Canadian Conservation Institute
Institut canadien de conservation

CCI Notes 1/7

Mercury in Museum Collections

Introduction

Mercury is a heavy metal that conducts electricity well, has a high reflectance, and is liquid at room temperature. It is an excellent material for a wide range of applications, and can be found in barometers, pumps, thermometers, and medical equipment, as a conductor in physics apparatus and switchgear, and even as a reflective coating for mirrors. It has also been used in many medicinal and fungicidal compounds, and can turn up in other unexpected places: the flashing lights popular on some brands of sneakers employ mercury switches, and it is used in several kinds of light bulbs.

Museum environments often contain many sources of mercury: interior wall paints,[1] collections of pharmaceutical, medical, and dental equipment (e.g. Mercurochrome, calomel, thimerosal, and dental amalgams),[2] mineralogical collections that contain mercuric salts, artists' materials that contain compounds such as cinnabar and vermillion, and taxidermy and ethnology collections in which mercuric salts have been used as insecticides. The extent of mercury use in museum collections has been discussed in more detail by Barclay and Ziomkiewicz.[3]

The dangers of mercury are well-known and well-documented. To avoid these ill effects it is essential to know which objects in a museum collection contain mercury, and how to handle and care for them properly.

Exposure to Mercury

Mercury is a neurotoxin (or nerve poison) that can be absorbed by the body through direct contact, ingestion, or inhalation of mercury vapour. Once in the body inorganic mercury remains for weeks or months, and can accumulate in the kidneys and the brain where it can cause a variety of mental and physical symptoms. The portion that enters the brain is converted into an organic form and remains for even longer. Inorganic mercury in the blood of a pregnant woman can also enter the developing foetus.

The amount of metallic mercury that is absorbed by the body following ingestion or contact with the skin is quite small, although not insignificant when added to that which is regularly absorbed from other sources in the environment. In contrast, the amount that is absorbed following inhalation of mercury vapour is very large (about 80%), which makes mercury vapour particularly troublesome. Although the partial pressure of mercury in air

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at 25°C is low enough (0.0018 mmHg) that only a very small amount will evaporate, mercury vapour in an unventilated space can easily exceed the recommended maximum (0.025 mg/m^3). Any objects with open surfaces of mercury, or damaged objects where mercury has spilled, therefore present a risk.[4]

Liquid mercury in old objects is often oxidized and dirty, making it still more hazardous. These mercury compounds can pass easily into the body. Even extremely small amounts of these materials absorbed over time can cause chronic effects.

Detection and Identification

Liquid mercury is easy to detect because it is reflective, and its presence can be determined visually. The presence of mercury compounds is much more difficult to determine and requires chemical or electronic monitoring techniques, e.g. X-ray fluorescence can be used to detect the presence of mercury as a contaminant on metal objects, and electronic devices are available to monitor work spaces for mercury vapour.[5]

If there is any suspicion that high levels of mercury vapour exist, contact an accredited professional industrial hygienist to conduct air sampling (see "Resources").

Safety Information

Some of the best sources of information on proper handling procedures for metallic mercury and mercury-containing substances are the Material Safety Data Sheets (MSDSs). Unfortunately these are easily obtainable only for newly purchased chemical products, and many museum objects that may contain mercury do not have such documentation. Owners of old stocks of chemicals (such as pharmaceutical collections) should check with the manufacturers to see if the MSDSs are available; if not, these old chemical products should probably be discarded (although for museum documentation reasons such materials should first be identified by analysis).

All laboratories where chemicals are routinely handled are required by law[6] to have available the MSDSs on all materials. Museums and private owners can find the same information on the Internet (see "Resources").

The *Toxicological Profile for Mercury*[7] contains excellent information and should be required reading for all staff who deal with museum objects and collections containing mercury.

Employees who routinely work with objects containing mercury, or in areas where mercury-containing objects are stored in quantity, should discuss this with their healthcare professionals; regular monitoring of blood-mercury levels during occupational health assessments may be necessary.

Guidelines for Safe Handling

All museum objects that contain mercury and the places where they are stored should be clearly labelled so that caution can be exercised when opening these cupboards and handling the objects. As liquid mercury is heavy and usually contained in glass, these items require special attention. Objects with only small amounts of enclosed mercury (e.g. thermometers) can be carried by hand, but larger objects should be moved on a wheeled cart with a padded surface, taking care to avoid bumps and shocks.

The vapour pressure of mercury increases dramatically as temperature rises (i.e. more mercury vapour is released into the air at higher temperatures), so cool storage of objects containing mercury or mercuric compounds is recommended.

Unspecialized museum personnel should never attempt to remove mercury from a museum object, or replace it, or top it up. It is also inadvisable to attempt to clean dirty mercury as the dirt could be the result of oxidation (such dirt is very poisonous). When in doubt, consult a specialist for advice.

Spillage and Contamination

Museum staff should never deal with mercury spillage; even the smallest amounts must be handled by a specialist (see "Resources").

