


Safety Services Guidance

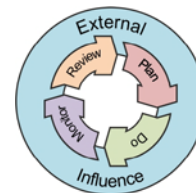


Mercury spills and legacy issues

Key word(s):	Mercury, Hg, quicksilver, renovation of laboratories; mercury spills
Target audience:	All managers; all staff and students using mercury instruments; Estates & Facilities managers and client representatives; project managers; safety advisors;

Contents

Introduction	2
Planning – policy & performance standards.....	2
Figure 1 Mercury policy thermometer	4
Part 1 – Mercury use and spills	5
Part 2 – Building renovation and refurbishment (major work)	8
Figure 2 Procedure for carrying out project work in buildings known to have been used as laboratories, workshops, etc.	9
Figure 3 Procedure for review and learning lessons	10
Part 3 – Routine building repairs and maintenance	15



Introduction

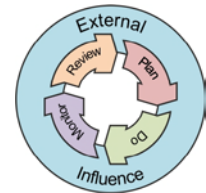
1. Mercury (also known as quicksilver) is a silvery white liquid metal at room temperatures. It has been widely used in temperature indicators such as thermometers, and pressure indicators such as barometers and sphygmomanometers, vacuum lines in general and diffusion pumps. Its use continues, but is being phased out except for specialist applications. Mercury is also highly toxic in liquid and vapour forms, and is capable of being absorbed through the skin, lungs and alimentary system. This guidance does not cover organic mercury which is not generally encountered at the University.
2. There is a legal duty to reduce exposure “so far as is reasonably practicable” and the current Workplace Exposure Limit¹ for mercury vapour is 20 µg/m³. This is quoted as an airborne concentration averaged over an 8 hour working day.
3. After a section on the University’s approach to managing risks from mercury, this guidance is split into 3 main parts targeted at different audiences:
 - Part 1: Laboratory and other users of mercury and equipment containing mercury
 - Part 2: Estates & Facilities staff, and their appointed contractors, working on major refurbishments which involve intrusive work into areas where mercury spillages may have or are known to have occurred
 - Part 3: Estates & Facilities staff, and their appointed contractors, carrying out routine maintenance and repairs on building elements that could have remnants of mercury spillages (e.g. drains, traps, underfloor or confined space work) or invasive construction works opening voids and ducts that could contain mercury vapour).

Planning – policy & performance standards

4. For decades, the University’s researchers, laboratory staff and others have used mercury in many different ways and in many different buildings. Detailed and extensive investigations into historic uses and their implications for current day occupiers have been carried out, notably the Coggan Inquiry into Rutherford’s work in Coupland 1 (now Rutherford Building), the Psychology Annex, and parts of the Museum.² University Safety Services and others have built up a considerable knowledge base of monitoring data and the factors influencing vapour generation and vapour movement around buildings.

¹ <http://www.hse.gov.uk/pubns/books/eh40.htm>

² All monitoring results, reports and independent assessments of this work are at <http://www.manchester.ac.uk/rutherfordreview/>



5. The Coggan Report of 2010 concluded that:

It is unlikely that any harm to human health has occurred in the past 20 years, or will occur in the future, from mercury contamination of the Buildings. In the unlikely event that adverse effects did occur, (perhaps in an individual with relatively high exposures who was unusually susceptible) the impact would probably be minor (subtle cognitive changes and biochemical abnormalities in urine), and potentially reversible following cessation of exposure.

There is more uncertainty about risks from mercury contamination in earlier periods. However, any toxic effects from possibly higher exposures to mercury more than 20 years ago would have been present at the time, and would have tended if anything to resolve as exposures reduced.

6. The remit of this investigation extended to occupiers of the buildings, and to those attending to carry out maintenance, cleaning, building repair work.
7. The Coggan Inquiry papers informed the development of the University's approach to managing the risks from mercury vapour, represented as a "thermometer" in Figure 1. This has been formally approved by the Safety, Health and Environment Committee, and guides policy and procedure decisions. It is important to understand that the trigger concentrations are for occupational exposures in "breathing zone" positions averaged over an 8 hour working day (a time weighted average); any measurement close to the source of mercury will give vapour concentrations much higher than these.
8. Anyone with concerns about their personal exposure to mercury or mercury vapour can contact Occupational Health for advice (contact details at <http://www.staffnet.manchester.ac.uk/services/occupational-health/>).

