

**Residual contamination survey
of Coupland 1 Building,
the Annexe and the Old Dental Hospital,
Manchester University**

by

S M Adams

CLIENT: Manchester University

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Adding value through knowledge

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01	For Issue	S Adams	A J Frith	May 2000
02	Addition of addendum to cover additional areas monitored	S Adams	A J Frith	Sept 2000

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Controlling procedure - QP 7, QP40

1 Introduction.

NIRAS have been appointed by Manchester University to provide radiological services to the investigation of residual contamination in Coupland 1 Building, the annexe and the Old Dental Hospital, including the laboratories historically used by Rutherford.

The objective was to carry out a radiological survey to investigate and identify areas of any residual contamination which may have radiological implications for persons undertaking the work or where demolition waste may be considered radioactive waste.

2 Method.

2.1 Scope of the survey

2.1.1 Monitoring

The current information on the potential contaminants based on the history of what was used by Rutherford and also some limited analysis undertaken on radioactive waste originating from Coupland 1 suggests that radium-226 is a likely contaminant of these buildings. Uranium may also have been used during this period. With the diverse use of radionuclides at the University from the early 20th Century to present day, the presence of other contaminants should not be ruled out.

With this in mind, two monitoring techniques were selected, one that would be highly sensitive to variations in gamma radiation and the other that would detect contamination with beta emitting radionuclides.

The gamma monitoring was undertaken with 2" x 2" sodium iodide scintillation detectors operated such that they would be able to detect gamma energies of 60 keV and above. Typical background count rates for this instrument are approximately 1×10^4 counts per minute, although higher background count rates may result from building materials that contain elevated levels of naturally occurring radioactivity. This monitor was used in each room for monitoring the floor and the wall, at waist height.

The beta contamination monitoring was undertaken using a large area gas proportional monitor, the Berthold LB122. The typical background for this instrument is 25 - 30 counts per second, but is again subject to the variations in natural activity of the building materials in the areas being monitored. This monitor was used for identifying any residual contamination in the walls, again at waist height and any other places where the gamma monitoring identified elevated readings.

Where areas of contamination were identified, further monitoring was undertaken for alpha radiation using a Mini Instruments 900 / AP2 alpha monitor, and for gamma dose rate using a Mini Instruments 1000R.

2.1.2 Rooms

Surveying was undertaken in the rooms identified in the plans provided by Velson Horie (curator of conservation). A copy of these plans is attached in Appendix A, in order that the room references can be identified.

2.1.3 Limitations

The scope of the survey was limited by the access to a number of rooms and the access to particular areas of walls and floor in certain rooms, for example by the presence of bookcases etc. These instances are noted in the survey listing given in Appendix B.

The survey was limited in scope to the surveying of gamma and beta radiation. Alpha radiation measurements were only made where contamination was identified by the gamma or beta measurements. It should be noted that whilst the gamma and beta surveying techniques are able to detect radiations from radium-226 and uranium and their decay products, the survey would not detect "pure" alpha emitters. This limitation was accepted as the majority of areas were covered with paint or carpet or linoleum, and as such it would not be possible to detect any alpha radiation other than from contamination on the current surface.

3 Results.

The areas where contamination was detected are described below. In order to form a complete survey record, the areas where an earlier survey by the University's Radiological Protection Service detected contamination are also included (*in italics*).

A full list of NIRAS survey results, including the rooms where access was not possible, is given in Appendix B. A copy of The University's Radiological Protection Service report is enclosed in Appendix C.

3.1 Coupland 1 Building.

3.1.1 Basement.

Room CB. 10

A hot spot was found on the floor towards the far end of the room. The gamma flux meter gave a maximum reading of 50,000cpm. Further investigation gave no reading for either beta or alpha radiation. The absence of a beta count rate suggests that the contamination may be at some depth. The dose rate measured, using a Series 1000R mini monitor gave $<0.5\mu\text{Sv/hr}$.

