University of Massachusetts Boston Lab XL Progress Report
June 28, 2001

INTRODUCTION

UMass Boston's Integrated Chemical Hygiene and Environmental Management (CH/EM) Plan was completed in October 2000. Since then, the Environmental Health & Safety Office (EH&S) Staff has been implementing the new plan through distribution of information packets, training, compliance audits and website postings. The new CH/EM Plan has been distributed to every laboratory worker who has received training in the new program and is available to all laboratory workers via the EH&S web site.

The following is a summary of initial environmental performance as measured by the nine Environmental Performance Indicators (EPIs) described in the Project XL Final Project Agreement (FPA).

EPI#1: OUTDATED CHEMICALS ON SHELVES

To date, UMass Boston has not directly tracked the absence of outdated chemicals on laboratory shelves. Instead, we have required laboratories to conduct comprehensive inventories of all laboratories with which EH&S highlights generic categories of Hazardous Chemicals of Concern (HCOCs) in training sessions. To date, we have seen decreases in amounts of these types of material being disposed (see EPI# 5) and believe that fewer of these materials remain on the shelf.

Additionally, Principal Investigators (PIs) are asked to evaluate peroxide-forming chemicals and nitro compounds when completing the Monthly Laboratory Self-inspection Checklists. These compounds are the most prevalent and problematic HCOCs that we have on campus**.**

EPI#2: INVENTORY/HAZARDOUS CHEMICALS OF CONCERN (HCOCS)

UMass Boston has designated the following chemicals as HCOCs. As described above, laboratory workers receive guidance with respect to the management of these chemicals during the CH/EM Plan training.

EPA P-listed wastes
OSHA Special carcinogens
OSHA Teratogens/Reproductive toxins
OSHA designated highly toxic substances
Explosive nitroarenes
Peroxide-forming chemicals
Pyrogens
Shock-Sensitive Explosives

The EH&S Office has tagged or highlighted these materials on inventory sheets for each laboratory. However, the current system for conducting the chemical inventory is undergoing

significant change. Under the old system, the EH&S Office generates, in August, a chemical inventory list for each lab from its database and sends it to all Principal Investigators. PI's have one month to update lists, sign them, and return them to EH&S for input into a central database. In the past, this manual process has taken an enormous amount of time for the PIs and EH&S staff. The typical update time period from start to finish has taken as much as 18 months. To minimize this problem and create more accurate inventories, EH&S is in the process of implementing ChIM 5.2, a new chemical bar code based tracking system on a lab-by-lab basis. We believe that the bar code system will speed up collection of our inventories and provide us with more accurate and reliable data. This tracking system will also likely enhance the ability of EH&S to identify potential pollution prevention and redistribution opportunities. The new system will also be much quicker, more efficient, and will allow EH&S to track chemicals from lab to lab. The current number of laboratories on campus is 122.

Currently, EH&S is testing the efficacy of the software with a pilot project based on the labs under the supervision of one professor, who oversees 5 very active labs in the Chemistry Department at UMass. The pilot was implemented in the fall of 2000, and has returned promising results which indicate that the barcoding system will indeed have each of the aforementioned benefits for our inventory management. EH&S hopes to have this new system in place for each laboratory by the end of 2001. In the meantime, we do not plan on conducting our annual inventory update because all of our resources will be carrying out the barcoding effort. We should complete a campus-wide inventory/HCOC Survey by January 2002.

EPI#3: POLLUTION PREVENTION ASSESSMENTS

The focus of both the EH&S Office and the Chemical Hygiene Committee has been training. During the training, emphasis is placed on pollution prevention and researchers are encouraged to incorporate product substitution, limited purchasing and other waste minimization strategies into their experimental design. If such pollution prevention alternatives do not exist, we remind them to purchase only what they need. Finally, we suggest that they determine whether or not a treatment method can be incorporated as the last step of the experiment.

Another campus-wide initiative currently underway is a mercury thermometer swap and a registration process for any remaining mercury containing devices. The Chemical Hygiene Committee is developing the campus-wide program. To date, a number of departments have been slowly replacing mercury-containing thermometers. The Chemical Hygiene Committee is documenting this activity as well as insuring that all mercury-containing thermometers are replaced. In those instances where replacement is not possible, or the device is not a thermometer, the mercury containing device and its location will be registered with the Committee and the information maintained in a database.