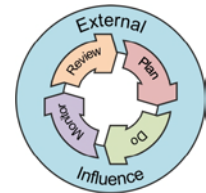
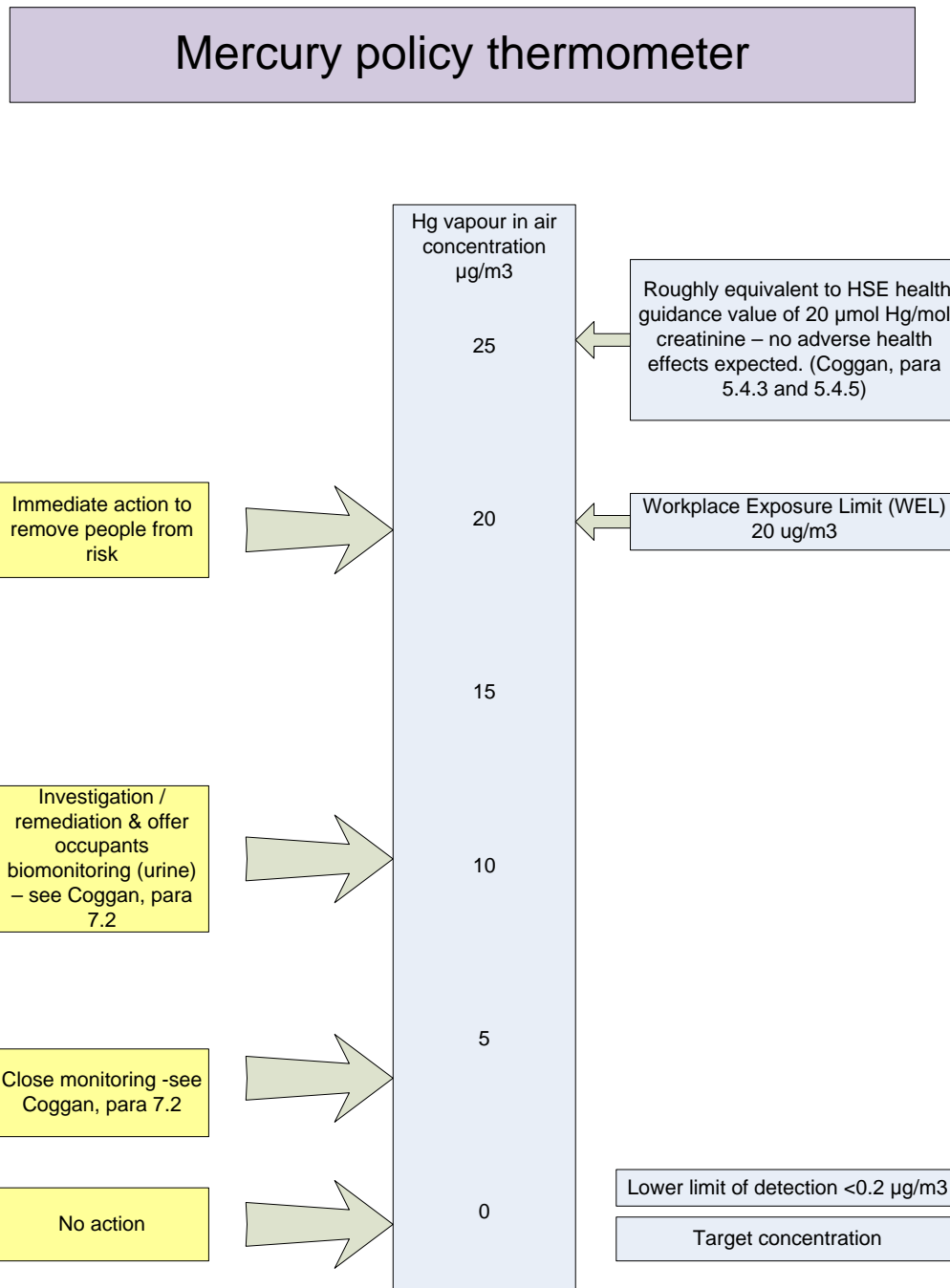
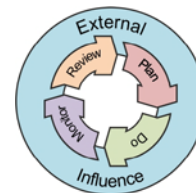


