare for presentation
Day 4
CMS© Software Teach-Back - prepare for presentation
Reminders & Adjourn
Day 5
Group Presentations: Teach-back
Discussion & Sharing: Ideas for successful CIMS & CSS Implementation
Next Steps & Conclusions
Follow Up & Implementation

- Follow up plan:
  - **Periodic:** We will send an email for progress updates and to help answer questions that arise in implementation:
    - 1 month, 3 months, 6 months, and 1 year
    - Update on CIMS implementation progress and CMS© Software use:
      - SOPs status
      - Personnel training status
      - Inventory database status (examples):
        - Entry of labs into Master Inventory
        - Assigning Ownership of all chemicals
        - Identifying chemicals of concern
      - Chemical storage status (examples):
        - Segregation
        - Use of recommended cabinets & storage units
        - Secondary containment
        - Access controls
        - Protection of Chemicals of Concern
    - Update on chemical management actions (examples):
      - Assignment of personnel duties for chemical management
      - Disposal of old chemicals
      - Minimizing “Orphan” chemicals
  - **Ongoing** coordination & support:
    - CMS© software troubleshooting
    - CMS© software upgrades
    - CMS© software Manual/information updates
Adjourn & Thanks

Please fill out the “Feedback” forms