INVESTIGATION OF POSSIBLE MERCURY CONTAMINATION WITHIN 3 LOCATIONS AT THE UNIVERSITY OF MANCHESTER

AT

THE UNIVERSITY OF MANCHESTER
COUPLAND 1 BUILDING[i]

FOR

C&D INDUSTRIAL SERVICES LTD
UNIT 10
WOODROW BUSINESS CENTRE
WOODROW WAY
IRLAM
M44 6NN

Report No:	**11826C amendment 1**	**Client Ref:**	**Mercury Monitoring**
Survey Date:	**25th January 2010** **3rd March 2010 (revisit)**	**Site Contact:**	**Mr Alan Lee**
Report Date (first issue):	**5th February 2010**	**Server Reference:**	**Occupational Hygiene Special Projects 2010**

ALcontrol On-Site Services undertake site and process confidentiality relating to your business at all times. If you have any queries regarding this report contact ALcontrol On-Site Services – Unit 5, Loomer Rd., Newcastle-under-Lyme, Staffordshire. ST5 7LB. Tel: 01782 576590.

CONTENTS

EXECUTIVE SUMMARY

ALcontrol On-Site Services were appointed by C&D Industrial Services Ltd to undertake a series of surveys on their behalf within 3 rooms located at the University of Manchester Coupland 1 Building, prior to significant building modifications.

The surveys where identified in ALcontrol On-Site Services Quotation document reference OH10245 and comprise of:
Mercury contamination investigation
Type 3 Asbestos Survey
Collection of Historical Plaster for the determination of possible *Bacillus anthracis* spore contamination.

This report only relates to the investigation of possible mercury contamination, with the other survey results being issued as separate reports.

All samples were obtained on the 25th January and results reflect the conditions prevailing at the time of the investigation

Airborne concentrations of mercury vapour were assessed on the 25th January 2010 within 3 rooms at the University of Manchester Coupland 1 Building (Rooms 2.58, 2.62 and 2.63).

Where mercury vapour concentrations indicate possible sources of contamination, bulk samples were taken of wall materials, to determine possible sources.

The results and information obtained during the visit indicate that:

Mercury vapour was detected in wall spaces, predominantly in the dividing wall between Room 2.62 and Room 2.63 side and bulk analysis determined varying degrees of mercury contamination, within the plasterwork.

Significant concentrations of mercury vapour were also found beneath the floor area in Room 2.62.

No mercury vapour was detected in room 2.58 and due to age of the partition wall, no bulk samples were obtained.

It should be noted however that removal of this partition wall may impact on older possible contaminated building fabric and any risk assessment for the removal of this wall should take this into account.

The mercury vapour has the potential to contaminate the air within these rooms through any breaks in the surface materials on the walls and floors.

It is recommended that due to levels of contamination found in the bulk samples, the rooms are stripped back to the brickwork in a controlled manner to remove any discrete contamination prior to the removal and decontamination works of the floors.

It is recommended that the client determine if the previous remedial works within these rooms has involved the walls as historical radiological contamination may be present and would need to be assessed before any works commence.

Any waste produced will need to be screened to determine what classification for the Waste Acceptance Criteria it will fall under.

As a result of the high mercury concentrations in the bulk samples, additional samples were collected from areas identified previously as having significant levels of mercury contamination to determine if the contamination is within the plasterboard or as a result of accidental contamination from the underlying brickwork during sampling. [ii]

It should be noted that these samples were obtained from as near to the original sample locations as was practicable allowing for the fact that bulk samples were already removed from the plasterboard.[iii]

The results from this further monitoring show that the contamination is within the plasterboard and previous recommendations regarding the handling and disposal of waste material still apply [iv]

SURVEYED BY :

Darren Bolton LFOH
Occupational Hygienist

VERIFIED BY:

Matthew Wadie
Technical Manager-Occupational Hygiene

1 INTRODUCTION

ALcontrol On-Site Services were appointed by C&D Industrial Services Ltd to undertake a series of surveys on their behalf within 3 rooms located at the University Of Manchester Coupland 1 Building, prior to significant building modifications.

The surveys where identified in ALcontrol On-Site Services Quotation document reference OH10245 and comprise of:
Mercury contamination investigation
Type 3 Asbestos Survey
Collection of Historical Plaster for the determination of possible *Bacillus anthracis* spore contamination.

