

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 >> Environmental Laboratory

Introduction

The project team consisting of Federal, state and interstate representatives visited a laboratory associated with a federal agency to (1) test out the effectiveness of a draft mercury inventory and management questionnaire; (2) understand the use of mercury-added products at the facility, and (3) learn about the efforts that the laboratory had undergone to comply with mercury discharge limits and to reduce their reliance on mercury-added products. The project team met with the laboratory's senior management, the supervisors and team leaders of the various sections of the laboratory, the facility manager, and the environmental health and safety official at the facility. The facility representatives explained the history of compliance-related mercury controls at the lab, the lay out of the facility, and their preliminary mercury assessments. This case study presents the results of this mercury site assessment and recommendations for additional mercury controls for the facility.

Facility Overview

The following types of laboratories and rooms were reviewed during the site visit:

- **Preparatory lab** – prepares soil and water samples
- **Screening lab** – extracts contaminants from the samples
- **Wet lab** – conducts biological analysis of water samples
- **Ambient air monitoring lab** – analyzes air samples
- **Dish room** – area for cleaning and washing glassware
- **Sample receipt and storage room** – incoming sample receipt/excess of samples declare as waste
- **Mechanical calibration room** – field sampling equipment and air sampling equipment
- **Microbiology laboratory** – processing of field water samples, fecal pathogen analysis
- **Technicon laboratory** – metals and mercury analysis field samples
- **Hazardous waste storage shed** – central storage area for hazardous waste materials storage



History of Compliance-Related Mercury Controls at the Laboratory

Starting approximately ten years ago, the laboratory found mercury in the sludge that was accumulating in the facility's acid neutralization tank. To determine the source of the mercury, the facility analyzed the influent wastewater to this tank and found that it contained levels of mercury that on occasion exceeded the facility's wastewater discharge limit. To address this problem the laboratory cleaned the tank, flushed the laboratory wastewater piping system with trisodium phosphate and cleaned sink traps. All material was collected and disposed of as hazardous waste. Neither of these measures produced results that made the management of the laboratory confident that the laboratory would be able to consistently meet their mercury discharge limit. They still had sporadic mercury levels more than one part per billion (ppb).

At that time, the laboratory decided to discontinue the use of their wastewater discharge system, disconnect the traps in the pipes, and install another wastewater system. Around this time the lab also instituted a water conservation program to minimize their use of water and reduce their discharge. The new wastewater system was operated in a batch mode, with all laboratory wastewater being collected and tested prior to discharge.

At the beginning of 1999, the laboratory changed their wastewater operations again, and began to drum all of the laboratory wastewater and ship it out since the facility found that the cost of doing the batch testing exceeded the cost of hazardous waste disposal. The wastewater was classified as a nonhazardous waste and shipped out on a hazardous waste manifest with the Massachusetts Waste Code - MA99 (Non-Hazardous waste). Therefore, no laboratory wastewater is currently being discharged.

In addition to working on improving their wastewater discharge, the laboratory initiated a program to reduce the number of mercury thermometers and other mercury devices present in the lab. They collected all thermometers not in use or used infrequently and stored them under lock and key. They have also been

collecting batteries for recycling. The Laboratory has collected all of the old mercury switch thermostats and replaced them with H/P electronic thermostats. Fluorescent light bulbs are recycled by the lessor through a local waste recycling firm.

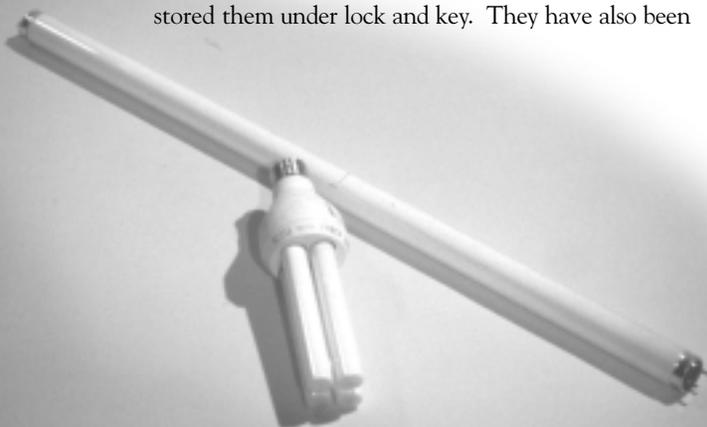
Current Inventory

The management of the facility conducted a quick audit of mercury-related products in the laboratories prior to the site assessment by the project team. They found that the lab still has a large barometer; about a dozen mercury-added thermometers, including a large thermometer that is used to calibrate the accuracy of thermometers used throughout the laboratory; and mercury lamps that are used in the atomic absorption spectrometer, the mercury vapor analyzer (Jerome Meter) and the Tekran field analyzer. The lab has ordered a plexiglass shelter for the barometer to help prevent breakage.

The large thermometer is required by the National Institute for Standards and Testing for calibrating other thermometers. The lab has six incubators, all of which require a mercury thermometer. The mercury thermometers are accurate to a tenth of a degree, whereas the alcohol thermometers are not as sensitive. The incubators have a high degree of temperature sensitivity. The lab has replaced all of the refrigerator thermometers with alcohol units. There is one mercury thermometer that is still used in a drying oven. The lab also keeps a few spare thermometers in case they need to replace one. The lab has purchased teflon coated thermometers to prevent the mercury from dispersing if the unit is broken. The project team did find a mercury thermometer in the facilities hazardous waste storage shed of which the laboratory was not aware.