CB.05 – contamination was detected on the right hand side window ledge and CB.09- contamination was detected on the window ledge immediately opposite the entrance door and to the right hand side of the sink.

3.1.2 Ground floor.

Room 54. (Rutherford's lab) (Drawing No. 1003 ref. G.24)

A hot spot was found on the floor in the corner of the room. The Bicon gamma flux meter gave a maximum reading of 500,000cpm. The Berthold gave a maximum reading of 80cps on the wall.

Further investigation gave no reading for alpha, although this cannot be eliminated as the floor was covered with lino.

A series 1000R dose rate meter gave a reading of $50\mu\text{Sv/hr}$ at contact.

Room 55. (Rutherford's lab) (Drawing No. 1003 ref. G.23)

Again a hot spot was found on the floor, directly opposite the dividing wall from room 54. The Bicon gave a reading of 500,000cpm and the Berthold gave readings of 1321cps on the floor and 253cps on the wall.

Further investigation gave no reading on the mini 900 alpha monitor. Again alpha cannot be eliminated as the floor is covered with lino.

The contact gamma dose rate, measured using a mini 1000R, was $50\mu\text{Sv/hr}$.

3.1.3 1st Floor

Room C. 1. 10.

An area is marked on the far wall. The Bicon gave a maximum reading of 25000cpm and the Berthold gave readings of 1338cps at contact and 98cps at 10cm. The mini 900 alpha detector detected localised hot spots with readings of 15, 20 and the maximum of 100cps.

3.1.4 2nd Floor.

Room 52 and 53. (Drawing No. 1005 ref. 2.21 and 2.22 respectively)

The Bicon detected a localised area of raised gamma flux on the floor, beneath the black boards, in rooms 52 and 53. These are back to back with the partition wall. The maximum Bicon reading in rooms 52 and 53 was 40000cpm. No readings were observed for beta and similarly for alpha, although alpha cannot be eliminated as the floor was carpeted.

2.62 (Drawing No. 1005 ref. 2.01) contamination was found in the far end of the room in the vicinity of the worn vinyl and

2.63 (Drawing No. 1005 ref. 2.02) contamination was detected on the wall above the hand washbasin.

3.2 Old Dental Hospital.

3.2.1 2nd Floor

Room D_2.05.

The Bicon detected an area of elevated gamma flux in the corner of the room, giving a reading of 90000cpm. No beta or alpha radiation was detected, although the floor was carpeted so alpha cannot be eliminated. The mini 1000R-dose rate meter gave a maximum reading of 1μSv/hr.

4 Conclusions.

The survey has detected localised contamination at a number of locations. These areas need to be sampled and analysed in order to determine the radionuclide content and activity concentration, and to estimate the waste volume in the Exempt, Very Low Level Waste, and Low Level Waste streams.

Once this has been established, the best method for remediation can be determined, along with the appropriate radiological precautions for the operation.

It must be noted that due to the levels of occupancy in the Old Dental building, the Annexe and other obstructions in Coupland 1 that was largely unoccupied, the scope of the survey was limited.

Residual contamination survey of Coupland 1 Building, the Annexe and the Old Dental Hospital

Addendum to the report MTC 2000 051

Radiation monitoring has been undertaken in Coupland 1 Building, the Annex and the Old Dental Hospital, and the results reported in MTC 2000 051. The report indicates that monitoring was restricted in some locations and not undertaken in areas where access was not available. In areas relevant to Phase 2b demolition the Museum/Psychology escape stair well and ground floor toilets were not monitored at the time. These areas have now been monitored, and localised contamination has been found on the wall between the stair well and Psychology. The total activity associated with the contaminated area is estimated at 2kBq. The area is to be remediated before demolition. With this exception, and subject to the limitations described in the report, no occupationally significant radiation hazard was detected in areas to be demolished.

