

CASE STUDY

Why Should Your Facility Be Concerned About Mercury?

- Mercury contamination is a serious environmental and public health problem. Elemental mercury can be transformed in the environment to methyl mercury which is a toxic and persistent pollutant and exposure to it may lead to irreversible neurological effects. About 60,000 children born each year in the United States might be at risk for adverse neurological effects from in-utero exposure to methyl mercury, primarily due to their mothers eating fish during pregnancy.
- Across New England, more than 80 percent of the inland waters have fish too polluted with mercury to eat and all the New England states have issued health advisories limiting consumption of certain freshwater fish.
- Mercury possesses the properties of both a liquid and a metal, and is an added component of many products including fluorescent lamps and certain types of thermometers, electrical switches, and measuring devices.
- Mercury can volatilize at room temperature enabling it to constantly circulate in the air, water, and soil. When spilled mercury is poured down the drain or a mercury-containing item is thrown into the trash, it doesn't disappear. The mercury enters the circulation in the environment after it passes through the waste incinerator, landfill or wastewater treatment plant.

Mercury Assessment >> New England College

Introduction

The project team consisting of Federal, state, and interstate representatives visited a New England College to identify the sources and uses of mercury-added products at the College and to suggest efforts the College might undertake to reduce or eliminate their reliance on mercury. The project team met with the College's Facilities Engineering Division Chief, Environmental Branch Chief, and other members of the staff. The Team utilized a mercury management questionnaire to facilitate discussion of past and current mercury use at the College. The Team also determined the locations at the College that were most likely to use mercury-added products. During the site assessment the project team visited the following buildings: chemistry and physics laboratories, medical and dental clinic, soils laboratory, power laboratory, metals laboratory, electrical laboratory, waterfront area, simulation laboratory, garage, boiler plant, building and grounds, carpenters shop, electrical maintenance shop, plumbing and heating shop, paint shop, and the public works building. This case study presents the results of this mercury site assessment and recommendations for additional mercury reduction and controls at the College. Attachment A outlines the measures undertaken by the College to address the recommendations.

Facility Overview

Prior to preparing for the Team's visit, overall awareness of mercury at the College seemed to be low. According to the Environmental Branch, the mercury assessment effort has significantly raised mercury awareness at the College. The College is an institution of higher education, and therefore consists mainly of dormitory and classroom buildings, teaching laboratories, and academic and administrative offices. There are also numerous support buildings, such as the boiler plant, the medical and dental clinic, and the waterfront marina area. The College receives its water and wastewater services from the local municipal system.



Mercury Reduction Efforts and Current Inventory

Prior to the Team's visit, the College had not focused on any mercury reduction activities. To prepare for the Team's visit, the Environmental Branch distributed the EPA mercury survey to all departments at the College. The Environmental Branch compiled the results of the survey into a preliminary inventory of mercury at the College. In response to the survey, several shops and laboratories expressed an interest in having mercury-containing items, primarily thermometers, removed. The College does have a program in place to collect used fluorescent bulbs and send them for recycling. Efforts to raise awareness of proper fluorescent bulb management procedures appear to be significant. Information about mercury-containing devices observed by the Team in specific buildings is outlined below.

Chemistry and Physics Laboratories The Team visited three laboratories in the main classroom/laboratory building where mercury-containing products were found: chemistry, organic chemistry, and physics.

Center Preparation Room: The center preparation (prep) room in the chemistry laboratory is used to store the chemicals and equipment used by students in their experiments. The prep room services the adjoining laboratory classrooms. Students are not allowed in the prep room. The prep room contains about 50 different elements and compounds, with many stored in glass bottles on open metal shelves. There are two locked flammable liquid storage lockers in the room and an adjacent locked chemical storage room that contain about 950 compounds. Many of the chemicals in the storage room and lockers had masking tape around the cap with a 1990 date on it, indicating that the containers had not been opened since that date. The laboratory technician stated that many of the stored elements and compounds are not currently used at the laboratory. They have not been removed because the laboratory might need them in the future and also because the laboratory did not want to incur hazardous waste disposal costs. The laboratory technician performs a detailed inventory of all the containers each summer.