The lab has a Coulter counter that includes a mercury manometer. This unit has 157 grams of mercury. It is used for counting algal cells. In one to two years, Coulter will be phasing out the mercury manometer in these units. When they make this change the company will no longer service the older models. At that time the lab will probably switch to the non-mercury unit.

The only mercury compound that the lab has a 200 ml container of mercury salts. There is also a small amount, 15-20 ml, of elemental mercury used as a standard for calibrating the Jerome Meter. This mercury is stored in a thermos and is locked up. The facility used to have some mercuric chloride in their inventory, but they have removed these materials from the site.



The facility collects all batteries and recycles them through a contractor. The building owner collects the fluorescent lamps and they are sent to a recycler. They fill up a box that can hold 85 bulbs approximately every 4 months. The laboratory rents the building and they have limited control over the selection of light bulbs and thermostat switches. The facility uses a contractor for cleaning, and they use their own cleaning products.

The outdoor lighting includes 6,400-watt mercury vapor flood lights on top of the building. Above the doorways, there are 100 watt mercury vapor lights. Above the loading dock doors, they have 150 watt high pressure sodium lamps. Above the boat room doors they have 500 watt quartz bulbs. In front of the building, there are 175 watt mercury vapor down lights. Above the doorway on top of the chemical shed is a 150 watt high pressure sodium bulb. All outside lights are controlled by a light sensor to turn lights on and off.

There are thermocouples in use in a biology walk-in chamber associated with the wet laboratory and in the air calibration laboratory in the ambient air monitoring laboratory.

Procurement Procedures

After a laboratory supervisor has signed off on a chemical purchase, the laboratory's health and safety officer reviews all of the new proposals for chemical purchases. He evaluates them for safety and examines potentially safer and less toxic alternatives. The officer reviews the toxicity of all new chemicals and, if they are toxic, he reviews P2 alternatives or safer substitutes. If he does not sign-off on the purchase of a chemical, the materials cannot be ordered. After the health and safety sign-off the lab manager may also need to review and approve the purchase. The lab has removed many hazardous chemicals, such as mercuric chloride and Nesler's reagent through this approval system. The lab has established a bar coding system for keeping track of its chemical inventory and for keeping track of the chemical as it is used. They have made an effort to reduce excessive packaging and overstocking in the liquid and dry chemical storage areas. The lab is audited once every two years for environmental compliance.

For purchasing equipment, the health and safety officer reviews all Material Safety Data Sheets. He works hard to minimize the lab's inventory of equipment

and materials. If the MSDS indicates that there is mercury in a product, the facility staff automatically evaluate whether to purchase it. These efforts have helped the lab to eliminate its problems with overstocks of products and chemicals.

This laboratory has made an extensive effort in the past to eliminate their wastewater discharges to help them meet their permit limit.

The laboratory has instituted microscale chemistry techniques where they are feasible and allowed under standard laboratory procedures. They are also minimizing the volume of the samples they collect and analyze in the lab. The facility staff also use portable analytical devices to test soil/water/biota/air in the field.

The laboratory has conducted training for its staff to review pertinent information on chemical health and safety.

The laboratory uses a certified hazardous waste hauler to pick up and dispose of the hazardous waste generated and managed by the facility. From June 1, 1998 through June 30, 1999, the laboratory produced 147.59 pounds (66.936 kg) of soil with mercury levels greater than 0.2 parts per million (ppm) of mercury. If all the soils contained mercury at twice the 0.2 ppm action level, the total amount of mercury would be 5.894×10^{-5} pounds. The laboratory also disposes of mercuric chloride solutions from the standards preparation and use. These standards have a maximum amount of 200 parts per billion (ppb). During this same period, June 1, 1998 to June 30, 1999, 41 pounds (18.597 kg) of solution was disposed accounting for a maximum amount of 8.199×10^{-4} pounds of mercuric chloride. This does not include any one-time disposal of mercury containing products, including thermostats and thermometers.

Recommendations

This laboratory has made an extensive effort in the past to eliminate their wastewater discharges to help them meet their permit limit. In addition, they have minimized their used of mercury-added products and their purchasing of mercury and mercury compounds. Nevertheless, the site assessment team did have a few suggestions:

- Develop an information bank on safer substitutes for common uses of mercury in the lab
- Develop a mercury specific baseline for tracking reductions
- Improve mercury awareness among employees by conducting targeted training for employees on the facility's standard operating procedures for mercury
- Ensure that all mercury thermometers have a teflon coating to help prevent their breakage and contain the mercury if they do break
- Work with the landlord on P2 for fluorescent light bulbs and thermostats
- Develop and disseminate standard operating procedures for mercury management
- Replace mercury thermometer in the hazardous waste storage shed with a non-mercury unit

Project Team

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Recyclers/Collectors of Mercury-Containing Products

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

Attachment A

Facility Response to EPA Visit and Recommendations

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

- All new mercury thermometers purchased will be Teflon coated
- Fluorescent light bulbs and thermostats are now recycled by the building owner
- Mercury thermometer in the hazardous waste storage shed was removed and disposed of properly
- A standard operating procedure for mercury management will be developed and disseminated that will include a number of the recommendations from the assessment outlined above, including training staff and encouraging safer substitutes.

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