

UNH Leads Development of Environmental Health and Safety Software

Founded in 1866, UNH is a public university located in Durham New Hampshire serving over 16,000 students from all 50 states and 71 countries. UNH comprises 12 colleges and schools including: Liberal Arts; Engineering and Physical Sciences; Health and Human Services; Marine Science and Ocean Engineering; the Carsey School of Public Policy; Thompson School of Applied Science; Peter T. Paul College of Business and Economics; Life Sciences and Agriculture; Cooperative Extension; and the Graduate School. UNH also has an urban commuter campus in Manchester New Hampshire, and a School of Law in Concord New Hampshire.

In 1997, the United States Environmental Protection Agency (EPA) conducted a 3-day audit of hazardous material and hazardous waste management at UNH. This audit was part of a multifaceted effort by the EPA designed to bring all New England colleges and universities into compliance with federal environmental laws. At the time of the EPA audit there was no centralized campus program for chemical ordering and receipt; Principal Investigators and facility managers purchased and managed their own inventories.

The EPA cited UNH for non-compliance with the Resource Conservation and Recovery Act (RCRA) as it relates to hazardous waste, including training and hazardous materials management in various laboratories and storage facilities. With possible fines reaching over one million dollars, the Office of Environmental Health and Safety (OEHS) and key stakeholders set out to find a solution to maintain compliance.

OEHS began looking for an off the shelf inventory management system. At the time there were few choices that could meet the needs of UNH. With the intention to minimize costs and fulfill specific campus needs, UNH decided to develop an in-house web-based chemical information tracking software. The software would be developed by OEHS and the Research Computing Center (RCC) at UNH. With the help of key stakeholders UNH defined the initial goals for the software solution. The initial goals were: facilitate UNH compliance with environmental rules; ensure that hazardous materials are not stored indefinitely on campus; optimize chemical purchases, and reduce chemical use in teaching laboratories through microscale techniques; improve laboratory safety and emergency preparedness; and identify highly hazardous materials on campus and recommend possible less-hazardous substitutions

During the pilot project and initial development, UNH approached the EPA with its' proposed web-based software solution as a key element to reduce the cost of the initial fine proposed by EPA. In 2000, the EPA accepted the settlement reducing the fine to \$49,000 and accepting the environmental software solution, with an estimated initial cost of implementation of \$180,000.

The software program is called UNHCEMS®, and today is a complete hazardous material, environmental management and training software solution.

Development of UNHCEMS® began in the winter of 2000. Initially the pilot project involved a marine biology laboratory and laboratories within the microbiology department. OEHS initiated a large-scale inventory barcoding system across campus: inventorying laboratory chemicals; applying barcodes; and entering chemical container information into the UNHCEMS® system. In addition to the chemical labeling information, chemical containers are linked to the

user/owner, the laboratory where the chemical is used, and manufacturer safety data sheets are uploaded and associated with the container record.

As part of this process two centralized chemical receiving areas were established, one in the Chemistry Stockroom the other at OEHS Chemical Transfer Station. Newly purchased chemicals coming onto campus are delivered by the vendor to one of these two locations where the containers are barcoded and chemical-specific data entered into the UNHCEMS® software database. This centralized the inventory, allowing OEHS to review chemicals in use on campus and to develop direct training outreach to faculty and staff on proper safety precautions or lab protocols to minimize risks. In some cases, OEHS has the opportunity to identify less hazardous chemicals or less hazardous concentrations to be used in lab research. In addition, OEHS embarked on a campus-wide education and outreach program to educate chemical owners on the use of UNHCEMS® for inventory management, to inform users of the preferred chemical ordering protocols, and to define the chemical owner responsibilities under this new process.

Over the years UNHCEMS® has evolved through feedback from stakeholders across campus and OEHS to include over 36 available customized modules to enhance the safety culture at UNH. UNH has created a personalized dashboard in UNHCEMS® for each Principal Investigator (PI) to assist them with environmental management compliance in the laboratory. The dashboard provides a summary of the status of environmental and laboratory compliance requirements and best management practices for the activities occurring in the laboratory or laboratories under the PI's control. The PI can access program specific safety modules for more detailed information on compliance status issues. Key modules may include: Biosafety Cabinet Certifications; Fume Hood Certifications; Institutional Biosafety Committee Registrations;

Radioactive Materials Inventory and Active Permits; Training Requirements for PI, associated Staff and Students; Hazardous Materials Inventory; and Hazardous Waste; among others.

The web-based system and user interface allows PIs to search the inventory for specific chemicals, by key element (such as Chemical Abstracts Service number, molecular formula, and manufacturer, among others), they may need and identify if the materials may be available through other laboratories, thus promoting an overall reduction in hazardous materials in storage on campus.

OEHS has developed modules, associated automated reporting and notification of responsible parties in UNHCEMS® for institutional environmental and occupational health and safety management compliance. These include, but are not limited to: an emergency response module for use by University Police and Durham Fire Department; a module to track compliance with the Department of Homeland Security Chemical Facility Anti-Terrorism Standard; and custom reporting for programs such as a Building Flammables Liquid Storage Limit module for the State of New Hampshire Fire Marshal; EPA Emergency Planning and Community Right to Know Act; and EPA Integrated Contingency Plan management.

OEHS has worked closely with emergency responders at the Durham Fire Department and University Police Department to develop a module specifically for emergency response. Mobile devices in the vehicles of the fire and police departments were programmed to log-in to UNHCEMS®. Through this emergency response module, responders have immediate access to hazard information for hazardous materials by owner, building or room. This allows emergency responders to review hazards related to hazardous materials while in route to a call. The emergency response module, was recently used by emergency responders to identify laboratory

contacts, hazardous material information, and recommended response practices for a personal hazardous materials exposure.

The Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standard (CFATS) reporting module in UNHCEMS® promotes compliance with CFATS by summarizing information about the Chemicals of Interest (COI). The report generates a dynamic spreadsheet that compares COI quantities to reporting thresholds, allowing efficient determination of chemicals that are above or below reporting thresholds. The module provides complete inventory data that allows EHS to verify the inventory and report it to EPA in a timely manner. The CFATS module leverages real-time chemical inventory data to help ensure compliance with CFATS with a simple, user-friendly interface.

UNHCEMS® has allowed UNH to customize the system as needed for regulatory changes or operational needs. For example, when renovating a building on campus UNH looked to the State Fire Marshal to obtain occupancy permits for the laboratories. The State Fire Marshal was concerned about the amount storage space available for flammable liquids having the potential to allow for Principal Investigators to store more than was permitted. To solve this issue, OEHS worked with RCC to develop a reporting system that was linked to the chemical inventories. Because UNHCEMS was tracking the information, such as the location and hazards associated with the chemicals, a report was created that notifies laboratory owners when they are within a certain range of the storage threshold set forth by the State Fire Marshal. OEHS and the local fire department also receives notice if the individual storage limits are in excess of the permitted amount. This automated reporting system was accepted by the State Fire Marshal as a solution to the flammables permit issue.

In addition, other UNH departments have utilized UNHCEMS® to develop and maintain modules specific to administrating their programs. These departments include, among others: Research Integrity Services (Animal Handler Training and Occupational Health Form; Effort Training; and Responsible Conduct in Research Data Management); College of Engineering and Physical Sciences (CEPS Technical Service Center Equipment Database and Preventive Maintenance Database); Facilities Management (Fall Protection Equipment Inspections and Inventory, Above Ground Storage Tank Inspections and tracking of Professional Development for staff); and University Instrumentation Center (Scientific Instrumentation Inventory Database).

UNHCEMS® allows OEHS to efficiently conduct annual hazardous material inventory verifications in the laboratories and other high hazardous material use areas. Inventory summaries provided to the PI allow for detailed discussions to reduce or dispose of legacy chemicals that are being stored and not in use by the laboratory. OEHS will dispose of legacy chemicals at no cost to the laboratory.

Initially the training program matrix developed in UNHCEMS® was intended to resolve the EPAs concerns with proper training of individuals in the laboratories for hazardous waste and hazardous materials management. As such, OEHS developed training materials for availability to laboratory faculty and students online. Principal Investigators and managers identify students and staff that would be working with certain materials and what training would be required through the UNHCEMS® interface. These students and staff simply log onto UNHCEMS® where links to the required training programs are clearly defined for them. UNHCEMS® allows OEHS to customize the training and track attendance all through the web-based functions as needed. The training matrix has been introduced to other departments at UNH. Currently UNH's Facilities,

Research Integrity Services and Campus Recreation are using UNHCEMS® to maintain their specific training needs outside of Environmental Health and Safety training and compliance. There are over 131 training programs available through UNHCEMS® and approximately 8,800 users, ranging from faculty, students, staff, visitors and outside contractors. The flexibility of the system allows for automated tracking of user proficiency through quizzes or other user defined means to determine completion of required training materials.

Today at UNH, UNHCEMS® tracks compliance for over 40,000 individual active chemical containers and maintains over 30,000 unique safety data sheets. Two modules in UNHCEMS® that utilize this information and synthesizes the information for the user is the emergency Door Signs Module and the Emergency Responder Module.

With a dynamic population of Principal Investigators, over 40,000 chemicals and 600 related door signs, having a system that would look to the recorded inventory and standardize the door signs with ease has been a great asset to efficiency at OEHS and helps to reduce some of the administrative burden. Door signage is used to identify NFPA hazards (automatically assigned by UNHCEMS®), use of toxic chemicals and other personal protective equipment required prior to room entry. These signs are a primary resource for emergency responders, facility managers and staff to recognize persons' familiar with each room through the door sign contact information. Through the door sign module, UNHCEMS® identifies discrepancies, via automated reporting, for chemical owners and chemical inventories by notifying OEHS when chemical owners are no longer part of the UNH system or when chemicals and hazards in a laboratory or storage location have changed. This allows OEHS to focus efforts where they are needed.

Due to the overwhelming success of UNHCEMS® at UNH, in 2003 UNH began offering licensing to other institutions. In November of 2003, UNH sold its first UNHCEMS® license to

Brown University, who still uses UNHCEMS® today. To date UNH, through UNHInnovation, has sold 27 licenses for UNHCEMS® to other higher education institutions and two licenses to the private sector. The flexibility of UNHCEMS® has appealed to large land-grant institutions such as University of Massachusetts - Amherst as well as smaller institutions such as YY (Matt Simon trying to get approval to use some client names). To date UNHCEMS® has brought UNH over a million dollars in cumulative revenue.

UHCEMS® is the premier management tool for ensuring institutional compliance and enhancing safety culture. It is a proven strategy for assisting a myriad of campus departments (breaking down silos) with managing a diverse number of compliance requirements that face higher education institutions. The functionality of UNHCEMS® will continue to grow as more departments become familiar with the versatility of the system and the services it can provide to meet ever-changing management perspectives and objectives. UNH sees UNHCEMS® as a key feature for meeting the published 2016 Association of Public and Land Grant Universities (APLU) Report for enhancing the safety culture in laboratories, classrooms, shops, and studios.