There is no reason to believe that the areas in question have been used for work with radioactive materials and have become contaminated as a result. The detection of contamination in the stair well, whilst giving confidence in the surveys ability to detect low level contamination, casts some doubt, however, and there may be similar low levels of contamination that have gone undetected. There is a remote possibility, therefore, that demolition debris leaving the site as waste may be "radioactive" as defined in the Radioactive Substances Act 1993.

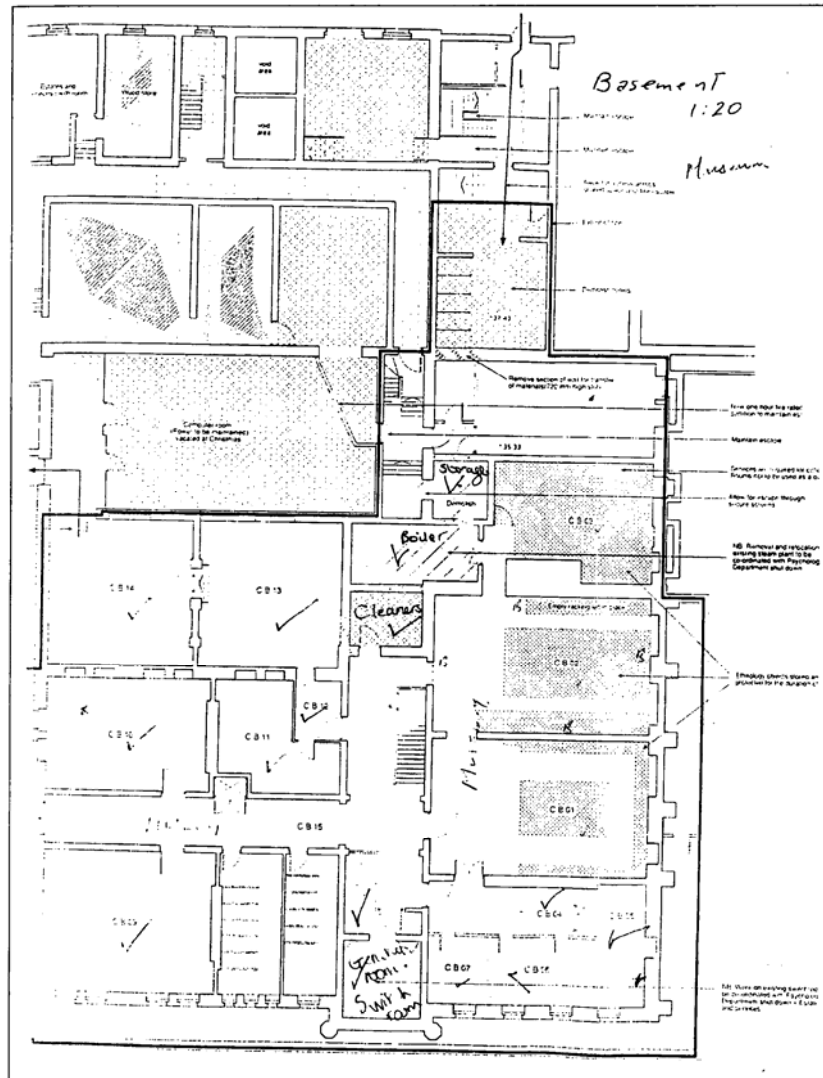
Our experience with the decommissioning of the Universities Research Reactor, where "non radioactive" demolition debris was removed from site under similar circumstances, leads us to believe that the Environment Agency would expect lorry loads of demolition debris to be monitored before leaving the site. I recommend, therefore, that this be done so as to demonstrate that on the basis of waste increments equal to a "lorry load" the waste leaving site meets the requirements of the Radioactive Substances (Phosphatic Substances and Rare Earths etc.) Exemption Order 1962.