Specific to mercury, the prep room contains 93 pounds of elemental mercury in several containers on the fourth shelf up on an open shelving unit. Most of the containers are plastic, but one is plastic-coated glass and another is ceramic. The prep room also contains several mercury-containing compounds at various concentrations and in various quantities. There were two glass manometers high up on top of one of the open metal shelving units and the Team estimated that each contains over 10 pounds of elemental mercury. The prep room also contains over 75 large mercury thermometers of various types that are stored upright in a wooden box with dividers to segregate them by size. This box is located on top of a small refrigerator that has floor drains located on either side.

The laboratory technician stated that each semester the students break between five and ten thermometers in the laboratory classroom. The laboratory supervisor has a policy that broken thermometers are replaced with alcohol thermometers. The chemistry laboratory classroom has a large elemental mercury-containing barometer that is relatively well encapsulated.

While the Team was in the prep room, a mercury spill occurred. The laboratory technician was showing the Team a piece of equipment, a mercury cleanup vacuum (that is no longer used) when several drops of elemental mercury fell from it onto the metal shelf. The laboratory technician used a suction bulb in an attempt to retrieve the mercury and put it in a small bottle that contained mercury collected from other mercury spills. The laboratory technician reported that the same spill response method is used to retrieve the mercury released when thermometers are broken in the classroom.

Organic Chemistry Laboratory: The organic chemistry laboratory had 15 to 20 additional mercury thermometers. Most of the thermometers were stored loose in a drawer. Some thermometers were stored in cardboard packaging.

General Chemistry Laboratory: The general chemistry laboratory contains two of the large elemental mercury-containing barometers. The lab also utilizes a mercury-containing gage to measure vacuum.

Physics Laboratory: The physics laboratory has two of the large elemental-mercury containing barometers. The laboratory also has a mercury-containing device that was used in an x-ray experiment that is no longer performed.



Medical and Dental Clinic The medical clinic uses non-mercury blood pressure gages and fever thermometers. Both clinics use x-ray developer and fixer that could contain mercury, although the MSDS's do not list mercury as a constituent. There are small mercury thermometers in the medical laboratory's refrigerator and freezer for calibration. However, the laboratory plans to purchase non-mercury calibration thermometers when the existing ones are changed-out. The incubator already has a non-mercury calibration thermometer. The dental clinic uses amalgam capsules and has mercury traps on the rinse drains.

Soils Laboratory The soils laboratory had 16 mercury thermometers lying together on an open shelf. The laboratory technician indicated that the mercury thermometers are not needed and that the Environmental Branch could remove them. The soils laboratory did not appear to have other mercury-containing items.

Power Laboratory The power laboratory had three mercury thermometers that the laboratory technician indicated were not needed and could be removed by the Environmental Branch. Other than the three thermometers, the laboratory did not appear to have other mercury-containing products.

Metals Laboratory The metals laboratory had ten mercury thermometers that the laboratory technician indicated were not used and could be removed by the Environmental Branch. The laboratory technician uses a digital thermometer, which he prefers.

Waterfront The waterfront marina area had no readily-apparent mercury-containing products. However, several hard to observe items could contain mercury, including bilge pump switches, marine auto-pilot controls, and safety cut-off switches in outboard motors. In addition, the waterfront stores and uses batteries of all types, including some that contain mercury.

Simulation Laboratory The simulation laboratory houses various in-the-field simulation rooms and their associated classrooms. The laboratory manager reported that there are four pre-1986 model HVAC systems on the roof of the building that could utilize mercury-containing flow control switches and pressure gages. There are two mercury thermostats in the radar room and one in the area known as ICS 1.

Garage The vehicle maintenance garage has a sump pump and an overflow alarm switch on the oil-water separator that are most-likely controlled by a mercury tilt switch. However, the Team was unable to visually inspect these devices. The vehicles used at the College are leased and contain anti-lock brake system (ABS) brakes and trunk light control switches that could contain mercury.

Boiler Plant The boiler plant has replaced most of its mercury switches and gages. However, the plant has 17 mercury-containing pressure switches and flow controllers. Boiler plant personnel report that they plan to replace most of those, with the exception of six mercury-containing low water cut-off pump controllers for which they have not found an acceptable substitute.

