"Hydrargyrum" - pretty liquid silver - how **dangerous** you are!

by Monique Muller

Mercury's original scientific name was Hydrargyrum (literally "watery (liquid) silver" in Latin), hence the symbol "Hg" it was given as element 80 in the periodic table. Mercury is found all over the earth in soil, rocks, water and even in trace amounts in the air. The largest common mineral deposits on earth, called cinnabar, are in the form of non-toxic mercuric sulphide. Mercury exists in several forms: as liquid metal (quicksilver), as vapour and in compounds with organic and other inorganic chemicals. Mercury is the only metal that is a liquid at room temperature and is so slippery that it will fall from your hand if you try and hold it. It is so heavy that 4 tablespoons of Mercury weigh nearly 1 kg!

Uses and effects

Mercury has been used throughout history in various ways and in different applications. The oldest sample of mercury dates to about the fifteenth or sixteen century BC. It was found in an Egyptian tomb at Kuma stored in a small glass container.

In Roman times Mercury was mined in the form of cinnabar and used as a pigment in paint. The practice was phased out by the USA only as late as 1991. Aristotle referred to Mercury as liquid silver and alchemists of his time believed that it was the origin of all other metals. Mercury fulminate was originally used as a detonator for explosives (1799). When polyvinyl chloride (PVC) was first produced (1835), the original synthesis relied on Mercury as the catalyst. Thomas Edison's incandescent lamp contained Mercury (1891) and Hamilton Young Castner discovered that Mercury could be used in the chloralkali process to produce chlorine and caustic soda (1894). During WWII, the Ruben-Mallory battery (Mercury dry-cell battery) was invented and widely used. By the 1960s, the production of electrical apparatus, caustic soda (used in the paper industry to bleach paper) and chlorine accounted for over 50% of Mercury's uses. The Fresnel lenses of old lighthouses used to float and rotate in a bath of Mercury, which acted as a bearing.

Unfortunately the use of Mercury sometimes came at a price; slaves who worked in Roman Mercury mines, for example, often died of exposure to Mercury. By 1000 AD, Mercury was used to extract gold by amalgamation. The solution of gold in Mercury was then heated until it evaporated, leaving the purified gold. A gold Mercury amalgam was often used during gilding; 60 men died from gilding during the construction of the Saint Isaac's Cathedral, St Petertsburg.

Two British ships salvaged a large load of Mercury from a Spanish wreck in 1810. The bladders containing the element broke and Mercury spread all over the ships. The vapours caused neurological and physical symptoms amongst the crew.

The first Emperor of China (Qin Shi Huang) drank Mercury to gain eternal life, but not surprisingly died shortly thereafter.

By the late 1800s, the main uses of Mercury were in recovering gold and silver, manufacturing fulminate and vermilion (a dye), and felt-making. The process to make felt hats used Mercurous nitrate to remove the fur from animal skin and to mat it into felt. This caused dementia in milliners - hence the phrase "Mad as a Hatter".

The 1920s silent movie actress Olive Thomas, died in Hotel Ritz Paris from drinking Mercury. It is not clear whether she committed suicide or her husband poisoned her!

Mercury use continued in scientific research fields largely as a result of Torricelli's 1643 invention of the barometer and Fahrenheit's 1720 invention of the Mercury thermometer. The latter in particular exposed the German inorganic chemist Alfred Stock and his colleagues to Mercury vapours causing their death.

In 1930, workers in a seed packing plant were exposed to the vapours of Methyl mercury used to disinfect and preserve the seeds. The disease caused by Methyl mercury was first named the Hunter-Russell syndrome. Later, when Methyl mercury caused large scale poisoning in Minamata, Japan, where industries discharged it in rivers and coastal waters, killing more than 500 people and causing birth defects in new-borns, the name was changed to Minamata disease.

More recently, in 1996, Dimethyl mercury caused the death of Prof Karen Wetterhahn due to spillage on her skin. Effects only became apparent months after the incident.

There have been incidents of people trying to poison others with Mercury such as Alan Chmumy who tried to kill a former employee by pouring Mercury in the ventilation of her car in 2000. In 2008, Tony Winnett died ten days after he tried to extract gold from computer parts.

It is estimated that, over the last 4 000 years, historical and continued use of Mercury has released 350 000 tonnes of Mercury from the depths of the earth into air, surface land and water.

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Mercury as medicine

In Aristotle's time alchemists used it to treat skin disorders. In India and China, it was used as an aphrodisiac and by Chinese woman as a contraceptive. Cinnabar is still used as a sedative in traditional Chinese medicine. Abraham Lincoln commonly used medicine called "blue mass" which contained large quantities of Mercury and supposedly cured ailments such as apoplexy, depression, worms, child-bearing, tuberculosis, toothaches or teething problems and even syphilis!

Present day – Uses and sources

There are many current uses for Mercury in addition to a large amount of outdated equipment still in use today containing Mercury. Examples include:

1. Switching equipment and devices: in motor vehicles, including air bags, tilt alarms and ABS, manufacturing equipment: flow tilt, limit and level switches, circuit breakers and thermostats, household appliances, boilers, lifts, manometers and thermometers, arc rectifiers in transformers.
2. Batteries such as alkaline-manganese and button-cell mercuric-oxide batteries in camera light meters and hearing aids; these were effectively banned in most countries in the 1990s due to concerns about the Mercury contaminating landfills.
3. Combustion sources such as coal fired power plants, medical waste incinerators, municipal waste combustors, commercial/industrial boilers, hazardous waste combustors, crematoria.
4. Cosmetics: historically Mercury was added to cosmetics as a skin whitening additive. It is still used as an antiseptic and antifungal agent in the manufacturing of mascara.
5. Lamps: Gaseous Mercury is used in Mercury vapour lamps, fluorescent tubes, metal halide and high pressure sodium lamps, neon advertising signs and LEDs.
6. Liquid crystal display equipment such as cameras and camcorders.
7. Measuring and control instruments: gauges, manometers, barometers, and vacuum gauges.
8. Medicine: antiseptics e.g. mercurochrome, stimulant laxatives, diaper-rash ointment, eye drops, and nasal sprays.
9. Scientific research: pharmaceutical industry, scientific research facilities at universities.
10. Pesticides: treatment of grains and seeds (Methyl mercury).