This report only relates to the investigation of possible mercury contamination, with the other survey results being issued as separate reports.

All samples were obtained on the 25th January and results reflect the conditions prevailing at the time of the investigation

Additional samples were obtained on the 3rd March 2010 at the request of the University of Manchester to determine if the contamination previously identified is within the plasterboard or as a result of accidental contamination from the underlying brickwork during sampling. [v]

It should be noted that these samples were obtained from as near to the original sample locations as was practicable allowing for the fact that bulk samples were already removed from the plasterboard.[vi]

2 OBSERVATIONS and OBJECTIVES

The two rooms surveyed were 2.62 and 2.63. These are currently unoccupied former office areas, although historically had been laboratory workshops.

Initially the Mercury Vapour Indicator (MVI) was used to determine concentrations before any sampling work was performed.

'Pilot' holes were then drilled in the plaster and the airspace was then analysed for concentrations of mercury vapour.

Full depth bulk samples of the plaster were then taken in significant areas identified by the MVI.

Workplace Exposure Limits (WELs) EH40

Although the possible mercury vapour is not strictly in an area currently occupied by staff, the following should be considered.

Under the COSHH Regulations a single type of occupational exposure limit is specified for substances hazardous by inhalation, this is the Workplace Exposure Limit. An employer must ensure that a WEL is not exceeded and in addition when a substance can cause occupational asthma, cancer or genetic effects then exposure must be reduced as low as reasonably practicable. The limits are time weighted average concentrations of substances in the air using either 8-hours or 15-minutes (short term exposure limit) as the reference period.

Regulation 7 also requires that where there is exposure to a substance hazardous to health, then control of that exposure shall only be treated as adequate if the principles of good practice for the control of exposure to substances hazardous to health set out in Schedule 2A are applied.

The COSHH Regulations also place a duty on the employer to apply principles of good occupational hygiene practice for the control of substances hazardous to health (regardless of

whether a substance has an exposure limit or whether exposures are below any published limit).

Mercury has not currently been assigned a WEL, therefore as guidance the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) was used for the purposes of this report. This is set at 0.025 $mg.m^{-3}$ based on an 8-hour Time Weighted Average (TWA).

It should be noted that there is also a draft Europe wide proposed Indicative Occupational Exposure Limit (IOELV) of 0.020 $mg.m^{-3,}$ which may also be used for comparison.[vii]

Mercury - Basic toxicology

Mercury vapour can cause effects in the central and peripheral nervous systems, lungs, kidneys, skin and eyes in humans.

It is also mutagenic and affects the immune system. Acute exposure to high concentrations of mercury vapour causes severe respiratory damage, while chronic exposure to lower levels is primarily associated with central nervous system damage.

Chronic exposure to mercury is also associated with behavioural changes and alterations in peripheral nervous system. Pulmonary effects of mercury vapour inhalation include diffuse interstitial pneumonitis with profuse fibrinous exudation. Glomerular dysfunction and proteinuria have been observed mercury exposed workers.

Chronic mercury exposure can cause discoloration of the cornea and lens, eyelid tremor and, rarely, disturbances of vision and extra ocular muscles.

Delayed hypersensitivity reactions have been reported in individuals exposed to mercury vapour. Mercury vapour is reported to be mutagenic in humans, causing aneuploidy in lymphocytes of exposed workers.

Mercury contaminated material waste

Currently the Waste Acceptance Criteria (WAC) for mercury contaminated materials determined as leachate is as follows:-

<0.01 mg/kg	–	Inert waste
<0.2 mg/kg	–	stable non-reactive hazardous waste
0.2-2 mg/kg	-	Hazardous landfill
>2mg/kg	–	Pre treatment needed

3 MONITORING

Airborne concentrations of mercury vapour were measured using a direct reading Mercury Vapour Indicator (MVI).

