



Preparedness & Security

Chemical Environmental Management System

Updated January 2006

Summary: As part of an EPA settlement agreement from a 1997 inspection, the University of New Hampshire's Chemical Environmental Management System was born. It is a web based system able to quickly retrieve updated lists of hazardous chemicals stored anywhere on campus. The system, developed by the UNH Research Computing Center (RCC) and the UNH Department of Environmental Health and Safety (EH&S), is designed specifically for colleges and universities and has gone well beyond its original intentions. It not only serves as an environmental management tool for faculty, staff, students, and emergency responders on the UNH campus, but it can also serve the same function for any campus around the country. The UNHCEMS provides a web-based solution to chemical management, safety, and compliance. And, says Brad Manning, Director of EH&S at UNH, "from the standpoint of homeland security, this system dramatically increases the ability of the university to track certain hazardous chemicals. One can query the system and find out within a minute if that substance is on campus and exactly where it is located."



Campus Profile

University of New Hampshire
Durham, NH
UG Students: 10,500
Grad students: 2,000
Resident Students: 5,000
Faculty and Staff: 3,300
Campus Area: 2400 acres
Operating Budget: \$363 million

Project Goals

- Develop and implement a comprehensive on-line EMS for chemical management and other engineering controls.
- Produce comprehensive, up-to-date hazardous material information.
- Create reports on hazardous waste generated per faculty, department, building, etc.
- Provide quick and easy access to Material Safety Data Sheets.
- Increase and sustain compliance with chemical management regulations.
- Improve lab safety by increasing the range of work practice controls.
- Ensure chemicals are not stored indefinitely on campus.
- Optimize chemical purchases, reduce chemical usage in teaching labs, and promote non-hazardous substitutes, if appropriate.

US EPA New England Best Management Practices Catalog for Colleges and Universities
For more information about the catalog and other case studies visit
<http://www.epa.gov/ne/assistance/univ/bmpcatalog.html>

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Description of Issue/Problem

Prior to the establishment of a centralized chemical management system, UNH had no designated unit responsible for tracking hazardous materials on campus or overseeing how they were being managed. Most users purchased their own hazardous materials and they were assumed to be responsible for managing them. When EPA came to inspect the campus in 1997, violations of the hazardous waste regulations were found. This resulted in a fine of \$49,000 and the funding of a supplemental environmental project.

Pre-Project Considerations

- Cooperation of administrators and faculty as well as ongoing financial and administrative support from the University to maintain the system indefinitely.
- A central area designed for receiving chemicals on campus is necessary.
- Ability to order chemicals on-line through a centralized system.
- Resources to perform the initial inventory of all hazardous materials on campus, to barcode all containers, and then maintain them on the system.
- Availability of employees in information technology to work on the project, help create and maintain the system, and to perform back-ups.

Steps Taken

The First Step

- Inventoried all hazardous chemicals on campus. EH&S managed this function and hired several students to assist and barcode every single hazardous chemical on the UNH campus.
- Placed bar codes on all in-coming hazardous chemicals.
- Put inventory data onto an Access database.
- Reviewed commercial software available to manage chemical inventories.
- Purchased a software system that was licensed with Sigma Aldrich and Fisher Scientific.
- Conducted a second chemical inventory and found a 20% discrepancy from what was on the database to what was out in the field. It was determined that the discrepancy came from newly purchased chemicals and chemicals removed and or disposed of.
- Evaluated and found that an in-house system could be better tailored to the University so the commercial system was discontinued. It was not web based and updating the database was difficult for employees not in EH&S.



Interesting Fact

During the first inventory, UNH found 50,000 chemical containers in various sizes and approximately 39,500 unique chemicals on campus.

The Second Step

- EH&S and the RCC at UNH developed an information tracking software named UNHCEMS.
- Central receiving areas were set up – the EH&S Chemical Transfer Station and a smaller one for Chemistry in its Stockroom.
- Faculty, staff, and students who purchased chemicals were trained on how to use the system. Chemical suppliers were informed of how the system works.
- UNH's Chemical Safety Committee designated which chemicals would be on the particularly hazardous chemicals list. There are 4 categories; acutely toxic, select carcinogens, teratogens, and peroxidizable/explosives. These chemicals are highlighted on user inventory sheets to attract the attention of the researchers.