Figure 1 Mercury policy thermometer

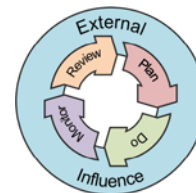




Part 1 – Mercury use and spills

9. School arrangements for risk assessment apply. Use of mercury should be avoided where reasonably practicable, and steps taken to replace or phase out its use in experimental procedures. Anyone using mercury or equipment containing mercury must carry out a risk assessment for the work, and include a contingency plan for dealing with mercury spills.
10. Mercury is dense, and should not be stored in glass bottles of volume greater than 500ml. Plastic bottles greater than 250ml should not be recommended as they may split with age. All bottles containing mercury or mercury waste should be supported at the base, and have secondary (outer) containment capable of holding the entire volume of mercury if spilt. Users should ensure that all equipment containing mercury, and any other containers, are clearly and indelibly labelled.
11. In the event of a spill, the contingency measures should be applied as quickly as possible. For spills at room temperature, these should include:

- Ensure the area is well ventilated.
- Segregate the area to prevent people spreading the spill even wider.
- Wear protective gloves.
- Gather as much mercury together as possible by using a straight edge (the larger the drops the smaller the surface area to mass ratio and the lower the evaporation will be).
- During warm weather avoid breathing too close to the mercury surface. If the spill is a large one, consider using respiratory protective equipment such as a facemask with a special mercury vapour filter (available from Dräger Ltd (<http://www.Dräger.com>)).
- Collect up the mercury by using either a foam spill collector, or a vacuum pump fitted with a water trap, or a syringe, or a small brush, or wet paper or adhesive tape – whatever you have available.
- Spilt mercury will find its way into all the cracks and crevasses in the benches and floor and it is unlikely that you will be able to retrieve it all by mechanical means. In these circumstances sprinkle the affected area(s) with flowers of sulphur and leave for 24 hours. This will convert the mercury to the far less volatile mercury sulphide. This should be carefully swept up (avoid raising dust) and disposed of as chemical waste.
- If you do not have any sulphur then you can also cover the area with zinc powder to amalgamate with the mercury. Again sweep up after 24hr and dispose of via the chemical waste disposal route.



- Where possible clean up all contaminated equipment for storage until next time.
- For small spills such as standard mercury thermometers, it should not be necessary to carry out air monitoring. For larger volumes, monitoring may be appropriate to ensure the mercury levels are below 20 µg per m³. You can do this yourself using the standard Dräger test kit (pump and tubes), available from Safety Services, or request a survey using the mercury analyser.
- Treat all materials used as contaminated waste. Bag them up, seal the bag(s), and arrange for collection as mercury contaminated waste. Mercury must not be put down the sink or included in the normal domestic waste, but be collected up and disposed of by an authorised disposal contractor when sufficient has been amassed.

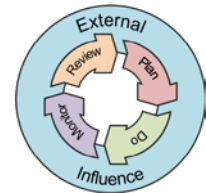
12. If a spill occurs at elevated temperatures, e.g. in a hot oven:

- DO NOT OPEN THE OVEN DOOR WHILST THE OVEN IS HOT.
- Turn off the oven and vacate the area until the oven has cooled down to room temperature (24hr). Ventilate the area well.
- When all has cooled down arrange for air monitoring to ensure atmospheric mercury levels are below 20 µg per m³.
- Wash all surfaces including ceilings, floor etc. with dilute nitric acid (2N) to remove any condensed mercury (grey condensate), then conventional cleaning solutions. Allow to dry and then retest the atmosphere with a Dräger pump and tube.
- If item is small and decontamination is not effective, consider disposal as contaminated waste.

13. The SSA should be informed that a spillage has occurred and has been dealt with, and an incident report completed and sent to Safety Services.

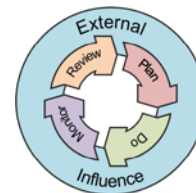
14. Various kits are available for mercury collection following a spillage, from reputable laboratory suppliers: [Mercury Safety Products](#), [Sigma Aldrich](#)

15. The evaporation rate of mercury from a clean open surface at room temperature is about 0.08mg/cm²/hr. In the absence of a mercury vapour indicator measurement, this can be used to estimate maximum mercury vapour



concentrations. A thin layer of oil can be used to reduce vapourisation from mercury surfaces.

