

Annual Report on Project XL Activities at Boston College

Prepared by N. Gail Hall, Environmental Health and Safety Officer

November 7, 2006

This annual report covers calendar year 2005 for waste production, and academic year 2005-6 for other reported activities. The past year has been an exciting one for the college and university community, with EPA's release of a proposed rule (Subpart K) for alternative ways to manage hazardous waste in laboratories. Boston College is proud that, as an "XL school," our programs and previous reports have significantly contributed to many of the elements of the proposed rule. This report describes the continuation of the work we have been doing under XL, and includes information on waste shipments, lab clean-outs, and Hazardous Chemicals of Concern.

EPI #1. Removal of old chemicals from shelves

Goal: Reduce amount of chemicals in storage in labs

► **Chemical Purchasing:** The science departments have begun to recognize the potential value in regulating chemical purchasing through a central point. If a central purchasing point is determined for each department, EHS plans to be actively involved in developing guidelines on keeping chemical inventories at a minimum and controlling the purchase of HCOCs.

► **Lab Clean-outs:** We did four clean-outs in the Chemistry Department for a total of 1300 lb. of chemicals shipped as waste, one a total clean-out of a major stockroom containing old material. Clean-outs resulted from either retirement or separation of faculty from BC¹, or down-sizing of lab space. All usable chemicals were made available to other users within the department prior to packing and shipment. Data on redistribution were not collected.

► **At Boston College,** down-sizing of one lab occurs to allow another lab to expand into the space, usually very quickly. As a result, clean-outs do not necessarily result in a net decrease in chemicals stored or wastes produced. However, they do serve the purpose of removing older chemicals from the shelves.

2007: The science departments and EHS may implement a centralized electronic chemical inventory system in 2007 depending on departmental decisions and available resources. We expect this activity to generate additional waste as labs shrink their stockpiles during the inventory process, and to help labs keep the inventories "fresher" through tracking chemical ages.

EPI #2. Annual HCOC inventory

Goal: Reduce the number of Hazardous Chemicals of Concern in labs

► We generated ~60 lb. of HCOCs as waste through lab clean-outs and solicitations to manage certain high risk chemicals.

2007: EHS is working with the sciences to adopt a chemical inventory system that will meet our requirements for chemical tracking and regulatory compliance. We expect to have a product that will allow us to tag HCOCs. We will also be able to view each lab inventory in real-time and monitor chemical ages.

¹ While there is steady turnover of graduate students and post-doctoral researchers, these people work within lab groups, and their unused chemicals are absorbed by the group.

EPI #3. Pollution Prevention Assessments

Goal: Identify activities that will lead to a reduction in hazardous waste produced by labs.

► We review literature from the American Chemical Society (ACS), and the EPA/ACS websites on green chemistry, for information on new developments in green chemistry. Our major efforts in sharing information and promoting P2 have been through training. In June '06 we trained approximately 140 Chemistry Department lab workers on waste minimization and especially waste segregation. Improving segregation in labs should shift the ratio of halogenated solvents² (which are incinerated) to non-halogenated solvents (which are used in fuels blending) from the current 3:1 to 1:1.

2007: We will collect data on solvent production, and follow up with feedback to the labs, and additional training as needed.

► As an additional note, Chemistry professors Marc Snapper, Amir Hoveyda, *et al.*, published a letter in the journal, *Nature*, in September, 2006, reporting on a new “environmentally friendly” chemical transformation process. Their discovery would reduce the number of steps in the creation certain chemical classes, and also reduce the amount of waste generated. If these processes are transferable to industries such as pharmaceuticals and organic synthesis, we would see small increments in waste reduction at the lab level be significantly magnified in industrial applications; it may also be true that in order to produce less waste ultimately it is necessary to generate more waste in the research process.