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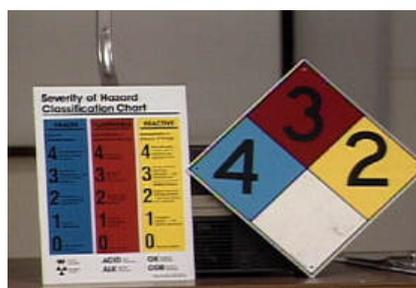
The System in Action

- When chemicals arrive at the chemical receiving area or the chemistry stockroom they are taken out of their box, inspected for integrity, and bar coded. If the chemicals are considered a particularly hazardous chemical, the researcher will also receive a material safety data sheet (MSDS).
- Chemical information is entered onto the central database.
- Materials are delivered in a van to the researcher's lab on the same day the material arrives on campus.
- Hazardous materials that are non-lab *do not* go through central receiving. Suppliers deliver these products straight to the location (i.e., Facilities Department). EH&S conducts periodic audits to obtain inventory information in these areas.
- When bottles are empty, they are brought back to central receiving to have their bar code removed. The item is then removed from the database. Faculty members can also easily update their inventory by clicking on the barcode number and selecting the option to remove it. The item is then removed from the database. EH&S has the ability to audit all such activities.
- EH&S staff periodically use a bar code scanner to verify lab inventories and to assist in inventory updates during lab clean-outs.

System Description & Tools Used

The UNHCEMS system has 10 modules. Users can use one or as many as they like. The modules are:

1. Chemical Inventory Management System
2. MSDS Archive
3. Particularly Hazardous Chemicals
4. NFPA Door Sign Module
5. Compliance Reporting Package
6. Hazardous Chemical Waste Module
7. Emergency Response Module NFPA Diamond Signage
8. Integrated File Manager
9. Community Modules
10. Administration Modules



The system also has special features to include:

- Notice to users (sends alerts to researchers for new features added to the CEMS system).
- Access groups (which may share inventories) allows faculty and staff in a particular department or building to contact each other.



Hardware includes Barcode Scanners

Software includes the Barcode System

Participants

- UNH – Research Computer Center
- UNH – Environmental Health and Safety
 - Includes Central Chemical Receiving
- UNH Vice President of Research – helped to build bridges with the faculty

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- President of the University – supported the program and wanted it to be a model for others across the country.
- Board of Trustees – showed their support for a state of the art system for C/U
- UNH Science Departments (e.g., Chemistry developed a stockroom for central receiving)
- UNH Purchasing Department
- Chemical Suppliers – agreed to make a default “deliver to” address of the chemical receiving area for those orders made through their websites.
- Chemical Shippers – delivery personnel have assisted by looking for packages marked with hazardous labels in an effort to route all chemicals through the chemical receiving area.
- The Local Emergency Planning Committee (LEPC) was involved in the design and implementation of the system.
- Colleagues at Plymouth & Keene State Universities provided valuable input.

Access to the CEMS system is for chemical users, EH&S staff, and local Fire and Police Departments. Each user can develop his own homepage for easy access and information retrieval!

Performance and Benefits

- The project met all the ‘goals’ and more.
- EH&S can now track chemical lifecycles on campus and more effectively manage chemical storage, use, and disposal.
- Research and laboratory staff can use the system to search for small amounts of hazardous materials they don’t want to purchase, but to “borrow” from other researchers. Faculty appreciate the availability of obtaining hazardous materials on the same day, which improves research operations.
- As of August 2003, the system supported 67 departments, 320 chemical users, and 255 lab associates.
- Chemical shippers like the system better as they only need to deliver to a few addresses on campus rather than traveling to many buildings and looking for delivery locations. This also turns out to be a security advantage for the campus which can now direct transporters where chemicals may or may not be delivered.
- Requests for hazardous waste pick ups can be done “on-line”.
- EH&S can quickly identify key waste generators and target education programs on waste reduction at these locations.
- Every three years, chemicals still in the system are evaluated to ensure they do not stay on the shelf indefinitely.
- The *Regulatory Compliance Module* reminds the responsible employee when inspections are due (e.g., satellite inspections, above ground storage tanks).
- The system takes into account security issues and will “hide” the location and type of chemical if the material can be used in potentially dangerous or illegal products.
- Prepares up-to-date door signage for emergency responders.
- Targets training and education of hazardous chemical users.

Financial Info

Initial Costs

- Initial EPA SEP costs estimated at \$150K
- Total project costs = \$322K
 - Labor -EH&S at 181K and RCC at 110K
 - EH&S 10 PT students for 10 weeks = \$64K;
 - RCC Labor 1 FT designer plus part time of other staff members
 - Capital costs - software, and hardware, to include ChiM at 14K, & RCC equipment at \$17K

Maintenance Costs

On going maintenance costs are labor for EH&S and RCC of about \$220K split almost equally between the two to include 1 new FTE for EH&S and 2 back up employees.
A vehicle to deliver and pick up materials is rented from UNH Fleet Services.