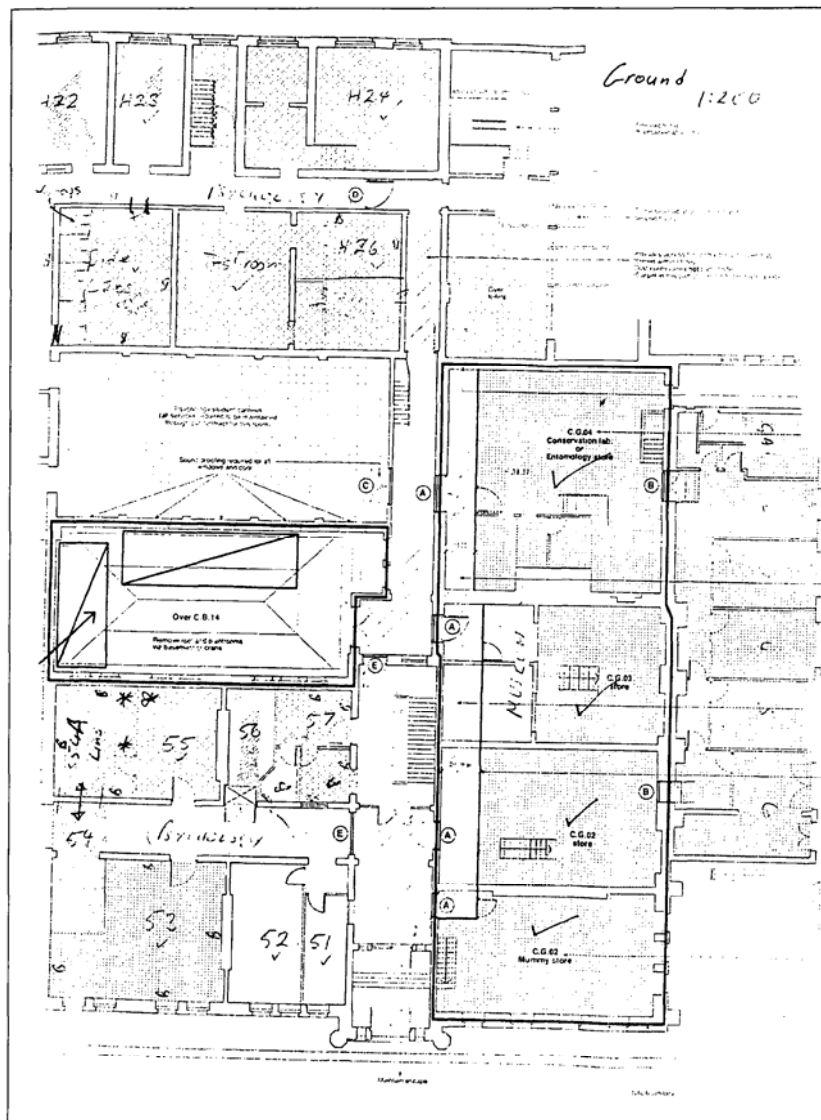
It is emphasised that this procedure is very much a confirmatory checking procedure designed to generate records that confirm compliance with the conditions of the Exemption Order.

