

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 >> Air Force Base

Introduction

The project team consisting of federal, state, and interstate representatives visited a New England Air Force Base to identify the sources and uses of mercury-added products at the Base and to learn about the efforts that the Base has undertaken to reduce or eliminate their reliance on mercury. The Team met with the Base's Environmental Manager and several members of the staff. The Team utilized a mercury management questionnaire to facilitate discussion of past and current mercury use at the Base and to determine the locations on the Base that were most likely to use mercury-added products. During the assessment the Team visited the following buildings on the Base: environmental services, wood shop, metal shop, HVAC shop, energy management control center, hazardous materials pharmacy, research laboratories, health clinic, elementary/middle school, and the power plant. This case study presents the results of this mercury site assessment and recommendations for additional mercury reduction and controls at this Air Force Base. Attachment A outlines the measures undertaken by the Base to address the recommendations.

Facility Overview

Overall awareness of mercury at the Base appears to be high and in general, the Base has done a considerable amount of work to control and reduce their use of mercury. The Environmental Services Department receives support from the base command for its activities, which has produced a strong and effective environmental program.

The Air Force Base consists of office buildings, research and development laboratories, a residential community of base personnel, and an elementary/middle school. Other buildings contain various support shops (e.g. metal, wood, HVAC), recreation buildings, health clinic, and commercial establishments. The Base has not supported military aircraft activity since the 1970's, and the airport facilities are no longer within the boundaries of the military base. The Base receives its water and wastewater services from the regional authority. There is no on-site wastewater treatment. The Base has two sewer pump stations and meters and pressure relief valves on the water supply system.



Mercury Reduction Efforts and Current Inventory

The Base has not conducted a base-wide mercury inventory. However, the quantity of mercury at the Base was significantly reduced in the 1990's due to updating and renovation of facilities. Approximately 90 percent of the buildings on the Base have been renovated since 1993 and therefore, most sources of mercury have been removed. In addition, as technology has improved, older mercury-added equipment has been replaced with state-of-the-art devices that do not contain mercury. For example, in 1999 two kilograms of mercury were turned into the hazardous waste collection system from a diffusion pump that was converted to oil. Mercury-added materials, such as chemicals and unused equipment that had accumulated, were collected and properly disposed of during the moving and renovation activities.

Support Shops The wood, metal, and HVAC shop buildings are among the ten percent of the Base's buildings that have not been recently renovated. Each shop had a mercury-containing thermostat. The HVAC shop performs maintenance, repair and replacement activities associated with the heating, cooling and ventilation of all buildings. The HVAC shop reports that they continue to purchase mercury-containing thermostats for use in residential and other buildings on the Base that are not serviced by the central power plant.

Buildings that are not connected to the central plant have individual oil-fired boilers that tend to have mercury-containing float switches. When a float switch needs replacing, the HVAC shop uses mercury-containing switches because they have had corrosion problems with electrodes. In addition, HVAC shop personnel report that there is a mercury-containing thermometer on the steam and chill line of each boiler. These thermometers are not Teflon-coated. The HVAC shop does not purchase thermostats, flow meters, and thermometers through the HazMat pharmacy. All mercury-containing devices requiring disposal are turned into the hazardous waste collection system.

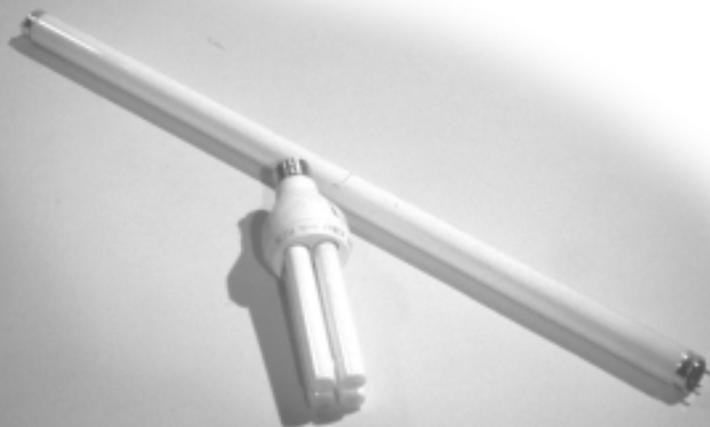
Research Laboratories The research laboratories underwent a complete mercury audit in 1989, and the environmental manager of the lab has made a conscious effort to remove all known, non-essential mercury sources from the laboratory buildings. This focus on mercury was prompted when the laboratory manager noticed that a significant number of mercury-containing vacuum pumps were being turned in for disposal. All sink drains in the laboratories have been disconnected from the wastewater system to ensure that no potentially harmful material is discharged from the facility. All HVAC controls are electronic. The only known mercury in the laboratories are the fluorescent light bulbs and three mercury-containing thermometers that are required to calibrate equipment.

Health and Dental Clinics The medical/dental clinic reported that they no longer use any mercury fever thermometers or blood pressure gauges. However, the Team did find two mercury-containing thermometers to monitor minimum and maximum temperature in a refrigerator. The medical laboratory also has a mercury-containing reference thermometer that is kept in a prescribed location. None of these thermometers is Teflon-coated. The dental clinic uses encapsulated amalgam and has mercury traps on the rinse drains. The dental clinic collects excess amalgam and disposes of it properly.

Elementary/Middle School The elementary/middle school on the Base is owned and operated by a local public school system. Approximately four or five years ago, the school science teacher performed an inventory and clean-out of hazardous laboratory chemicals, including mercury. Subsequently, the science laboratory has instituted micro-scale chemistry to significantly reduce the quantities of all hazardous chemicals used. There is a large mercury-containing barometer/thermometer on the wall in the science laboratory and two boxes of smaller thermometers, including approximately ten mercury thermometers. None of these had physical protection against accidental breakage or a Teflon coating to prevent the discharge of mercury in the event of breakage. The school now has a policy to purchase only non-mercury thermometers. However, they keep the mercury-containing thermometers that are still useable. The school discards their fluorescent light bulbs in the regular trash which is not legal under state regulation.