EPI #4. Chemical redistribution

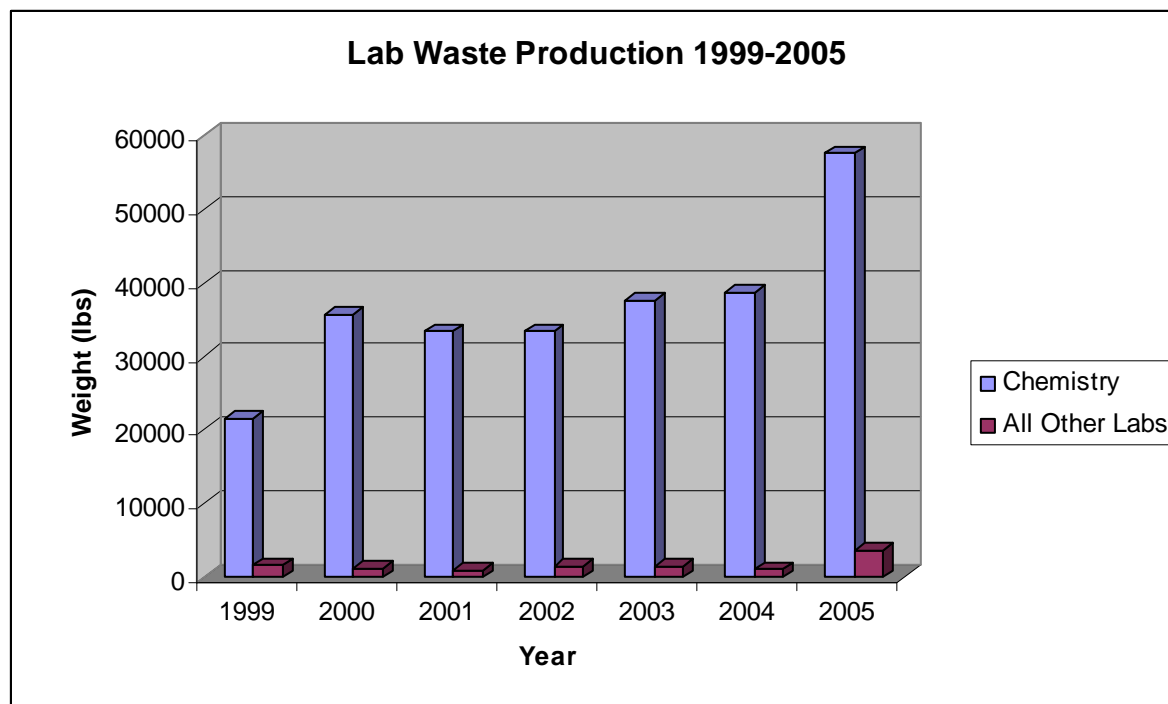
Goal: Reduce the volume of waste disposed by allowing chemicals to be offered to other labs when deemed “waste” by the generator. (This applies to virgin chemicals.)

In past years we decided that a formal redistribution program was not cost effective, and we have relied on informal exchange between labs and “tag sales” at clean-outs. We have not collected data on redistribution, and believe the *ad hoc* approach to be appropriate to the culture and generally successful in promoting redistribution.

² Halogenated solvents are flammable or combustible liquids that have chlorine (or related atoms) attached. The halogen atom makes the solvent toxic. Disposal requires incineration and scrubbing of the gases, with the formation of a toxic ash by-product which requires secure disposal. “Clean” non-halogenated solvents are still usable as fuel for the incineration kilns, providing some value in the process of their destruction and not leaving a toxic by-product.

EPI #5. Annual accounting of hazardous waste produced by labs.

Goal: Tracking annual waste production from labs will provide information on waste reduction opportunities.



In calendar year 2005, Boston College shipped 61,165 pounds of hazardous waste from laboratories. The Chemistry Department continues to produce approximately 95% of lab waste.

The jump in the amount of hazardous waste in 2005 results from a number of factors – 1) the size of the 2004 entering class of graduate students nearly, and they are now actively engaged in research; and 2) the addition of two aqueous waste streams that contain very small amounts of methylene chloride. Because of our waste water permit and the strict limits set down by the Massachusetts Water Resource Authority (MWRA), we are forced to capture any concentration of halogenated wastes. While these streams do not qualify as RCRA wastes because of their dilution or the empty container rule, they are bulked with our other toxic wastes. 3) In addition, as we mentioned in EPI#1, there have been a number of retirements and lab closures, and the newly empty labs (some of which produced little waste) are being converted to additional lab space for the rapidly growing area of chemistry research at BC, organic synthesis. The Chemistry Department also recently completed a conversion of a seldom used teaching lab to an organic lab.

► Since the beginning of Project XL we have been interested in relating the amount of hazardous waste produced to some normalizing factor(s). To that end, Boston College hosted a workshop on May 3, 2006 titled “Measuring and Reporting on Environmental Performance.” (See Attachment 1) The workshop succeeded in getting people from EH&S and the Institutional Research Department at each institution to talk to one another (often for the first time) about how each institution can do a better job of reporting on environmental measures. Each school agreed to publish environmental measures in the next edition of their “fact book.”

On the matter of normalization, the participants generally agreed that attempting to normalize lab waste generation data against any variable (such as research dollars, lab area, # people) was not likely to be successful universally. However, we may have some success at normalizing data within our own institution. As a follow-up to this report we will be submitting an addendum that reports on some current data collection activity and our attempts to identify any normalized factors that help explain our waste trends.

2007: Continue to analyze and report on waste production.

EPI #6. Environmental awareness survey

Goal: Environmental awareness of lab workers should increase with training and the experience of working within the EMS framework.