16. School arrangements apply for checking and monitoring that suitable arrangements, including risk assessments, contingency plans and spill kits are in place, and that personnel are informed about the risks and familiar with the contingency plan.
17. Safety advisors should report all mercury spillages (together with investigation findings and any recommendations) to their local health & safety committees so that risk assessments can be reviewed and revised as appropriate.
18. When schools vacate laboratory and workshop spaces, or any other space where a mercury spill is known to have occurred, the hand-over to Estates & Facilities should include details of where the spillage(s) and potential contamination occurred, with a copy to Safety Services.
19. General health and safety guidance on vacating space is at <http://documents.manchester.ac.uk/DocuInfo.aspx?DocID=12907> Estates & Facilities have issued guidance to assist Faculty Estates Teams when space is being relinquished by faculties (EPM GM4).



Part 2 – Building renovation and refurbishment (major work)

20. All work of this nature must be carried out by Estates & Facilities ([see Chapter 29](#)) and their arrangements for managing construction work apply.
21. Whilst most mercury spills will probably have occurred in areas occupied as laboratory or workshop space, there is no definitive correlation between historic use and risk of mercury. Many laboratories will have no history of mercury use or contamination; mercury thermometers were used and broken in offices; however, the unexpected discovery of mercury and its remediation can be expensive and disruptive to work schedules.
22. The Victoria University of Manchester and UMIST both had policies in place for dealing with mercury spillages, dating from before the 1970s. These documents explained how efforts should be made to collect up all traces of spilt mercury, but that visible mercury trapped under floor coverings, should be covered with flowers of sulphur (a yellow powder) to convert the mercury to a less volatile compound. Evidence of historic mercury contamination may therefore be visible as silvery beads of liquid which may be difficult to see under a dust or dirt crust until disturbed, or the remnants of yellow powder (unreacted flowers of sulphur) or black powder (the product of treatment, mercury sulphide).
23. The Project Manager's role includes the provision of health and safety information to CDM appointees and contractors. The process for obtaining the best information about the risk from mercury, and proceeding with a project is summarised in Figures 2 & 3.
24. In planning how to manage any risks from mercury vapour, Project Managers have access to a wide range of expertise and knowledge from within the University, including (but not limited to):
- Occupancy and space planning data from within Estates & Facilities
 - Faculty Estates Teams
 - Academic and administrative occupiers – existing, now occupying other space on the estate, retired
 - Estates & Facilities Safety Officer
 - University Safety Services personnel
 - Safety Services records of mercury spillages (from approx. 2010 onwards)
 - Vacating space and hand-over records produced by previous occupiers
 - University archivist
 - University researchers into the history of science