Central Heat Plant and Energy Management

Control Center The central heat plant was constructed in the 1960s and extensively renovated



in 1988. The central heat plant supplies steam heat and cooling to approximately 60 of the 98 buildings on the Base. Generally, the remaining buildings on the Base have their own oil-fired boilers, and the residential buildings on the Base are serviced with natural gas. The central heat plant boilers are fueled by natural gas and oil. The central heat plant contains several mercury-containing thermometers and gages. The central heat plant disposes of their fluorescent light bulbs in with the regular trash which is not legal under state regulation.

The buildings serviced by the central plant are connected to an energy management center that controls heating and cooling to maximize energy efficiency. All flows are controlled electronically and no mercury-containing devices are used. In some buildings the control is limited to whether the heating/cooling is on or off at a given time, and the building occupants control the temperature setting locally with a thermostat.

Procurement and Disposal Procedures

The Base established a HazMat pharmacy in 1995 to reduce the quantity of hazardous materials in storage and to track the use of hazardous materials used on the Base. The pharmacy is run as a matrix organization with affiliated staff in many locations at the Base. The following summarizes the purchasing process:

- Before ordering, departments on the Base consult the GSA's "green book" to determine if there is an environmentally preferable item.
- If no alternative is available, a form to request the purchase of a potentially-hazardous material is submitted to the HazMat pharmacy.
- The information is then reviewed for environmental and biological hazards by the environmental department. The environmental department also performs research to determine if a non-hazardous alternative is available and if so, they specify it on the order.
- After an item is approved for purchase, it is delivered to the HazMat pharmacy where a HazMat label is placed on the product before it is distributed to the user.

The use of mercury-containing materials is tracked at the Base under this system.

The Base has a network of 43 hazardous waste satellite areas, each with a manager and an alternative manager. These managers and alternative managers receive

training once a year. The Base has a central hazardous waste storage facility that receives the material from the 43 accumulation points and controls all hazardous waste shipments from the Base. Fluorescent light bulbs from most buildings on the Base are turned into the hazardous waste accumulation points on a regular schedule. The bulbs are collected at the accumulation points every Tuesday and turned into the central hazardous waste storage area. Fluorescent bulbs are then sent off the Base for recycling.

Recommendations

The mercury team offers these recommendations for consideration:

- Conduct a comprehensive base-wide mercury inventory to capture procurement, uses and waste streams that are not currently well-documented. This inventory can serve as a baseline from which to measure future mercury reduction efforts. All mercury-containing devices should be clearly labeled.
- Raise the overall awareness of mercury hazards, products that contain mercury, and proper disposal practice through a base-wide educational outreach or training effort that reaches all employees. In several instances, employees in the buildings we visited told the Team that they did not have any mercury at their facility and then the Team proceeded to find a mercury-containing device or illegal fluorescent lamp disposal.
- Expand the HazMat pharmacy to cover mercury-containing switches, thermostats, thermometers, and other products.
- Not all purchases come through the HazMat pharmacy due to Air Force procedures for procuring different types and classes of material, such as the use of IMPACT credit card purchasing. The Base should add a mercury section to the HazMat training and develop a standard operating procedure for procurement of mercury-containing equipment.
- The HVAC department and the central heat plant should discontinue the purchase and use of mercury-containing thermostats, gauges, and other devices and switch to their digital alternatives wherever feasible. Although the upfront cost and maintenance requirements of non-mercury alternatives may at first appear significant, when the life cycle cost is considered, particularly proper disposal and the potential for a hazardous spill,

the overall cost of alternatives is significantly reduced. All remaining mercury-containing thermostats should be encapsulated to prevent the release of mercury if they are accidentally broken.

- The HVAC department and central heat plant should receive training on the proper handling of mercury-containing products, particularly thermostats, gauges, and measuring devices. The HVAC department and central heat plant should also have a mercury spill kit and receive training on how to use it.
- Review the fluorescent bulb disposal practices of each building on the Base and educate all building managers that it is illegal to throw fluorescent lamps in the trash. Ensure that the central heat plant, the elementary/middle school, and any other building not already doing so, collect their used fluorescent light bulbs and properly dispose of them. All building managers should certify that the collected bulbs are being recycled.
- 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.
- 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 barometer/thermometer on the wall of the science laboratory at the elementary/ middle school with a non-mercury alternative, or at least encapsulate it so as to protect against breakage and release of the mercury.
- Expand mercury awareness in the Base community and provide a greater opportunity for the Base community to properly discard/recycle mercury-containing products. Several ideas are: sponsor a thermometer exchange for employees and residents;

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Recyclers/Collectors of Mercury-Containing Products

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

promote bulb recycling to residents and staff by providing information and appropriate collection at a convenient location on the Base, such as at the commissary; and teach the middle school students about mercury hazards and sources of mercury and have them conduct a mercury audit of their homes

Project Team

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Attachment A
Facility Response to EPA Visit and Recommendations

The Environmental Services Department appreciates the Assessment and Case Study. Since the Mercury Assessment, the relationship between the Environmental Services Department and the Air Force has undergone extensive restructuring. Therefore, they have been unable to devote resources to implementing the recommendations made in the case study. The Environmental Services Department did meet with building managers to further educate them on the proper disposal of fluorescent bulbs. Once the restructuring is complete, the Environmental Services Department plans to develop a strategy to address each of the recommendations.