Bulk samples were analysed using Inductively Coupled Plasma- Optical Emission Spectrometry (ICP-OES) to determine mercury concentrations within the plaster using Scientific Analysis Laboratories Ltd In-house method listed in appendix III of this report.[viii]

4 RESULTS

Concentrations of mercury vapour monitored are reported in Tables 1A – 1B – APPENDIX I

Concentrations of mercury within bulk materials are reported in Table 2 – APPENDIX II

5 DISCUSSION

Mercury vapour concentrations

An initial scan was performed using the MVI and the only positive reading was found at the small gap around the pipe work in room 2.62 and adjoining wall to room 2.62. These pipes service the radiators beneath the window at the front of the room. The MVI indicated a concentration at 0.020 $mg.m^{-3}$.

Pilot holes were then drilled along this plasterboard wall in room 2.63. The majority of readings were of a positive nature, with the highest concentration peaking at 0.040 $mg.m^{-3}$, this was towards the window side of the wall at a low level.

Measurements in this area were taken up to 2m and although reduced, vapour was still being detected up to 0.015 $mg.m^{-3}$.

Additional readings were then taken towards the adjoining door; again mercury vapour was detected all the way along to the door at a gradually reduced level. Pilot holes were drilled in the same wall, the other side of the adjoining door and in the rear wall to the main wall and no mercury was detected in these areas.

Holes were also drilled in the opposite wall and initially there was a positive reading (although this was not logged), although later the MVI did not locate any vapour. Pilot holes were then drilled in the adjoining wall from room 2.62, these indicated low concentrations of mercury vapour at 0.002 $mg.m^{-3}$.

The highest concentration in this room was found beneath the wooden floor panelling, in the far right hand corner close to the front window at 0.020 $mg.m^{-3}$.

During the survey background concentrations of mercury vapour were detected up to 0.009 $mg.m^{-3}$ in room 2.63. This was probably due to vapour being vented into the room after holes had been drilled. This soon dissipated when windows were opened for ventilation.

Bulk Samples

18 full plaster depth bulk samples were taken during the survey. ICP-OES analysis was performed on all and only 1 sample was found to be below 1 mg/kg concentration, this was on the sample in room 2.63 rear wall, right hand side of the door.

The other samples taken ranged from 1 – 8 mg/kg of contamination to mercury.

The additional samples obtained on the 3rd March 2010 had mercury concentrations ranging from 2-5 mg/kg. Although these results are lower than previous sampling, it should be noted that the sample locations were as close to the original samples locations as practicable, but the removal of bulk material for sampling means that no sample can be an absolute duplicate.[ix]

6 CONCLUSIONS AND RECOMMENDATIONS

It was concluded that mercury vapour was present in the wall spaces in room 2.63, and presumably beneath the floor, although no measurements were taken here.

The higher concentrations were detected at low levels of the adjoining wall, close to the window.

The vapour has the potential to contaminate the room through gaps in the plaster as proven with readings at the pipe work surround and in the general area after drilling.

Vapour was also prevalent beneath the floor in room 2.62 and to a lesser extent behind the plasterboard wall adjoining to room 2.63.

The source of the mercury is yet to be found, although it is suspected to be within the main structure of the rooms, within brickwork and joists etc…

No mercury vapour was detected in room 2.58 and due to age of the partition wall no bulk samples were obtained.

It should be noted however that removal of this partition wall may impact on older possibly contaminated building fabric and any risk assessment for the removal of this wall should take this into account.

It is recommended that due to levels of contamination found in the bulk samples, the rooms are stripped back to the brickwork in a controlled manner to remove any discrete contamination prior to the removal and decontamination works of the floors.

It is recommended that the client determine if the previous remedial works within these rooms has involved the walls as historical radiological contamination may be present and would need to be assessed before any works commence.

Any waste produced will need to be screened to determine what classification for the Waste Acceptance Criteria it will fall under.