If even minuscule quantities of mercury are thought to be lodged in places like floorboard cracks, have the whole area checked by an industrial hygienist. Should the airborne mercury prove to be well below the level of concern, sprinkle zinc dust in the area and brush it well into the surface (the zinc will amalgamate with the mercury and render it harmless[8]). Most well-equipped laboratories keep spill kits for neutralizing hazardous materials, and one specific to mercury is a good addition. Ensure that at least one staff member has training in handling hazardous materials.

If there is any doubt about the amount of mercury present or the extent of contamination, contact a specialist (see "Resources").

Mercury amalgamates readily with other metals, so refer any spills that have come in contact with metal objects to a metals conservation specialist. Not only is the problem difficult to deal with from the point of view of the object's stability, but the residues from the process are potentially dangerous and must be disposed of carefully. Gold jewelry is particularly susceptible to contamination by mercury, and can be ruined very easily.

Alternatives for Safer Display

It is often possible to use a substitute for mercury (one that has the same appearance but not the drawbacks) for displays. For example, if the bulb of a thermometer is broken but not visible, a thin wire could be inserted

into the bore to simulate the mercury; platinum would be the preferred choice because of its white colour and resistance to tarnish but tin — although not so bright — would be an acceptable (and cheaper) alternative. Larger glass containers could have thin films of silver or aluminum deposited chemically or by vacuum on their inside surfaces; an optician can often suggest resources for this kind of service. These thin metal films are easily removable with acid should the need arise in the future, although this should be done only if the glass is stable and will not be damaged by this subsequent treatment. In some displays, a highly polished disk of aluminum or a glass mirror could stand in for what should be a pool of mercury.

Resources

Accredited hazardous waste disposal companies can be located in the Yellow Pages under 'Waste Management', 'Hazardous Waste', and 'Waste Reduction & Disposal Service - Industrial'. If atmospheric contamination is suspected, look for 'Environmental Consultants & Services' and 'Air Quality Testing Services'. University and community college chemistry departments may also provide referrals.

It is essential that the chosen company be accredited. Listings of accredited companies in Canada and elsewhere are available on the Web site of the American Industrial Hygiene Association (http://www.aiha.org/foreign.html).

The Canadian Centre for Occupational Health and Safety has MSDS information on its Web site (http://ccinfoweb.ccohs.ca).

Most governments post information and legislation on the Internet, e.g. the Government of Ontario (http://www.gov.on.can/lab/ohs/00-oelte.pdf).

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Advisory

This Note is intended solely for guidance and advice on resources. The Canadian Conservation Institute accepts no liability as a result of misinterpretation of the information provided herein.

Endnotes

1. Interior wall paints were often preserved with mercury (phenyl mercuric acetate) until the 1990s, when it was discovered that mercury out-gassed from these paints for several months after they were applied in amounts sufficient to poison household occupants [see Centers for Disease Control, *Mortality and Morbidity Weekly Report (MMWR)* 40, 17 (May, 1991), pp. 280–281]. The *Hazardous Products Act* (R.S. 1985, c. H-3), Schedule 1, Part I, Section 9 (d) banned the use of mercury in Canada as a coating for children's toys, and an effort is being made to broaden this restriction.

2. Over-the-counter drugs such as Mercurochrome (merbromin), calomel (mercurous chloride), and thimerosal have only recently been banned [*Physicians' Bulletin*, San Diego Department of Health Services, May 1996, press release #31-96; California Department of Health Services, Sacramento, *MMWR* 45, 19 (May 17, 1996), pp. 400–403; and *MMWR* 45, 29 (July 26, 1996), pp. 633–635], and are very likely to appear in pharmaceutical collections. Mercury metal is still used in dental amalgams and may well be encountered in dental equipment that has been acquired by a museum.

3. Barclay, R., and B. Ziomkiewicz. "Historic Scientific Instruments Containing Mercury." *Rittenhouse* 15, 1 (June 2001), pp. 21–30.

4. *Hazardous Chemical Safety Course Manual*, J.T. Baker Chemical Co., Phillipsburg, NJ, 1991, pp. 12–19.

5. CCI offers analytical services to identify doubtful compounds on museum artifacts. For more information, contact Client Services by telephone (613-998-3721) or e-mail (cci-icc_services@pch.gc.ca).

6. In Canada, hazardous materials are a provincial responsibility. Canadians should check their provincial legislation to ascertain their legal responsibilities. But don't forget that while legislation may vary from province to province, the hazard remains the same.

7. *Toxicological Profile for Mercury*, U.S. Department of Health and Human Services, March 1999. Available from: Agency for Toxic Substances and Disease Registry, Division of Toxicology/Toxicology Information Branch, 1600 Clifton Road NE, E-29, Atlanta GA 30333, USA (e-mail: atsdric@cdc.gov).

8. Bretherick, L., and G.D. Muir. *Hazards in the Chemical Laboratory*, 3rd ed. London: Royal Society of Chemistry, 1981, p. 381.

Copies also available in French.

Le présent texte est également publié en français.

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