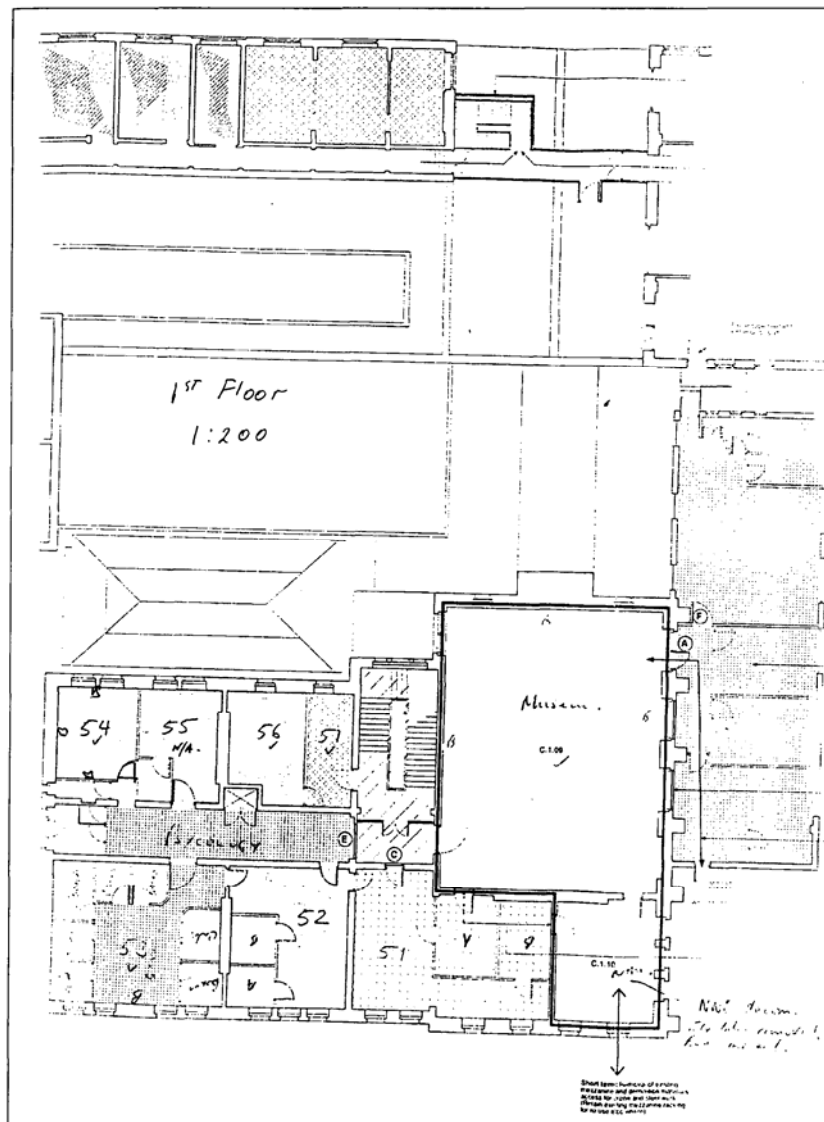
Barry Frith

25th Sept 2000

Appendix A: Plans of Coupland 1 building and the Old Dental Hospital





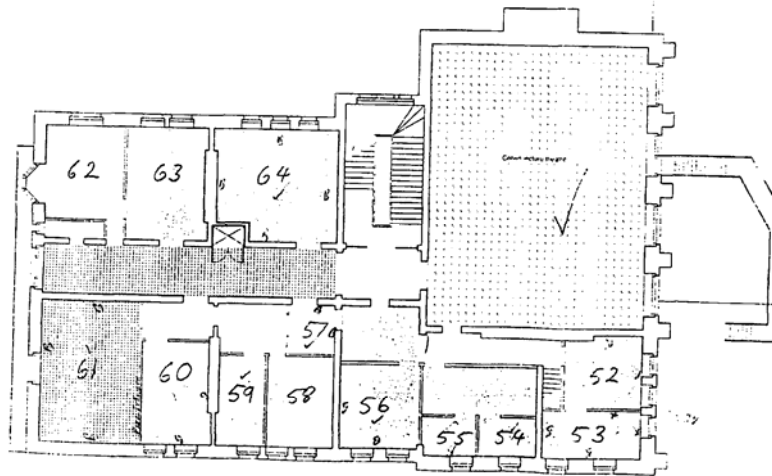