The results from this further monitoring show that the contamination is within the plasterboard and previous recommendations regarding the handling and disposal of waste material still apply [x]

APPENDIX I

MERCURY VAPOUR MEASUREMENTS

Table No: 1A Levels of mercury vapour – Rutherford Building Room 2.63

Room	Location	MERCURY[1] EXPOSURE	
		mg.m^{-3}	% TLV
Room 2.63 - Left hand plaster wall from main door from corridor.	Gap in plaster at the incoming radiator pipes, prior to any drilling.	0.020	80
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 1 – close to window and above pipe work, described above. At 30cm height. Bulk sample M1	0.040	160
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 2 – 30cm along same plane towards adjoining door.	0.035	140
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 3 – 30cm along same plane towards adjoining door.	0.030	120
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 4 – 30cm along same plane towards adjoining door.	0.019	76
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 5 – 30cm along same plane towards adjoining door.	0.011	44
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 6 – 30cm along same plane towards adjoining door.	0.009	36
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 7 – 30cm along same plane towards adjoining door.	0.007	28
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 8 – 30cm along same plane towards adjoining door.	0.007	28
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 9 – 30cm along same plane next to adjoining door.	0.002	8

Table No: 1A (continued)

Room	Location	MERCURY[1] EXPOSURE	
		mg.m^{-3}	% TLV
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 10 - Above the plastic ducting at 1m height close to window	0.030	120
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 11 - Above the plastic ducting at 1m height right hand side of green board	0.030	120
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 12 - Above the plastic ducting at 1m height left hand side of green board. Bulk sample M6	0.011	44
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 13 - Above the plastic ducting at 1m height 30cm along same plane towards adjoining door	0.009	36
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 14 - Above the plastic ducting at 1m height 30cm along same plane towards adjoining door	0.002	8
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 15 - Above the plastic ducting at 1m height 30cm along same plane next to adjoining door. Bulk sample M7	Nil	-
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 16 – 30cm height other side of adjoining door. Bulk sample M13	Nil	-
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 17 – 1.3m height close to window. Bulk sample M2	0.030	120
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 18 – 1.7m height close to window. Bulk sample M3	0.030	120
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 19 – 2m height close to window. Bulk sample M10	0.015	60

Table No: 1A (continued)

Room	Location	MERCURY[1] EXPOSURE	
		mg.m^{-3}	% TLV
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 20 – 1.7m height above green board. Bulk sample M11	0.009	36
Room 2.63 - Left hand plaster wall from main door from corridor.	Pilot hole 21 – 1.7m height centre from green board to door. Bulk sample M12	0.009	36
Room 2.63 - Right hand plaster wall from main door from corridor.	Pilot hole 22 – 30cm height close to window. Bulk sample M8	Nil	-
Room 2.63 - Right hand plaster wall from main door from corridor.	Pilot hole 23 – 30cm height beneath book shelf close to main door. Bulk sample M9	Nil	-
Room 2.63 – Rear wall with main door to corridor.	Pilot hole 24 – 30cm height left hand side of main door. Bulk sample M14	Nil	-
Room 2.63	After drilling holes for short period until windows opened	Up to 0.009	36

[1] TLV for mercury vapour = 0.025 mg.m^{-3} 8-hour TWA

% TLV expressed for guidance illustrative purposes only. Not representative of past or present personal exposure, as the readings are mostly behind building materials.

Table No: 1B Levels of mercury vapour – Rutherford Building Room 2.62

Room	Location	MERCURY[1] EXPOSURE	
		mg.m^{-3}	% TLV
Room 2.62 – Right hand plaster wall from main door from corridor.	Pilot hole 25 – 30cm height close to window. Bulk sample M15	0.002	8
Room 2.62 – Right hand plaster wall from main door from corridor.	Pilot hole 26 – 30cm height centre between window and door. Bulk sample M16	0.002	8
Room 2.62 – Right hand plaster wall from main door from corridor.	Pilot hole 27 – 30cm height close to adjoining door. Bulk sample M17	0.002	8
Room 2.62 – Right hand plaster wall from main door from corridor.	Pilot hole 28 – 30cm height other side of adjoining door sample M18	Nil	-
Room 2.62 – beneath wooden floor panels	Pilot hole 29 – far right corner near to window	0.020	80

[1] TLV for mercury vapour = 0.025 mg.m^{-3} 8-hour TWA

% TLV expressed for guidance illustrative purposes only. Not representative of past or present personal exposure, as the readings are mostly behind building materials.