Mercury exposure from fish

A number of fish species are susceptible to contamination with Mercury due to environmental poisoning - in particular shark, swordfish, king mackerel or tilefish and some shellfish. Five of the most commonly eaten fish that have low levels of or no Mercury include shrimp, canned light tuna, salmon, pollock, and catfish. It is wise to check with the local authorities about the safety of fish caught by family and friends in rivers or coastal areas.

Mercury spill clean-up

If equipment on the premises contains Mercury that can be released accidentally, ensure that your company's emergency response plan caters for Mercury spillages. Consider keeping a Mercury spill kit close by. Although such kits can be purchased, it should be ensured that a respirator and appropriate cartridges are also supplied. When even a small quantity of Mercury is spilled, it is best to evacuate the area immediately and prevent others from entering. Crews should don appropriate personal protective equipment before attempting to the clean-up. Of this, the most important are latex gloves and a respirator with suitable Mercury vapour protection cartridges. Usually sulphur, a yellow powder, is sprinkled over the area of the spill. The sulphur combines with the Mercury to produce a non-toxic red powder, Mercury sulphide (HgS). This is then scooped up and disposed of, with the scoop and the brush, in accordance with the approved procedures developed by your Hazardous Waste Disposal Company's disposal instructions.

Mercury toxicity

Mercury and most of its compounds, both inorganic and organic, are toxic. The most toxic are the organic compounds such as Dimethyl mercury.

When liquid Mercury is spilled, it can turn into vapour classified as highly toxic. The lethal concentration (LD50) by inhalation of

Mercury vapour by rats is less than 27mg/m^3 over a two hour period. By comparison, the LD 50 for Hydrogen cyanide is 160mg/m^3 and 63mg/m^3 for Arsine gases over a one hour period. Thus, despite requiring an extra hour, the concentration needed to cause fatality in rats is less than half those of commonly recognisable poisons.

Mercury poisoning can take place at low concentrations over a long or at high levels within a short period of time.

Mercury targets the neurological and reproductive systems and kidneys. It accumulates in the body over a long period of time and can poison the brain. Mercury vapour is heavier than air and tends to remain near the floor or area of spillage. Thus, if not removed, a concentration of toxic vapours can build up in poorly ventilated or low-lying areas putting children and infants particularly at risk.

Long-term mercury poisoning symptoms

Perpetual grumpiness/ Irritability

Anxiety/Excessive shyness

Anorexia/ Loss of appetite

Fatigue/Sleeping problems

Forgetfulness

Tremors

Changes in vision & hearing

Short-term Mercury Poisoning Symptoms

Cough, sore throat

Shortness of breath/Chest pain

Nausea, vomiting, diarrhoea

Increase in blood pressure or heart rate

A metallic taste in the mouth

Eye irritation/Vision Problems

Headache

Mercury Poison Testing and Cure

To test for Mercury exposure or poisoning the patient should go to a medical facility where urine or blood samples will be taken. A urine test is preferred for measuring elemental Mercury. Urine samples may be collected over a 24-hour period, or taken once, preferably in the morning after awakening. A blood test can be used to measure exposure to high levels of Mercury provided the test can be carried out within three days of being exposed.

If a test indicates an excess of Mercury - Mercury poisoning - the doctor can prescribe chelating drugs for acute Mercury poisoning that will remove the Mercury from the body.

Current chelators include: N-acetyl-D, L-penicillamine (NAP), British Anti-Lewisite (BAL), 2,3-dimercapto-1-propanesulfonic acid (DMPS), and dimercaptosuccinic acid (DMSA).

Working at **Heights** and the **Safety Practitioner**

By Leighton Bennett, Treasurer IOSM

The Institute for Work at Height (IWH) is the recognised SAQA professional body for work at heights and they have a number of recognised designations related to the competencies necessary for working at heights (eg. fall protection planners, rope access technician, supervisor and practitioner, MEWP Practitioner, TSP erection supervisor, fall arrest rescue co-ordinator, etc)

During the Institute for Work at Height's seminar at Midrand on 18 Sept 2014, the question was asked, "should the IWH develop a working at heights training course for Safety Practitioners?" Let's leave this answer for now.

From a safety perspective there are five critical management elements which must be considered when any work at heights is being considered. Are safety practitioners considering these points?

1. Hazard management involving a site specific risk assessment of the location and work to be done.
2. People management in terms of the selection (and medicals), training, experience, etc of the workers and especially their supervision (on site).
3. Equipment management in terms of type, selection, quality, inspection and fit for purpose of each item of equipment and/or component element going to be used.
4. Work methods requiring all involved following the safe working practice and standards so that good practice standards are maintained at all times.
5. Incident management in terms of preparing emergency and rescue procedures to respond immediately should something go wrong.

What different working at heights situations can the general safety practitioner describe? Probably only just the normal aspects of working on ladders, on scaffolding, on roofs and using fall arrest or fall protection at times. What about the other work at heights aspects?

Working at heights involves lots of different work and access methods which the safety professional should be aware of and have knowledge of the safety aspects involved with each of these methods.

Let's look at the various working at height options:

1. Ladders (GSR 13A) all types of ladders are covered including extension ladders which can extend beyond 9m in height and the ladder inspection, safe placement angle, holding,