In previous Project XL annual reports we have reported the results of a survey of lab workers. This year we chose not to do a survey because awareness responses have remained relatively consistent in the last two years. We have a strong training program that doesn't vary significantly from year to year, so we do not believe we would learn anything new from using the same survey.

2007: Create a survey (to be delivered electronically) with a wider scope that includes the other environmental impacts from lab work (e.g. utility consumption, water use). Use the survey as part of a marketing campaign whose purpose is to create a culture of environmental responsibility in all aspects of lab work.

EPI #7. Training

Goal: Training in the EMP will lead to changes in behaviors, practices and attitudes, ultimately leading to waste reduction.

▶ In the 05-06 academic year we continued to provide initial and refresher training for lab workers in all the sciences. We added a training module for lab workers on DOT awareness about shipping chemicals,

▶ The Physics Department conducted a training session on the use of gas cylinders.

▶ We issued an expanded edition of the Lab Waste Management flyer that trainees receive each year, and have also written it in a web format.

2007: Work with a BC employee or consultant to implement web training applications.

EPI #8. EMP Effectiveness

Goal: Completion of this report is a systematic way to measure the success of the EMP.

▶ We have created two new tools to improve compliance. In response to generator requests we have a larger and better laid out lab waste label. In addition, we developed a "ticket" that the waste technician leaves with non-compliant containers in the Lab Waste Accumulation Area (if the generators aren't present), and have invoked a policy that non-compliant containers (e.g. bottles with caps that don't match, or whose labels are unreadable) will not be picked up until the lab worker makes the necessary changes.

EPI #9. Conformance with the EMP

Goal: Audits of the labs are a measure of lab workers' conformance with the EMP.

A number of audits by different people (Project XL coordinator, lab safety coordinator, Chemistry Operations Manager) were conducted in the labs. The most significant waste-related findings were not completely filling out waste labels, and not documenting weekly Lab Waste Accumulation Area inspections, which is a requirement of our Environmental Management Plan that goes beyond federal and state regulations.

2007: Compile findings from the various audits that are conducted and report them to the Chemical Hygiene Committee, Chemistry Safety Committee, and to the lab workers through training or a newsletter.

Conclusion

Boston College's participation in the Lab XL Project continues to provide us with opportunities both to learn and to inform others in our sector about the challenges of waste management in university laboratories throughout the country and internationally. We are pleased to see that our experience with the Environmental Management Plan and the functional shift of RCRA compliance out of the labs has had a significant influence on the current version of Subpart K. This has been the greatest success of Project XL. By relieving some of the waste management pressures

on the labs we have created a spirit of cooperation between the sciences and EHS. As this relationship continues to grow, and as Boston College adopts a stronger and more visible stance in environmental responsibility, we can predict an expansion in the “environmental awareness” of lab workers as it was originally intended by the partners in Project XL. While some of the changes have been slow, they are also steadily taking BC forward toward an era when “green” will be part of the discussion in future experimentation and lab design.

Attachment 1:

**Workshop
Sponsored by C2E2 and Boston College**

**MEASURING AND REPORTING ON ENVIRONMENTAL
PERFORMANCE**

May 3, 2006

Boston College

Walsh Function Room

<http://www.bc.edu/centers/sbdc/seminars/workshopdirections/#walsh>

- 8:00 – 9:00 am Registration, tea and coffee
- 9:00 am Welcome, review of agenda, logistics
- 9:15 am Presentation by Tom Balf, C2E2, on sustainability/environmental issues and the relationship of research laboratories to the sustainability agendas of universities. Models and examples will be provided.
- 9:45 am Presentation by Larry Litten, Dartmouth College, on institutional research data reporting function, including tools, audience and models; how sustainability reporting relates to institutional research, and how laboratory reporting fits into the mix
- BREAK**
- 10:30 am Gail Hall, Boston College, “Why Labs? Experience with Evaluating Improvement in Laboratories under EPA’s Laboratory project XL”
- 11:00 am Jaclyn Emig, Harvard University “Efforts and Considerations in Measuring and Reporting on Environmental Performance of Laboratories”
- 11:30 Kelli Armstrong, Boston College - Queue up afternoon
“exercise”/Workshop and lunchtime reports

LUNCH – Working/Networking Lunch

(In addition to eating lunch, each campus will be asked to share information & experiences concerning relevant environmental data that they currently collect and report. Five minutes allotted per institution.)

- 1 – 2:30 pm Breakout Groups (3 groups) to explore better methods for collecting, measuring and reporting on environmental performance.
- 2:30 – 3:15 Breakout Group Presentations and Discussion
- 3:15 – 3:30 Wrap up with Larry Litten, Next Steps...