APPENDIX II

BULK MONITORING RESULTS TABLE AND SAMPLE LOCATIONS

Table 2
Bulk Sample Mercury Results
(For sample locations see below)

Sample Number	Mercury concentration mg/kg
M1	3
M2	4
M3	5
M4	3
M5	4
M6	4
M7	3
M8	1
M9	2
M10	8
M11	3
M12	3
M13	2
M14	<1
M15	7
M16	4
M17	5
M18	1

Table 3
Bulk Sample Mercury Results (3/3/2010)

Sample Number	Mercury concentration mg/kg
M10B	5
M15B	3
M16B	3
M17B	2

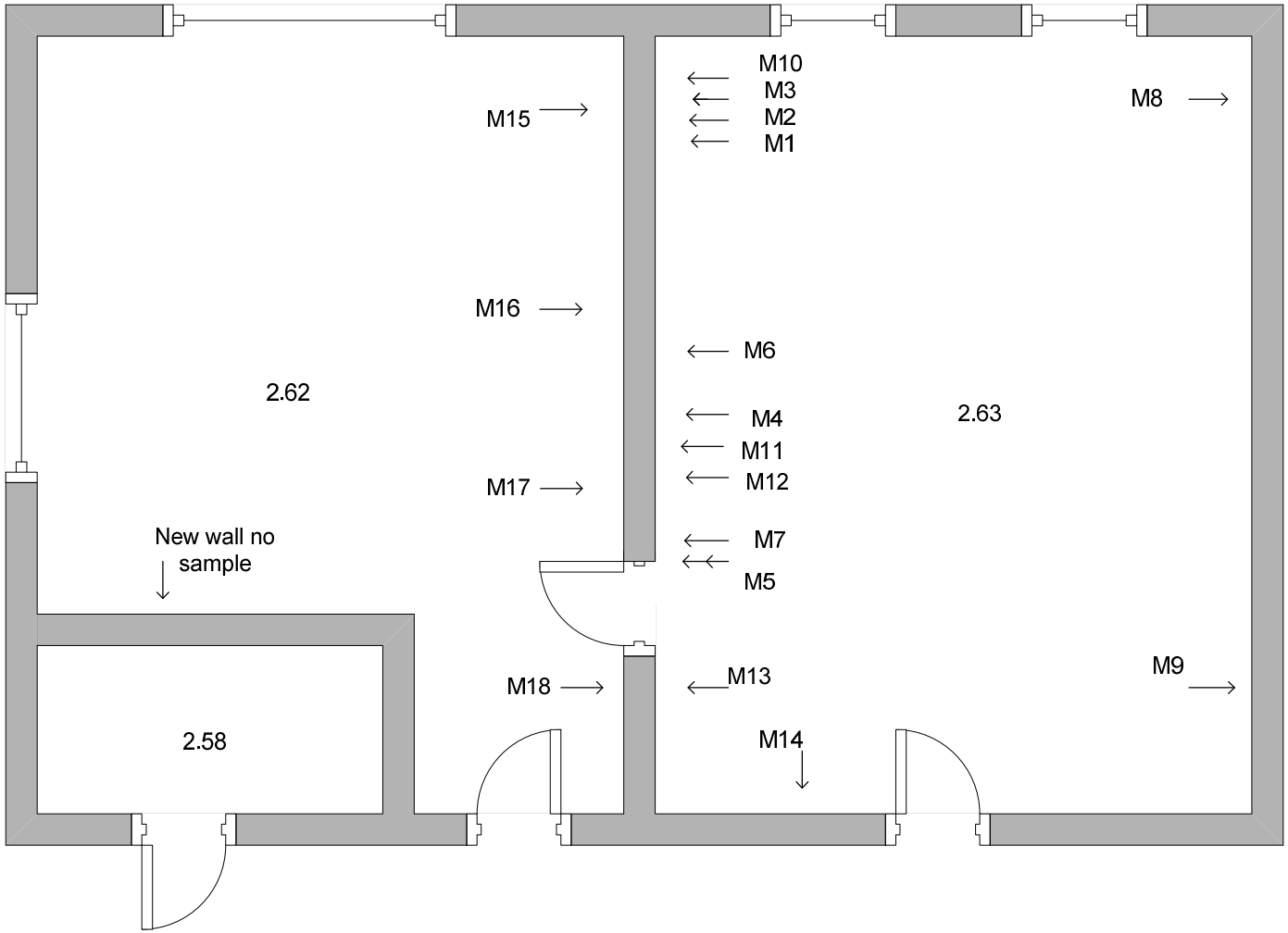
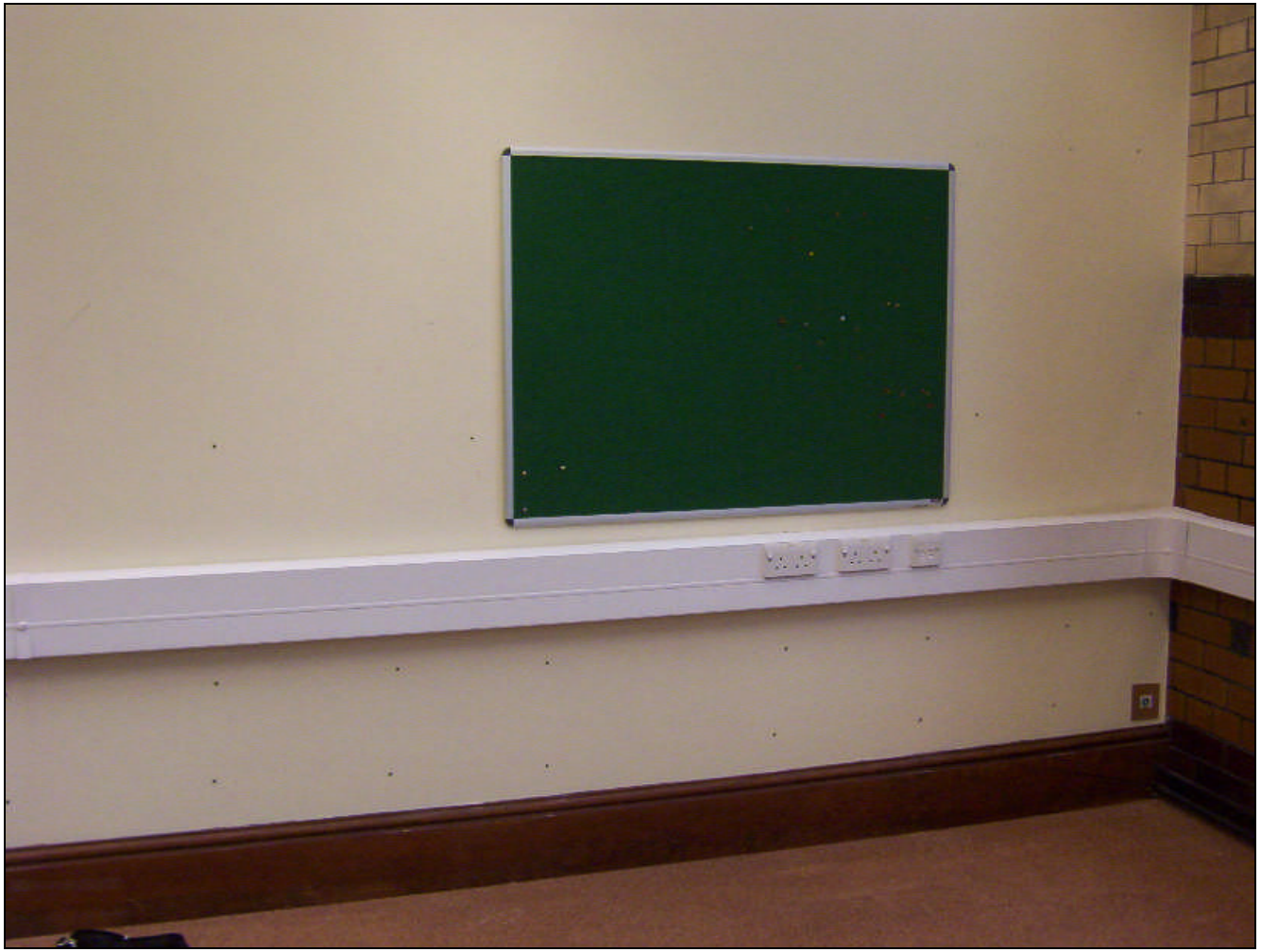


Diagram showing bulk sample locations (not to scale)