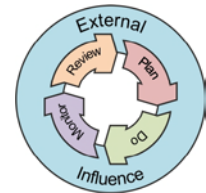
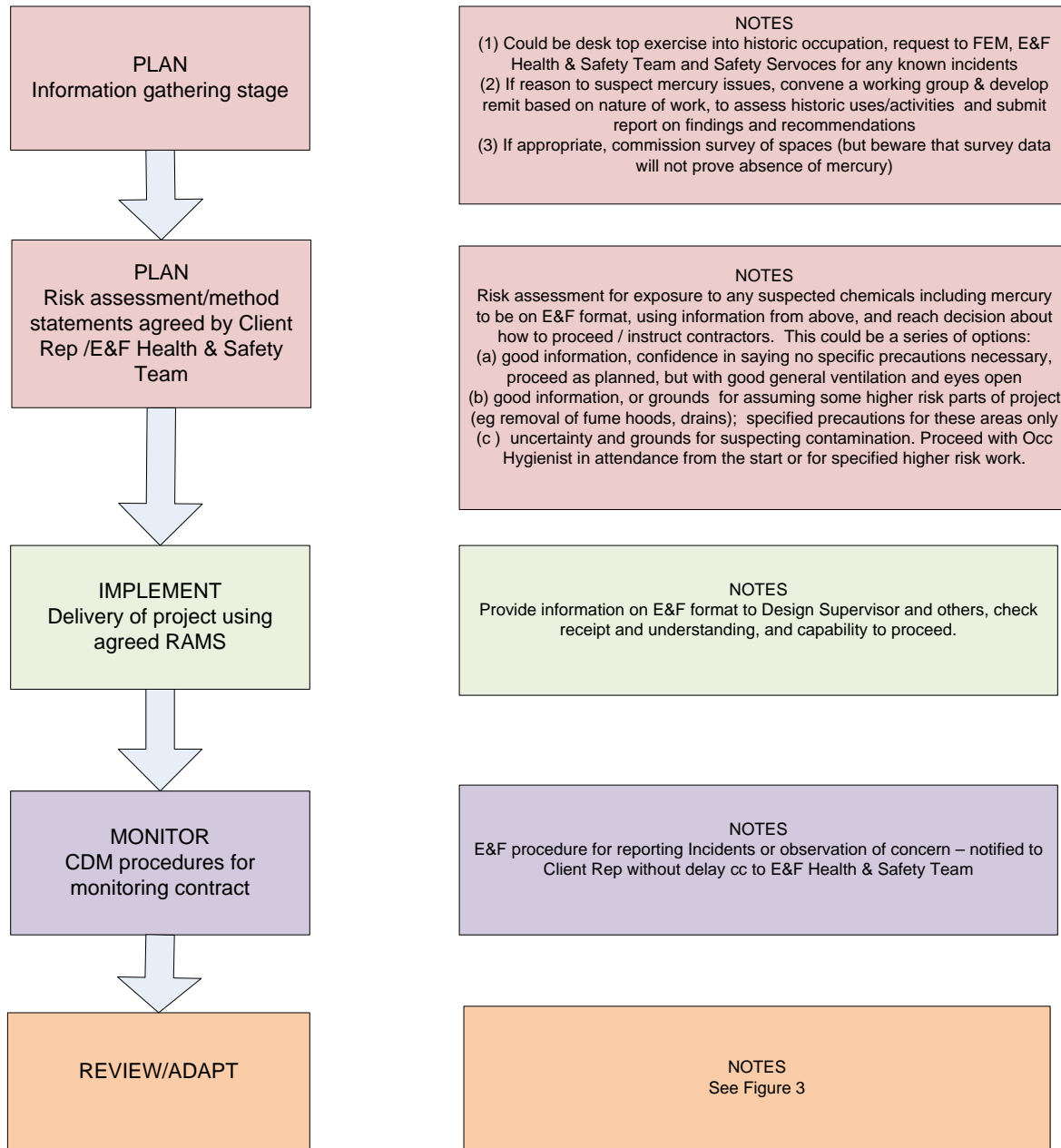


Figure 2 Procedure for carrying out project work in buildings known to have been used as laboratories, workshops, etc.

Note: Client Representative is an employee of the University, and may be the internal project manager, area supervisor (maintenance) or similar appointment