The Committee will be meeting in July 2001 to determine its next P2 priority area(s).

EPI#4: RE-USE AND REDISTRIBUTION

In January 2001, EH&S sent out a pamphlet to all PIs describing the purpose of a re-use and redistribution program. A formal reuse and redistribution has never been in place prior to the XL

Project. The pamphlet also contained a tear-off sheet for PIs to fill out and return to EH&S if they had any material available. We have also been introducing the idea and promoting the program during our training sessions. EH&S obtains information concerning redistribution possibilities from direct mail, email, departmental postings, laboratory decommissionings and laboratory waste pickups.

Approximately twenty (20) liters of materials have been collected to date, and EH&S is in the process of developing an inventory. By September 2001, when the new EH&S hazardous waste accumulation area is in place, we will publish a list of materials available for redistribution on our website so that it will be accessible at any time. When materials are identified as potentially re-useable, they will be labeled with the date. Each time they are used, they will be tracked by EH&S. If materials are in storage for more than two years, they will be disposed of.

EPI#5: HAZARDOUS WASTE GENERATION

A determination of total laboratory wastes, in pounds, was generated for the calendar year 1999 and 2000 (Table 1), from University manifests and the biennial report. For the year 1999, the University generated 5584.76 pounds of laboratory waste. In the year 2000, the total pounds of laboratory waste generated has decreased to 4928.23 pounds. This is equivalent to an 11.76% decrease when compared to 1999 data. The decrease can be attributed primarily to smaller numbers of acutely hazardous wastes, organic peroxides, pyrophorics, flammable liquids and compressed gases. There were slight increases in overall amounts of corrosives, flammable solids and oxidizers.

EPI#6: ENVIRONMENTAL AWARENESS SURVEY

In order to measure general environmental awareness on campus among faculty, staff, and students, a survey was distributed in April of 2000. Results were tabulated in the summer of 2000, and are posted on the EH&S web site. A second survey was distributed in February of 2001, rather than in April, to allow for a broader, more general sampling of the population, to determine if environmental awareness on campus has improved or remained the same. Unfortunately, despite our best efforts to induce a large return of the distributed surveys, EH&S has received just over 50 completed surveys. The returned surveys have been tallied and results are shown in Table 2. EH&S will continue throughout the month of July to collect additional surveys so that overall results will be comparable to last year. These partial results suggest improved environmental awareness with respect to internal standards, compliance and proper hazardous chemical management,

EPI#7: TRAINING

Prior to formal training, EH&S formulated and distributed summary pamphlets about Project XL and specifics about laboratory waste collection to members of each relevant department at the beginning of October. In addition, EH&S has also posted new signage in each lab consistent with the CH/EM Plan and distributed new “tie-on” laboratory waste tags.

EH&S began notifying all relevant departments in September 2000 that training would begin at the end of October of 2000. At that time, we asked departments to identify individuals, particularly students, who needed training. EH&S already maintains a list of all Principal Investigators (faculty and staff) who can be contacted directly when the need arises. Training in the new CH/EM Plan for all faculty, staff, graduate students and undergraduates who work alone in laboratories began at the end of October 2000, and continued over the next several months. The training program is a general introduction to the new regulations set forth in the CH/EM plan and is carried out predominantly on a lab-by-lab basis. Each trained lab workers receives a copy of the CH/EM Plan. When feasible, EH&S has trained groups from departments in a single session. Each session lasts for roughly one to one and a half hour. Our goal was to have all laboratory personnel trained in the CH/EM Plan by March of 2001. We have since discovered that this was a far too ambitious goal. As of June 2001, EH&S has trained the Anthropology, Physics, and some of the Chemistry and Biology departments. Training for the ECOS, Psychology, and remaining members of the Chemistry and Biology departments will be completed at the beginning of the fall semester of 2001. EH&S estimates that there are approximately 200 laboratory personnel from these departments. Since October, 146 people have been trained. We anticipate that the majority of those remaining to be trained will be captured within the first two weeks of the Fall 2001 semester (first two weeks in September 2001). Our plan to train all laboratory workers within twelve (12) months of a training program rollout is a significant improvement over past experiences which typically required additional time.