Photograph showing area of highest contamination



APPENDIX III
SAL LTD ANALYTICAL METHOD STATEMENT

SCIENTIFIC ANALYSIS LABORATORIES Ltd

Method Statement for Mercury in a Bulk Product

Weigh 1.00 +/- 0.01g of the 425um sub-sample into a 50 ml polyethylene digestion vessel that has been labelled with the correct sample identifier.	Depending on the nature of some samples, it may not be possible to dry and grind them.
Acidifying samples:	
Add 2.0 +/- 0.2 ml of 1:1 nitric acid to the sample. Allow any effervescence or excessive frothing to subside.	Carry out this procedure in a fume hood using a dispenser.
Add 5.0 +/- 0.2 ml of 1:4 hydrochloric acid to the sample.	Carry out this procedure in a fume hood using a dispenser
Place the vessel in the digestion block and cover with a screw cap and heat to 95 ^{0}C. Heat the sample for one hour.	Note that the screw cap is only gently placed onto the vessel and must not be tightly attached.
Remove the sample from the hotblock and allow to cool to ambient temperature.	
Carefully add deionised water to the 50 ml mark. Gently agitate the vessel then allow to stand to allow any non-dissolved solids to settle.	In some cases the solids do not settle, in which case a 'filtermate' or syringe filter may be used to remove the solids before transfer of the extract.
Transfer circa 10 mls of the extract to an autosampler vial and place it in the sample rack. Record the order of loading the samples onto a rack loading sheet for subsequent entry into the ICP-OES sequence table.	

SAL Reference: 188826
Customer Reference:

Bulk Product Analysed as Bulk Product
Miscellaneous

				SAL Reference	188826 001	188826 002	188826 003	188826 004	188826 005
				Customer Sample Reference	M1	M2	M3	M4	M5
				Test Sample	AR	AR	AR	AR	AR
Determinand	Method	LOD	Units	Symbol					
Mercury	ICP/OES	1	mg/kg	N	3	4	5	3	4

SAL Reference: 188826
Customer Reference:

Bulk Product Analysed as Bulk Product
Miscellaneous

				SAL Reference	188826 006	188826 007	188826 008	188826 009	188826 010
				Customer Sample Reference	M6	M7	M8	M9	M10
				Test Sample	AR	AR	AR	AR	AR
Determinand	Method	LOD	Units	Symbol					
Mercury	ICP/OES	1	mg/kg	N	4	3	1	2	8

SAL Reference: 188826
Customer Reference:

Bulk Product Analysed as Bulk Product
Miscellaneous

				SAL Reference	188826 011	188826 012	188826 013	188826 014	188826 015
				Customer Sample Reference	M11	M12	M13	M14	M15
				Test Sample	AR	AR	AR	AR	AR
Determinand	Method	LOD	Units	Symbol					
Mercury	ICP/OES	1	mg/kg	N	3	3	2	<1	7

SAL Reference: 188826
Customer Reference:

Bulk Product Analysed as Bulk Product
Miscellaneous

				SAL Reference	188826 016	188826 017	188826 018
				Customer Sample Reference	M16	M17	M18
				Test Sample	AR	AR	AR
Determinand	Method	LOD	Units	Symbol			
Mercury	ICP/OES	1	mg/kg	N	4	5	1

SAL Reference: 192682
Customer Reference: 11826C Part 3

Bulk Product Analysed as Bulk Product
Miscellaneous

				SAL Reference	192682 001	192682 002	192682 003	192682 004
				Customer Sample Reference	M15B	M16B	M17B	M10B
				Test Sample	AR	AR	AR	AR
Determinand	Method	LOD	Units	Symbol				
Mercury	ICP/OES	1	mg/kg	N	3	3	2	5

APPENDIX IV
LIST OF AMMENDMENTS

[i] All references to Rutherford removed and new name of Coupland 1 applied at the request of the University of Manchester

[ii] Additional text referencing new samples

[iii] Additional text referencing new samples

[iv] Additional text referencing new samples

[v] Additional text referencing new samples

[vi] Additional text referencing new samples

[vii] Additional text regarding proposed Draft IOELV for mercury

[viii] Removal of HSE method reference and addition of SAL Ltd in-house method for mercury determination in bulk materials of varying matrices, shown in appendix III

[ix] Additional text referencing new samples

[x] Additional text referencing new samples

[xi] Additional results table for bulk samples obtained 3/3/10