Elemental mercury exists as a silvery liquid and an odourless vapour at room temperature.[1,2] Elemental mercury has a wide variety of industrial uses, including, electrical equipment (e.g. batteries and semiconductors), medical appliances (e.g. sphygmomanometers and thermometers), dentistry (mercury amalgams), barometers, paper manufacturing, and paints.

Incidents resulting in mercury contamination are not uncommon. For example, household contamination resulted in Scotland recently following, in one case, the breakage of a mercury sphygmomanometer and in another damage to a mercury barometer. Elevated levels of mercury were present in both homes and significant human exposure occurred. A child developed renal failure and peripheral neuropathy and was subsequently found to have extremely high levels of blood mercury. Local environmental heath and public health departments were asked for advice on the management of both incidents.

HEALTH RISKS

Elemental mercury vapour may enter the body via

i) The lungs (inhalation)
Up to 80% of inhaled mercury crosses the alveolar membrane and accumulates in red blood cells and tissues

ii) The skin (dermal absorption).
Significant skin absorption of mercury vapour can also occur.

iii) The gut (gastrointestinal absorption)
Gastrointestinal absorption is minimal (0.01%) partly due to the formation of sulphur laden compounds on the surface of the metal. Ingestion of a large amount of elemental mercury has occurred without adverse effect.[3]

Excretion of Mercury

Elemental mercury has a half life of 60 days within the body. It is eliminated in urine, faeces, saliva, sweat and by exhalation.

Low Concentration Exposure Risks

At chronic low doses the body can oxidise most of the inhaled elemental mercury to form mercury salts. As mercury salts do not readily cross the blood brain barrier or placenta, brain and foetal abnormalities are unlikely to occur.

High Concentration Exposure Risks

At high levels of exposure this protective mechanism can be overloaded and elemental mercury, if present in the blood for a sufficient length of time, can enter the brain and foetus. Where the central nervous system is affected, irreversible tremor, paraesthesia, limb weakness, social withdrawal, memory loss and anorexia can follow. Renal accumulation resulting from exposure to elemental mercury may take place but often without clinical dysfunction. Toxic pneumonitis, gastrointestinal haemorrhage and cardiac arrhythmias may follow inhalation of high concentrations of mercury vapour.

LABORATORY INVESTIGATIONS

Suspected cases of mercury poisoning should have a full blood count, urea and electrolytes, liver and renal function tests and urinalysis. A chest x-ray and electrocardiogram may also be required.

Blood and urine mercury levels are used to measure exposure. Blood level measurement is the best measure of recent exposure to elemental and inorganic mercury but it is not a measure of total body burden. Organic mercurials tend to concentrate in the red blood cells due to their lipid solubility. A plasma to red blood cell ratio of 1:1 is indicative of inorganic mercury toxicity whilst a plasma to red blood cell ratio of 1:10 is indicative of organic mercury toxicity. Symptoms can be seen with methyl mercury at 3-5 µg/dl blood and with other mercurials at 20 µg/dl blood. The upper limit of normal urinary excretion of mercury is 25 µg/dl. The total body burden of mercury can be assessed by a chelation challenge. A fourfold increase established by 24 hr. monitoring over baseline urinary mercury concentration indicates a significant body burden[1].

PRINCIPLES OF GOOD PRACTICE

It is very likely that the question of immediate and paramount importance facing local authorities will be what advice to give when the phone call comes from the householder or perhaps the duty nurse in a residential care facility. The degree of risk and, in consequence, the protocol adopted is influenced by the amount spilt.

Large Spillages (e.g. when a barometer or sphygmomanometers is broken)

The first advice is obviously to avoid contacting the spillage with bare hands and, since the major hazard is from breathing mercury vapour, to ensure the area is well ventilated. **On no account should a vacuum cleaner be employed to remove mercury**. No materials which have become contaminated (e.g. carpets, bedclothes or soft furnishings) should be removed from the area without thought or careful preparation, and the spillage should be covered with plastic sheeting until such time as safe disposal can be arranged. In practice, carpets and soft furnishings cannot be effectively decontaminated and must be discarded. **Contaminated clothing should never be washed in a washing machine.**

On hard surfaces etc. the decontamination protocol adopted will depend on the situation. Where the spillage is onto a floor, a worktop or into a basin, the metal can be drawn into a syringe for disposal. Where a trap below a sink has been contaminated, this should not be flushed through but should, in preference, be disconnected and decanted or simply replaced.

