

Notes of Meeting: University of Manchester with HSL, 16 July 2010.

Present: David Barker (UoM), Owen Butler (HSL), John Cocker (HSL), Andrew Easterbrook (HSL), Melanie Taylor (UoM).

Purpose of meeting: To consider the recommendations in section 7.1 of the Coggon Report (ref) with respect to mercury contamination in the waste removed from under the floor of rooms 2.63/3 in the Rutherford Building, during the 2004 refurbishment, and related issues.

Main conclusions

2004 refurbishment waste

1. There are many uncertainties associated with the quantitative measurement of mercury and mercury compounds in samples of the waste. These arise from
 - the known difficulty of performing reproducible solvent extractions of mercury and mercury compounds;
 - the relative ease with which Hg covalent bonds are broken during processing of samples;
 - carry-over of mercury in one sample into subsequent ones which confounds calculations of mercury concentrations;
 - the tendency of elemental mercury to "stick" to surfaces and contaminate sample and measurement equipment (even Teflon-smooth surfaces) and subsequent samples;
 - the heterogeneity of the waste stream (previous samples have found a range of 38.0 to 312,000 mg/Kg), and difficulty in obtaining representative samples.
2. Identification of each mercury compound present is similarly complex and subject to large sampling errors. The co-existence of radiological contamination restricts the technologies available (and the willingness of laboratories to risk contamination of expensive equipment).
3. The University has carried out some tentative X ray diffraction analysis, which has identified mostly gypsum, calcite, bassarite, anhydrite (i.e. substances normally present in plaster), with mercurous chloride found in one sample out of nine. This could have come from spillage of a calomel electrode, rather than reaction of elemental mercury. This technique has practical limitations in that it detects only crystalline forms and has a lower detection limit of 5% w/w Hg.
4. There is no evidence (from other enquiries) to suggest that mercury vapour measuring equipment, such as that used by Cassella Winton in 2004, HSL and the University subsequently, does not respond to mercury in compounds such as mercuric chloride, although this is not conclusive.
5. HSL would have expected full dissolution of mercury species in test samples in the selected acids and is surprised that an acid-insoluble residue was reported
6. Manchester Museum staff (Conversation with AE) have commented that they are aware of historical preservative treatment of specimens with mercury-containing chemicals (e.g. HgCl_2), but not of cotton waste when used as building insulation.

7. The heterogeneity of the samples taken by IRAS and analysed by STL/SAL supports the hypothesis that preservative treatment is the *less* likely source of any non-metallic mercury.
8. For these reasons, it is unlikely that further analysis of the waste will shed more light on the origin of mercury apparently identified in analyses carried out by STL/SAL for IRAS, or enable us to determine whether it comes from a preservative treatment of cotton insulation wadding or from chemical reactions between mercury of other spilled chemicals or other source, during the past 100-odd years.
9. Assumptions made by HSL in their report to Professor Coggon erred on the side of caution and noted the difficulties and uncertainties of predicting historic exposures. It is unlikely that, given the issues noted above, further analysis of the waste would reduce these uncertainties.
10. HSL provided references to Waste Management Technology, which appears to provide a disposal route for waste streams contaminated with mercury and radiation, and to IKIMP, a knowledge exchange forum for storage and disposal of redundant mercury.

2010 remediation

11. In terms of occupational risk, it is reasonable to rely on measurement of mercury vapour, even if other mercury species are present.
12. It is possible that mercury / mercury compounds could have been present in plasterboard when installed in 2004 (as the board might have incorporated by-products from desulphurisation of flue gases in the manufacturing process,) although the existence of some samples from the same room (2.63) with very low concentrations suggests otherwise. What proportion of recycled material has been used and when it became available from desulphurisation of flue gas in the UK is unknown.
13. A possible explanation for higher mass concentrations in core samples taken higher up the party wall between 2.62/3 is the convection of contaminated air (due to heating by pipes and radiators) and subsequent surface deposition of mercury contamination.
14. Pumped samples collected by HSL (in the quarterly sampling programme from June 2009) will collect all airborne mercury species. Results from these are in reasonable agreement with passive samples and from mercury vapour indicators (sniffers), suggesting elemental mercury is the major species present.

Manchester Museum herbarium samples

15. Some organic plant material is known to have been treated with mercuric chloride decades ago. Monitoring with a ShawCity mercury vapour indicator by UoM staff has shown a very wide range of concentrations in specimen boxes, but there are many significant variables (source material collected and transported from all over the world; variation in preservation techniques and "recipes" used; various

materials used between specimens and for boxes; no record of when boxes last opened and vented, etc). Hand-held Hg monitors based upon UV absorption can potentially be influenced by high concentrations of organic vapours.

16. The key risk now was of exposure to elemental mercury vapour, and it was not practicable or necessary to differentiate between airborne mercury compounds. There was no known workplace data or studies of such exposures.
17. There was mutual interest in looking at such a study. A number of papers had looked at related topics, eg Roane and Snelling (2007) Bacterial Removal of Mercury from Museum Materials: A New Remediation Technology? Other papers described the development of pastes or dots that change colour in the presence of mercury vapour.

Drafted: Melanie Taylor (UoM),
Finalised: HSL team, 23rd September 2010

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