Plumbing and Heating Shop Facility personnel report that mercury thermostats are still used in the command's housing quarters and they had one spare thermostat in their inventory. Personnel also reported that the sewage pump station has two mercury float switches that will be replaced with a non-mercury alternative.

Public Works Building A portion of the public works building serves as a new bulb storage area and used fluorescent bulb collection area. The door to the storage and collection area is locked. There were numerous new mercury-containing lamps of several different types in storage, including mercury, mercury vapor, and high intensity discharge (HID). The Team noted two broken fluorescent bulbs in a trash barrel outside the locked room.

Procurement and Disposal Procedures

Anyone wanting to purchase a hazardous material that is not on their shop/laboratory's Authorized Hazardous Material Inventory must fill out a New Product Request form and submit it, along with the MSDS, to the Environmental Branch for approval before it can be ordered. Where possible, the Environmental Branch suggests alternative products that are more environmentally friendly. Once a product is approved it is listed on that shop/laboratory's Authorized Hazardous Materials Inventory and can be reordered by that shop/laboratory without specific

approval. However, all shops and laboratories have government credit cards on which they can make independent purchases of less than \$2,500.

The College is about to begin a pilot program between the Waterfront area and a nearby Department of Defense (DOD) installation to consolidate unused materials and promote their reuse, known in the Navy as the Consolidated Hazardous Material Reutilization Inventory Management Program (CHRIMP). All material at the Waterfront will be inventoried and bar coded. When a hazardous material is needed at the waterfront, they will order it from the CHRIMP facility at the DOD installation. After use, the unused portion is sent to the CHRIMP facility at the DOD installation. CHRIMP reduces the potential for a material to exceed its shelf-life and become a waste. If the Waterfront pilot program is successful, the College plans to expand CHRIMP to encompass the entire facility.

Waste mercury-containing items, including mercury-added manufactured items, are collected and handled as a hazardous waste. The College has approximately 30 satellite hazardous waste accumulation areas. Hazardous Material Coordinators at each location ensure that hazardous materials and waste are handled properly. The College collects and manages fluorescent bulbs as a hazardous waste. The bulbs are recycled.

Recommendations

The project team offers these recommendations for consideration:

- Establish an overall mercury use and management policy for the College, including:
Establish a mercury team at the College and develop a written mercury spill protocol with clear lines of responsibility. Mercury spill reporting should be centralized to document trends in the location and number of spills, and the quantity of mercury involved. Mercury spill kits should be distributed to all locations that use mercury or have mercury-containing products. The spill response designee(s) at each location should be trained on the proper use of the kit, and to record and report all spills.
Develop a standard operating procedure for procurement of mercury-containing materials and equipment, including credit card purchases. Include mercury-added manufactured products, such as switches, thermostats, and thermometers in the

hazardous materials procurement system so their purchase and use is identified, minimized, and tracked.

All unused mercury-containing products should be retired and properly disposed of, rather than sent for possible reuse.

Expand overall mercury awareness at the College and provide a greater opportunity for the College community to properly discard/recycle mercury-containing products. Potential methods are to: widely publicize the environmental and health effects of mercury, and the mercury reduction efforts that occur at the College; sponsor a fever thermometer exchange for students and employees; investigate the feasibility of using cleaning products that do not contain heavy metals; and investigate the Thermostat Recycling Corporation (TRC) take-back program and participate, if eligible.

- The chemistry laboratory could constitute an imminent and substantial hazard. The College should perform a thorough clean-out of the chemistry laboratory's prep room and associated classrooms:

The hazardous materials stored in the prep room could be a potential liability. The College should identify the hazardous materials that are utilized by the classroom experiments and other research and remove and properly dispose of all unnecessary items. Use best management practices to minimize the potential for breakage and spills. For example, wherever feasible, chemicals should not be stored on open shelves or in breakable containers.

Evaluate the prep room and associated laboratory classrooms for residual mercury contamination and decontaminate, as necessary. This effort should extend to the various sink drain traps and floor drains located in those rooms.