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- EH&S personnel can search for an MSDS for each unique chemical on campus and electronically link it to any inventory. This MSDS database is available to all campus personnel.
- CEMS has a related links page that allows users to view UNH's Hazardous Waste Management Plan, take the required Hazardous Waste Training Course on-line, as well as links to several pollution prevention web resources.
- Each user has a dynamically generated homepage based on their roles and responsibilities as identified by EH&S personnel.
- The LEPC received a laptop computer from UNH and access to the system to download the chemical inventory on an as needed basis.
- The CEMS system has a module that generates Tier II Reports.

Lessons Learned

- Speedy delivery of chemicals has not been compromised by the new inventory system.
- Need to educate faculty that if chemicals are not received directly to their lab – that is ok – they will still get their chemicals on a timely basis even though it goes through a central receiving area.
- Researchers can be skeptical over “any form of control” and think the system to be intrusive.
- Spend a lot of time with researchers in promoting the new system.
- Work with suppliers so they ship materials to only a few locations on campus.
- Training has to be on an ongoing basis to deal with the high turnover rate of graduate students and research assistants in the labs.
- Obtain the support of the Purchasing Department and get them involved. Ask Purchasing to include delivery information in new contracts with chemical suppliers.
- The only way to “catch” chemical users who may try to circumvent the system is when a container is found without a barcode. This is typically seen if a lab is moved; an owner requests assistance of EH&S to inventory their materials; or a lab undergoes significant renovation and a hazard assessment is performed.
- The inventory tracks containers, not consumption. In the inventory the container is assumed full until the owner declares it to be empty.

Next Steps

- New modules may be developed to further enhance the system based upon past learning experiences. UNH is looking toward developing a system for radiological and biological inventories.
- The system will not track financial information. Investigating how a chemical accounting system might be integrated with this tool is being looked at for future applications.
- Continue to seek alternatives to using highly hazardous chemicals.
- Build upon the “borrowing and sharing” of research chemicals to reduce unneeded chemicals on campus.

Standardized Barcodes:
Can it be the Future?
Chemical purchasers around the country would declare a victory if chemical manufacturers standardized their labeling and bar coding of all hazardous materials. In this, bar code scanners on any campus could read existing barcodes rather than having to establish individual coding systems.

For Further Information

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Brad Manning, Director EH&S 603-862-2571

<http://www.unh.edu/ehs/CS/>

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Commentary

Brown University in Rhode Island, and the University of Massachusetts in Amherst, MA, are using the UNHCEMS.

The entire UNHCEMS product is customizable for use by other academic institutions. It allows institutions to maintain consistency with their own websites, and choose available features. Contact UNH for costs that include the system that could be kept on the UNH server, training, and maintenance.

Thank you to Chemical Strategies Partnership for information related to this BMP.

Update

UNHCEMS has expanded dramatically since the Homeland Security: Prevention and Mitigation case study was done in 2003. The following features have been added or expanded:

- The compliance module is now being used to collect all fume hood and biological safety cabinet inspection results, and it sends an email reminder to the lab safety officer when the annual inspection is due for each device.
- The compliance module sends automatic reminders when radiation meter calibrations are due, and when it is time to test sealed radioactive sources for leak checks.
- The compliance module has a lab safety survey inspection form that can be filled out online.
- The existing Satellite Accumulation Area, Small Quantity Generator and Above Ground Storage Tank reports are still successfully used in the compliance module.
- UNHCEMS has an extensive radioactive materials module that tracks both sealed and unsealed radioactive sources. The module tracks radioactive decay in real time and allows the RSO to validate what is available to order for each researcher. Each researcher is able to look at their own order history and material usage, as well as viewing their own permit and the authorized users under their permit.
- In collaboration with Keene State College, the Research Computing Center has developed the Public Safety Management Project, which integrates UNHCEMS with another application for First Responders, called Project 54 (<http://www.project54.unh.edu/>).
- Now a First Responder has the ability to view the hazards in the building of a participating UNHCEMS institution.
- The most recent feature added to UNHCEMS is a biological materials module. This module allows an institution to track the biological type, titer, risk group and biosafety level for each organism and recommends the appropriate personal protective equipment for each agent.
- The chemical inventory module has been modified to allow for the integration of PDA's equipped with barcode scanners that allow laboratory or Environmental Health and Safety personnel to verify or make changes to the chemical inventory. For those laboratories that are equipped with wireless networks, the changes can be made in real time.
- Currently, the institutions using UNHCEMS are: UNH, UMASS at Amherst, Brown University, University of Alabama at Tuscaloosa, Keene State College, Plymouth State University, and two New Hampshire High schools.
- UNHCEMS has been completely redesigned to run on local computers under Microsoft Windows.

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