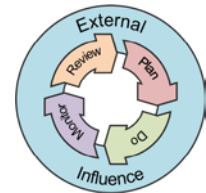
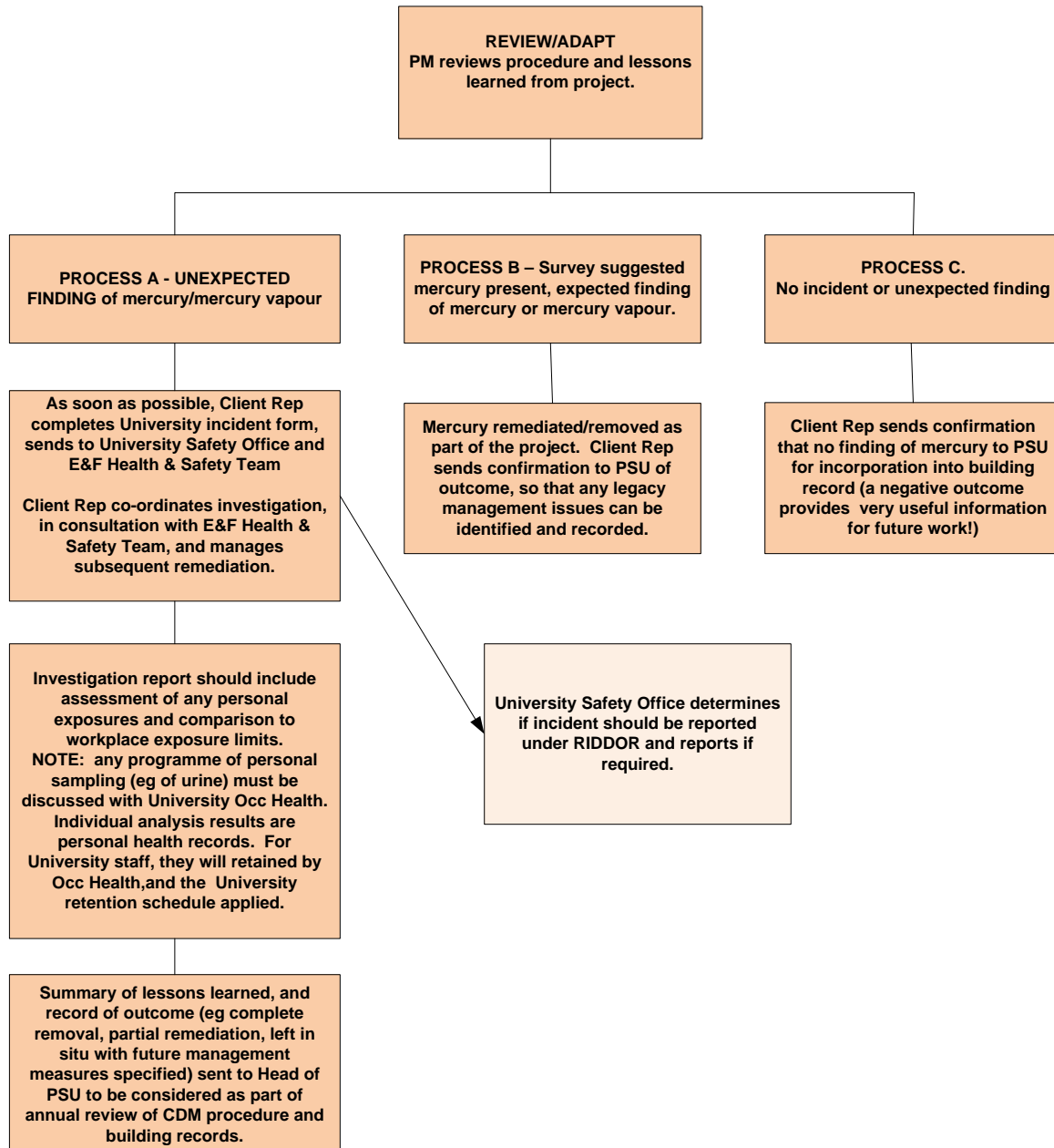
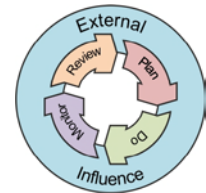


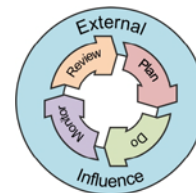
Figure 3 Procedure for review and learning lessons



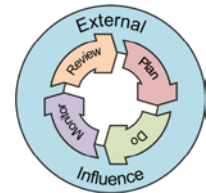


25. All intrusive works in Rutherford Building, Manchester Museum and the Psychology Annex should be discussed with Safety Services at the earliest opportunity and well in advance of any work starting. Safety Services hold an extensive dataset of mercury vapour monitoring results and have detailed knowledge and experience of the type of contamination recorded for these buildings.
26. If a working group is set up at the planning stage, it should be led by the relevant Project Manager, and be assisted by the Directorate's Health & Safety Officer. Its remit will depend very much on the nature of the project (how extensive and intrusive the planned work is), and how much is known about historic occupancy and activities.
27. It is essential that the limits of enquiry and uncertainty are recognised and managed. It is important to note that a survey of mercury vapour in an undisturbed location will not give certainty about whether mercury is present. If a source of mercury is covered with water (e.g. in a drain trap), or has become encrusted with dust and debris over the years, the generation of vapour may be very slight or prevented altogether, and therefore not detectable by this method. Intrusive work may disturb it, and expose surfaces from which vapour can be generated.
28. The working group should pay particular attention to work planned in confined spaces or with limited ventilation, where vapour could build up quickly. For example during the construction of an asbestos stripping enclosure (before air handling units are operational), working in voids, service areas or under the floor.
29. The outcome of the working group should be in a risk assessment format, with clear recommendations about how to proceed based on the evidence available. In practice, and over time, Estates & Facilities should be able to construct some standard approaches to select from, as indicated in the following table:

Planned work includes intrusion into confined spaces, lifting floor coverings, opening drains, removing fume cupboards, remediation/demolition asbestos and other surveys, and similar		
Good reliable information, confident in data	No positive indication that a mercury risk exists	Proceed with project as planned. Provide good general ventilation (as agreed during assessment stage and good practice) and implement E&F procedures for adverse incident or finding.
Good information,	Risk exists but is	Proceed with RAMS to