- Replace all mercury-containing thermometers with non-mercury alternatives. Where replacement is not feasible, all essential mercury-containing thermometers should be Teflon-coated to protect against the release of mercury in the event of accidental breakages. All thermometers should be stored in a secure location and in a manner that minimizes the potential for breakage. Each location that uses mercury thermometers should establish an inventory and a sign-in/sign-out system to keep track of the total number of thermometers and who has them at any given time.

- Determine the location of all mercury-containing manufactured products, such as thermostats, barometers, and switches, and replace them with digital alternatives wherever feasible. Remove and recycle or dispose of any used items. All remaining mercury-containing manufactured products should be clearly labeled, inventoried, and tracked. Wherever feasible, these items should be encapsulated to prevent the release of mercury if they are accidentally broken.
- Evaluate lighting needs to determine if the purchase and storage of mercury-containing lamps/bulbs can be reduced.
- Provide greater access to the used fluorescent bulb collection area to minimize their placement in nearby trash receptacles.
- Mercury traps on dental clinic drains only collect large particles of mercury. There are amalgam separators available that can remove both the solid and suspended mercury from the rinse drains. The dental clinic should evaluate installation of these devices.
- Replace the barometers in chemistry and physics laboratories with non-mercury alternatives, or fully encapsulate them to protect against breakage and release of the mercury.

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Recyclers/Collectors of Mercury-Containing Products

www.epa.gov/region01/steward/neeat/mercury/disposal.html

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Attachment A

Facility Response to EPA Visit and Recommendations

As a result of the Mercury Assessment, the College has undertaken several efforts to implement the recommendations made in the case study. The following measures have been completed or are planned:

- Approximately 230 pounds of elemental mercury and 45 pounds of mercury-containing items have been removed from the chemistry laboratory and sent for recycling, including the manometers and the mercury from spill cleanups.
- 108 mercury thermometers have been removed from the chemistry laboratories and sent for recycling. 60 non-mercury replacements were purchased to eliminate mercury thermometers from the chemistry laboratories. The remaining mercury thermometers were moved away from the floor drains and into the locked storage room.
- The 16 thermometers from the soils laboratory, the 10 from the metals laboratory and the 3 from the power laboratory have been sent for recycling. An additional 14 thermometers from the marine science department and 4 from the clinic were also sent for recycling.
- Air monitoring for mercury vapor was conducted in the chemistry laboratory, including inside sink and floor drains, cabinets, and drawers. All levels were non-detect or otherwise below Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) standards for mercury vapor with the exception of a floor area of approximately 300 square foot and some shelves. The College hired a cleanup contractor that decontaminated these areas in August 2000. Mercury vapor was not detected with a Jerome meter after the cleanup was completed.
- The spent fluorescent bulb collection area has been relocated to an accessible area. A newsletter focused on proper fluorescent bulb management and disposal procedures was distributed to all hazardous material coordinators and building managers.
- Mercury spill kits were purchased and the Environmental Branch updated the College's Spill Response Procedures to include mercury spills. In addition, during their annual hazwaste management training, all Hazardous Material Coordinators will be reminded that mercury spills are reportable to the Spill Response Team. The Chemistry Lab technician was provided with a mercury spill kit and trained on proper cleanup procedures, including the requirement to report mercury spills to the Spill Response Team.
- The Environmental Branch is working with the various support shops to determine which items contain mercury and if there are suitable non-mercury alternatives available. In August 2000, support personnel received training on the importance of properly disposing of mercury-containing items and purchasing non-mercury products. The Environmental Branch has also developed stickers that say "Contains Mercury" that were distributed at the staff training.
- The Chemistry Department no longer stocks mercury-containing compounds. They will only purchase such compounds on an amount needed basis per use. The use of mercury containing compounds is projected to be extremely small (less than one use per year, and in milligram amounts). The Environmental Branch disposed of all of the mercury-containing compounds that the Chemistry Department had in stock.
- The chemistry laboratory installed a barrier around each barometer to protect them from breakage.
- The two mercury-containing barometers in the physics laboratory have been removed and shipped for recycling.
- The dental clinic is investigating the feasibility of installing a treatment system to remove mercury from the rinse sink wastewater.
- Four Teflon-coated sling psychrometers were purchased for the marine science section.