Small Spillages (eg a thermometer is broken)

If the breakage is in the stem it is entirely possible that very little mercury will have been released and even where the bulb has fractured the amount released will be comparatively small. Wearing plastic gloves, the glass should be carefully picked up and placed in a polythene bag or plastic container. Spilled mercury should be collected using a thin piece of plastic or card and placed in the bag or container. The bag should be sealed in another bag or container and then disposed in the manner normally used for domestic waste. Health Protection Scotland would recommend that prior to disposal, the Local Authority is contacted for further advice. Table 1 summarises actions which should and should not be undertaken in the event of a mercury spillage.

Post Decontamination Monitoring

Mercury decontamination kits exist which are used in NHS premises but these are applicable only to hard surfaces and their efficacy is not uniformly applauded. Monitoring of mercury vapour levels in the contaminated areas is advisable and some, but not all, occupational health departments may have such monitoring equipment. Other possible sources of monitoring equipment are Community Dental Services, HSE and private laboratories.

Waste Minimisation

The value of elemental mercury is sufficiently high that laboratories are known, subject to quantity, to often be interested in dealing with spillages simply to obtain supplies of mercury for laboratory use.

TABLE 1: Spillage of Mercury: Dos and Don'ts

Actions to be undertaken	Actions not to be undertaken
Evacuate the area	Do not touch mercury with your bare hands
Ensure area is well ventilated	Do not use a vacuum cleaner
Reduce the surface area by pooling globules	Do not discard to sinks toilets or drains
Use syringe to remove liquid mercury	Do not take any action which will disperse the mercury e.g. brushing.
Keep mercury in air tight container	Do not walk over/stand on the mercury
Plan removal of contaminated items (such as soft furnishings)	Do not attempt to decontaminate and retain carpets and soft furnishings which have been affected.
Completely destroy contaminated items to prevent further use	Do not dispose of large amounts of mercury to the household wastestream
Consider air monitoring	Do not use a washing machine for contaminated clothing.
Contact laboratory with a view to collection of mercury	

LEGISLATIVE POSITION

The legal position concerning the disposal of mercury and mercury wastes from "households" (domestic premises including residential care homes) is quite simple. The Special Waste Regulations 1996[4] implemented the Hazardous Waste Directive (91/689/EEC)[5] and replaced the 1980 Control of Pollution (Special Waste) Regulations[6] and the Special Waste Amendments (Scotland) Regulations 2004 (SSI 2004 No 112). The regulations specifically exclude household waste from control. Thus wastes from "household" sources cannot be special.

For other situations the 1996 regulations include "*wastes containing mercury*" as a category on the hazardous waste list and where such waste possesses one or more from amongst a range of 14 hazardous properties listed in the regulations then that waste is deemed to fall within the control of the regulations. Mercury wastes are considered as "toxic" and the risk phrases R23 (toxic by inhalation) and R33 (danger of cumulative effects) are stated as being relevant in the "Approved Supply List"[7]. Guidance[8] confirms R23 as the principal risk phrase and advises that the limiting concentration is 3%. Therefore where the mercury content of a waste is less than 3% the waste is not special, with respect to R23. When carrying out an assessment for a particular mercury (compound) bearing waste, reference to the Approved List of Substances[7] and the CHIP Regulations[9] should always be made.

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* A new edition is now in print (3rd Edition)

Thanks for assistance in the preparation of this Guidance are due to Dr Colin Clark (University of Strathclyde), Dr David Cromie (Lanarkshire Health Board), Dr Marianne Vinson (Argyll and Clyde Health Board), Dr Ian Dale (Greater Glasgow Health Board) and Dr Anthony Breslin (Grampian Health Board).