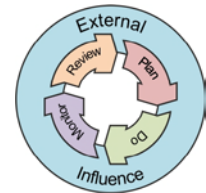


<p>suggestions that mercury used/spilt and may remain in specific area(s) or equipment</p>	<p>contained or limited in extent.</p>	<p>access and monitor specific area(s) of interest. These might include, separate RAMS for, for example, drains and traps, fume cupboards, sites of experimental rigs containing mercury. Could separate removal of such items from main contract and carry out works under more controlled conditions. Note: mercury vapour detected above gaps in floor coverings, tiles, etc. does not necessarily mean the mercury source is directly underneath, although it is possible that spillages occur more frequently at constrictions such as doorways.</p>
<p>Patchy information, grounds for suspecting mercury contamination.</p>	<p>Risk not capable of being assessed with confidence. Need for consideration on a case-by-case basis, with advice from safety advisors.</p>	<p>Proceed with project, but instruct everyone to be watchful for evidence of contamination (silvery beads of metallic mercury, yellow and/or black powders indicating treatment for spillages). Retain services of Occ Hygienist to be present on site during exploratory / intrusive work and deal with any contamination found, and (depending on circumstances) carry out assessment of exposure during normal use of space, and assessment of exposure of those carrying out works.</p>
<p>Initial working group</p>	<p>Immediate unassessed</p>	<p>Stop work (making safe if</p>



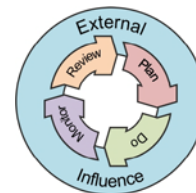
<p>report (or existing project with previous assessment) found nothing of concern. Evidence of mercury found unexpectedly</p>	<p>risk.</p>	<p>necessary), maximise ventilation, vacate area and prevent re-entry. Ensure PM is informed of finding, contingency plans implemented and other relevant E&F procedures followed. Obtain survey data of mercury vapour to inform assessment of occupational exposure of workforce, for RIDDOR consideration by Safety Services, and record/retain details.</p> <p>Complete incident form as soon as possible and send to Safety Services. Follow up with investigation report and findings, including assessment of exposure.</p>
<p>Work involves walk-through surveys, measurements, project planning work, showing site to contractors, etc.</p>		
<p>All scenarios</p>	<p>Risk of airborne mercury concentrations exceeding workplace exposure limits extremely low (no measurements at University work positions have done so to date).</p>	<p>Proceed as planned. Provide good general ventilation were possible.</p>

30. During the implementation of a project, Estates and Facilities normal project management procedures apply.
31. In particular, if a project space is occupied, contact must be made in advance of the visit so that a responsible person such as a lab manager or safety advisor, can be present to ensure safe access, provision of any necessary personal protective equipment, and give advice about local hazards.
32. The findings of the risk assessment should be communicated to all those involved in the project, and additional explanation provided if necessary. It may be



appropriate to provide specific information and training about the risks of mercury and mercury vapour to Estates and Facilities personnel and / or contactors.

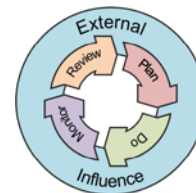
33. Monitoring processes during implementation phases should be in accordance with established Estates arrangements, with clear reporting lines for any adverse events or observations or expressions of concern to the Project Manager.
34. Response to any adverse events or incidents should be in accordance with established Estates arrangements, with prompt completion of incident forms, and more detailed investigation reports to follow.
35. All contaminated waste must be contained and removed in accordance with the relevant regulations and disposed of via specialist contractors where required, obtaining appropriate certificates of their disposal (to be kept on project file) and summarised in any reports on the final status of the space after it is handed back to the occupant.