EH&S is also in the process of building a more accurate training database. We have sent out forms to the PIs asking them to identify all laboratory personnel under their supervision that require training. EH&S will enter the information into a database. We will then be able to generate the information on a semester-by-semester basis for the PI to update, thus insuring that our training records are accurate and up-to-date.

EPI#8: PROGRAM EFFECTIVENESS

The following list represents a review of the goals of the XL Program as set for in the Project XL FPA.

EPI#1 It appears as though there is a sharp decline in outdated chemicals in laboratory--however, it has not been directly measured to date.

EPI#2 The EH&S Office has a complete chemical inventory on file. It needs to be updated, but will be delayed until January 2002 when the new barcoding system is in place.

EPI#3 Campus-wide mercury thermometer replacement and mercury-containing device registration is underway. The next round of assessments will be identified in July 2001 by the Chemical Hygiene Committee.

EPI#4 The amount of laboratory waste collected for reuse has increased substantially, however the amount of laboratory waste reused or redistributed has not yet increased by 20%.

EPI#5 The amount of laboratory waste disposed of decreased by 11.76% in 2000.

EPI#6 The Environmental Awareness Survey was completed and the partial results demonstrate that laboratory workers are more aware of environmental issues and relevant standards.

EPI#7 The number of laboratory workers trained increased significantly from previous years. We estimate that approximately 75% of the total number of laboratory workers have been trained in the CH/EM Plan.

EPI#8 Some EPIs are on-track (decrease in laboratory waste disposal, outdated chemicals, internal and external audits); others need more attention (pollution prevention, environmental awareness surveys). Table 3 describes the status of certain major objectives and targets for the EH&S Department.

EPI#9 Both external and internal audits show significant compliance with the Minimum Performance Criteria of the XL Regulation.

EPI#9: CONFORMANCE WITH THE EMP

Conformance with the UMass Boston CH/EM Plan has been measured internally by the EH&S Office staff and externally by auditors from the Campus Consortium for Environmental Excellence (C2E2). Summaries of the two audits are given below:

External Audit Report

The external audit was conducted on April 4th, 2001, by Thomas Balf of the C2E2, and David Messier from Worcester Polytechnic Institute and the C2E2. The audit included one anthropology lab, three biology labs, four chemistry labs, three ECOS labs, and two psychology labs. In conducting the audit, Mr. Balf and Mr. Messier evaluated labs for conformance with the Minimum Performance Criteria Protocol. The most common and consistent problem observed during the audit concerned labeling. In many cases, the laboratory waste "tie on" labels were filled out incompletely or incorrectly, or were not being used at all. Other common problems included uncapped bottles and monthly container inspection checklists that were not filled out.

Internal Audit Report

The internal audit began in June of this year, and is currently being conducted by EH&S personnel. Thus far, roughly two thirds of the laboratories on campus have been audited. The common problems that were observed a few months earlier in the external audit have disappeared for the most part, which can be attributed to increased emphasis during training on these issues. The problems EH&S has observed thus far have included a few open containers and improperly filled out laboratory waste "tie-on" tags. The most common problem with the tags has been that laboratory workers are identifying the date that waste

accumulation begins, rather than dating the container when it is full or is deemed ready for pick-up. All identified deficiencies were immediately corrected. Qualitatively, however, the internal audit appears to show that management of laboratory waste and adherence to the CH/EM Plan regulations has improved dramatically. EH&S is also working to tailor the training sessions to address any outstanding issues.

Table 1. Laboratory Waste Generation Information

University of Massachusetts Boston
Laboratory Waste Generation Data
Total Pounds

Waste Stream	Calendar Year	
	1999	**2000**
Labpack with poisons	**192.83**	**350.05**
Labpack with corrosives	**1161.46**	**1520.16**
Labpack with acutely hazardous wastes	**31.48**	**14.43**
Labpack with misc. hazardous waste	**739.57**	**413.53**
Labpack with organic peroxides	**19.87**	**0.00**
Labpack with spontaneously combustible material	**11.68**	**30.21**
Labpack with pyrophorics	**21.34**	**0.00**
Labpack with flammable liquids	**2470.02**	**1655.83**
Labpack with flammable solids	**11.70**	**47.10**
Labpack with oxidizers	**148.48**	**249.04**
Compressed gases and aerosols	**264.27**	**60.41**
Non-hazardous/non-regulated waste	**512.07**	**587.47**
TOTAL	**5584.76**	**4928.23**
Difference	656.53	lbs
% Difference	-11.76	%

TABLE 2. Environmental Awareness Survey Results – 2001

	2000	2001
1. Which federal agency regulates the disposal of chemical wastes		
a. Occupational Safety and Health Administration	25	13
b. Environmental Protection Agency	42	81
c. Department of Transportation	9	6
d. National Institutes of Health	11	0
2. Ultimately, most chemical wastes generated in laboratories are:		
a. incinerated	28	17
b. sent to a land-fill	13	6
c. release to a sewer	20	28
d. treated	27	49
3. What are the four main reasons researchers should keep containers of laboratory waste securely closed except when adding chemicals?		
1 reason	54	15
2 reasons	12	26
3 reasons	17	36
4 reasons		23
4. Which costs more, purchase or disposal of laboratory chemicals?		
a. disposal costs more	44	82
b. purchase costs more	21	4
c. costs are roughly the same	22	14
5. In the book, "Prudent Practices in the Laboratory", what is the preferred waste management hierarchy for pollution prevention? Use a scale of 1-4 with 1 being the preferred management method.		
Source Reduction		70
6. What is the proper way to dispose of strong mineral acids?		
a. Dilution with water	23	14
b. Neutralization with lime	29	26
c. Collection for pick-up by hazardous waste personnel	7	60
d. Mixing with organic chemicals	7	0

7. What is the maximum amount of acutely hazardous laboratory waste that your laboratory is allowed to accumulate ?	31% correct	42% correct
8. What emergency response equipment is available in your laboratory to respond to a hazardous chemical spill?		
0	14	19
1-3 items	68	72
4-6 items	7	9
7 items	0	0
9. How is waste water from your laboratory buildings treated?		
a. Purification before release to the sewer	21	7
b. pH is controlled by acid neutralization, then released to the sewer	32	37
c. Diluted with the rest of the building's water, then goes to the sewer for municipal treatment by aerobic digestion	22	56
10. In general, how are fume hood emissions controlled in your laboratory?		
a. Filtration to remove particles	27	16
b. Carbon filtration to remove gases	26	19
c. Dilution with laboratory room air	21	65
11. The last time you needed health and safety information about a particular chemical, what resource(s) did you use?		
0 responses	15	24
1 response	41	41
2 responses	15	24
3 responses	4	11
12. Typically, what is the largest environmental impact of laboratory work?		
a. release of toxic chemicals through the fume hood	13	7
b. disposal of toxic chemicals with a hazardous waste disposal company	22	22
c. release of chemicals to the sewer system	28	57
d. energy use to cool or heat laboratory space	13	14

13. The last time you disposed of laboratory hazardous waste, what four pieces of information did you put on the label?		
0	19	28
1-3	23	70
4-6	29	2
14. What document(s) describes how to dispose of laboratory hazardous waste at your institution?	0 correct responses (The Environmental Management Plan had not yet been publicized in campus laboratories)	51
15. What is your current role in your laboratory?		
Faculty	19	15
Staff - Administrator	5	1
Staff - Lab Tech	9	9
Graduate Student	12	16
Undergraduate Student	39	12
16. How many years have you been working in college or university laboratories?		
less than 1 year	34	11
1-2 years	18	10
3-5 years	8	9
more than 5 years	24	22

68 % of respondents in 2001 report having attended a EH&S training session on the CH/EM Plan

Table 3. Key EH&S Objectives and Targets

Objective and Target	Status
Development of new, integrated Chemical Hygiene and Environmental Management (CH/EM) Plan	Complete (August 2000)
Develop training materials for CH/EM Plan by October 2001	Complete (October 2000)
Train all laboratory workers by March 2001	To be completed by Sept 2001
Roll out reuse and redistribution program by January 2001	Posted to EH&S web site by September 2001
Design of new, centralized chemical storage area	Complete (March 2001)
Building of new, centralized chemical storage area	To be completed by September 2001
Identify and replace or register elemental mercury-containing instruments	To be completed by September 2001