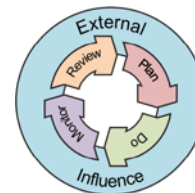
Part 3 – Routine building repairs and maintenance

36. Work of this nature must be carried out by Estates & Facilities ([see Chapter 29](#)) and their arrangements for managing this type of work apply.
37. Typically, but not exclusively, this work is of relatively short duration but may involve entry into confined spaces or areas of limited ventilation, breaking into blocked or defective drains, repairing floors/floor coverings and similar.
38. Whilst it is possible that mercury contamination could be present, the short duration limits the potential for exposure.
39. Generic and specific risk assessments should refer to the possibility of mercury (and other chemical) contamination, and existing procedures enable the risk to be managed. When entering laboratory and (non-Estates) workshop areas, prior notice should always be given to a responsible person such as a laboratory manager or safety adviser.
40. The risk assessment should also include arrangements for dealing with unexpected findings (which should include stopping work, making safe if necessary, maximising ventilation, then vacating the area and preventing re-entry until decontamination takes place). The procedure for reporting to line managers and completing an incident form should be followed.
41. There are a few scenarios where mercury has been found in the past:

Scenario	Indications that mercury may be present	Action
In laboratory sink and fume cupboard water traps	Trap or plumbing sections "feel" heavier than they should. Mercury liquid may be present in U bends, traps or poorly drained sections.	<p>Take immediate steps to ensure drain section is supported. DO NOT DROP IT.</p> <p>Ensure traps are wet (so water covers mercury surface). Add water if necessary.</p> <p>Where possible place a bowl, tray or other sturdy container underneath to contain spills while disconnecting. Securely support the suspect section at both ends, and disconnect/cut</p>

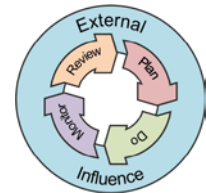


Scenario	Indications that mercury may be present	Action
		<p>ends, allowing good lengths on either side for gripping, and plug both ends. Carefully remove section, giving good support at all times. As soon as practicable, place in a secondary sturdy container. Dispose of as mercury contaminated waste.</p> <p>If spillage does occur, stop work and try to limit spread but do not attempt to collect it up. Make other tools etc. safe if necessary, increase ventilation if possible, vacate area, prevent re-entry and inform supervisor.</p>
<p>Removing/repairing floor coverings</p>	<p>Visible silver beads, or evidence of yellow powder (unreacted sulphur) or black powder (reacted with mercury).</p>	<p>(Assuming area not occupied)</p> <p>On discovery, stop the work leaving the mercury as found. Make other tools etc. safe if necessary, increase ventilation if possible, vacate area, prevent re-entry and inform supervisor (in accordance with E&F procedures)</p> <p>DO NOT ATTEMPT TO CLEAN WITH A DOMESTIC VACUUM CLEANER OR BRUSH UP.</p> <p>Supervisor contacts E&F SO or Safety Services for advice about assessing exposure, recording results, and completing incident form. Risk assessment reviewed and updated; safe method of proceeding agreed with manager.</p> <p>If area is occupied, inform</p>



Scenario	Indications that mercury may be present	Action
		<p>occupier(s) of finding and actions taken.</p> <p>Carpets and other soft or fibrous coverings cannot be effectively cleaned and will normally need to be disposed of as contaminated waste.</p>
Unexpected discovery of evidence of mercury in other work situations	Visible silver beads, or evidence of yellow powder (unreacted sulphur) or black powder (reacted with mercury).	<p>On discovery, stop the work, make safe if necessary, increase ventilation if possible, vacate area, prevent re-entry and inform supervisor. Inform local occupiers of finding and actions taken.</p> <p>Supervisor contacts E&F SO or Safety Services for advice about assessing exposure, recording results, and completing incident form. Risk assessment reviewed and updated; safe method of proceeding agreed with manager.</p>

42. Monitoring of routine work follows MSU procedures.
43. If mercury is discovered, an incident report should be completed and forwarded to Safety Services, on the [University incident report form](#).
44. Measurements of airborne mercury vapour concentrations may be made and recorded by Safety Services or an Occupational Hygienist. The incident report, investigation report, and details of measurements will be kept by Safety Services and details provided to Occupational Health, for retention with personal health records.
45. All contaminated waste must be contained and removed in accordance with the relevant regulations and disposed of via specialist contractors where required, obtaining appropriate certificates of their disposal (to be kept on project file) and summarised in any reports on the final status of the space after it is handed back to the occupant.



Document control box	
Title	Mercury spills and legacy issues
Date issued:	June 2017
Issued by:	Safety Services
Implementation date:	10 April 2014
Version:	1.3 (June 2017) personnel change 1.2 (November 2016) personnel change 1.1 (July 2015) addition of para 25 1.0 (April 2014)
Next review date:	Upon significant change
Owner of this document:	Head of Safety Services
Lead contact:	Safety Services