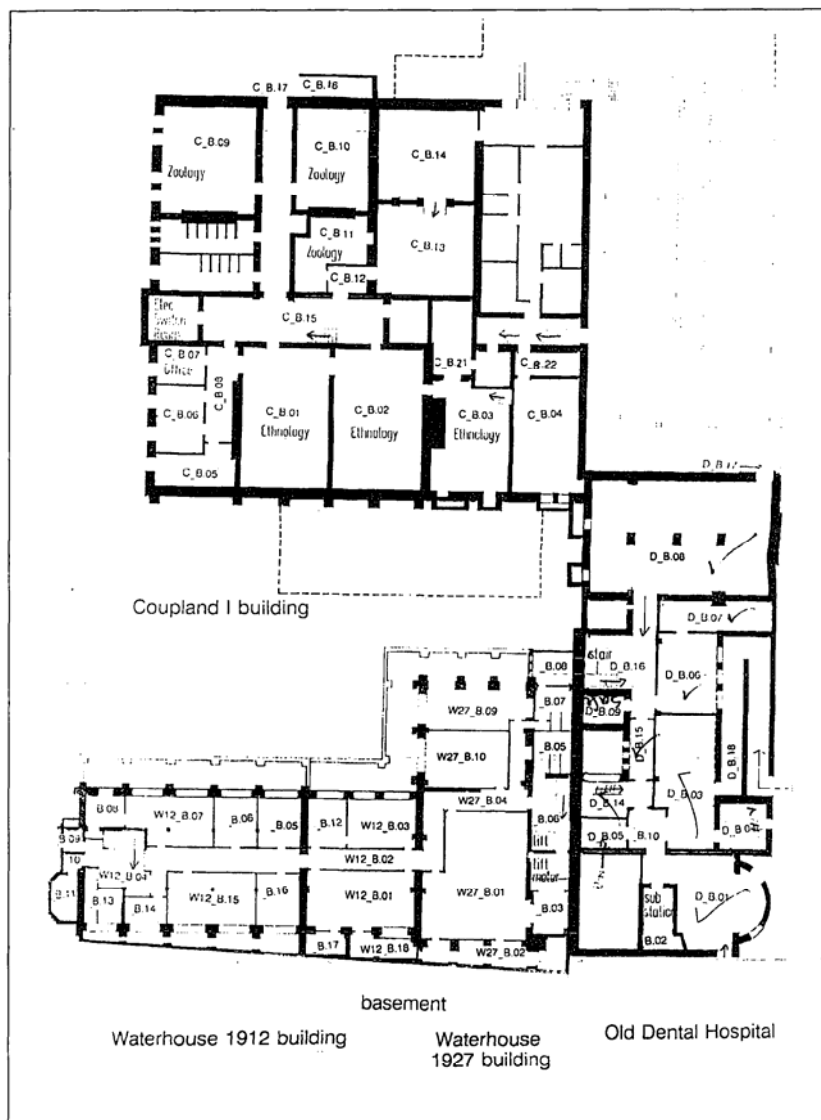
Coupland ①

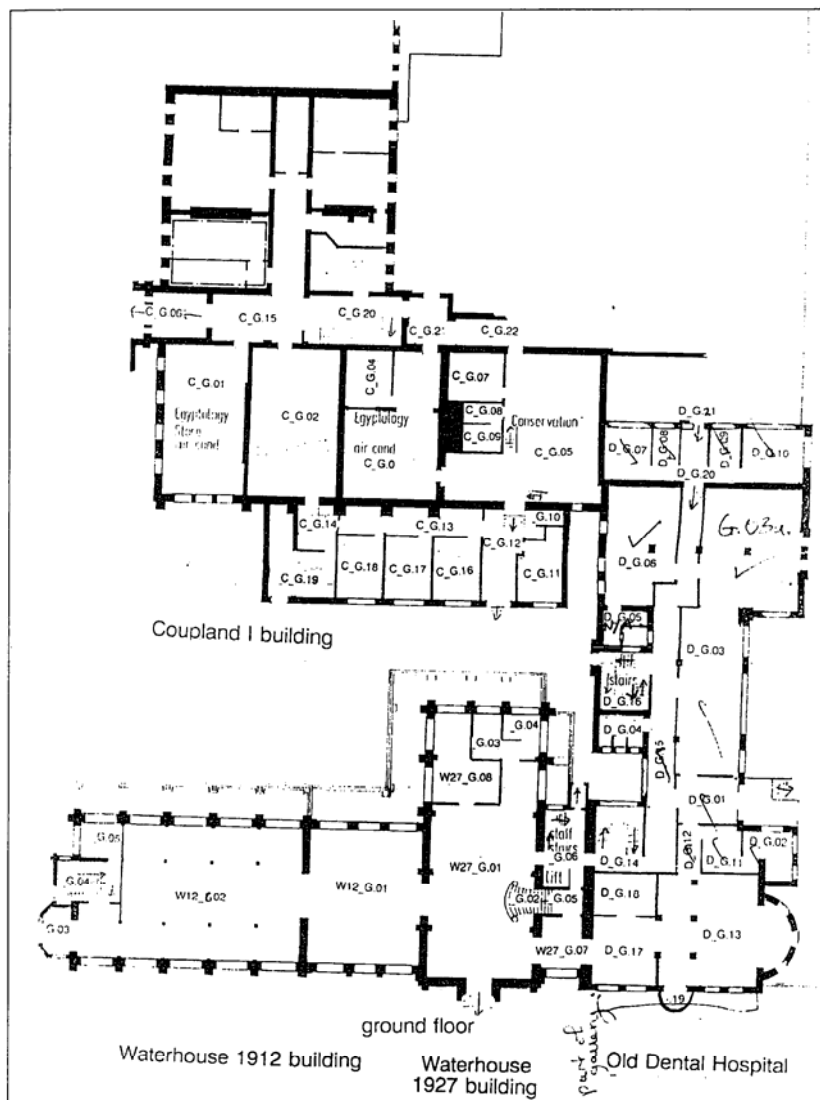
2nd Floor

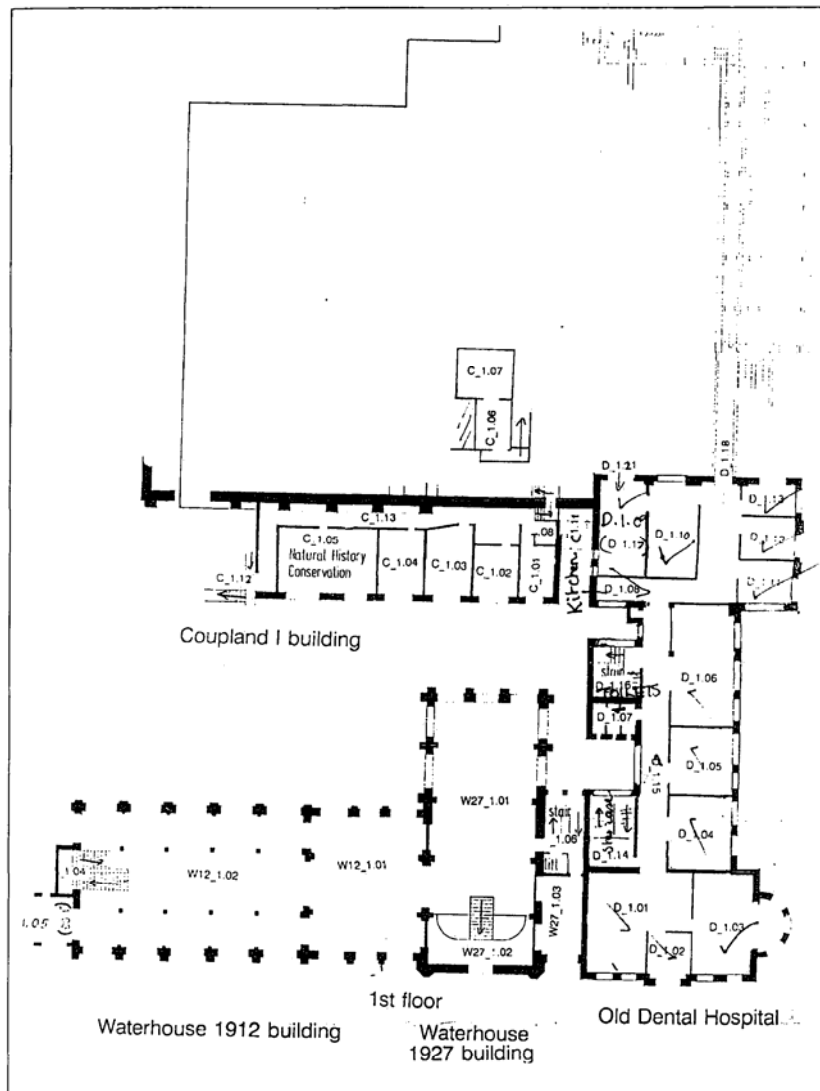
1:200

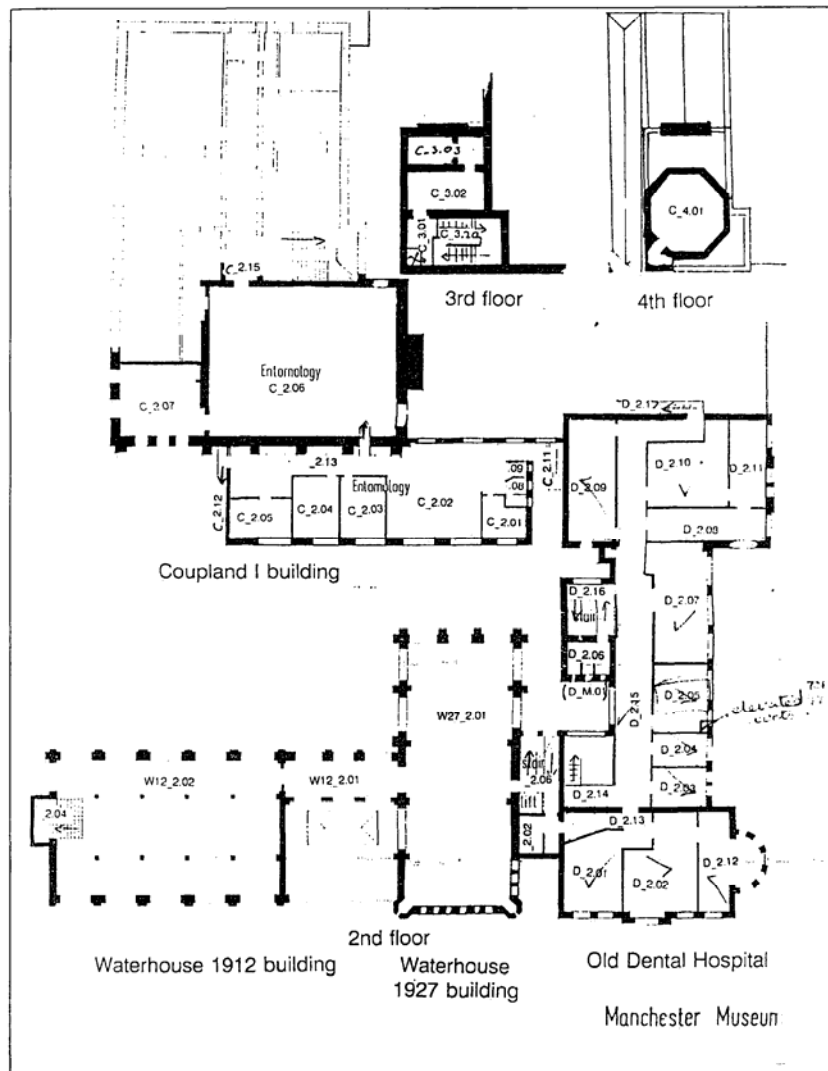
Psychology











Appendix B: Full Survey Results

Coupland 1: 2nd Floor

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
52	Floor 41 Wall 31	18789	40000 beneath blackboard	20000	Room empty
53	Floor 45	21437	40000 beneath blackboard		Room empty
54	Wall 35	17605	25000	20000	Room empty
55	31	14156			
56	33	16338	20000	20000	
57	31	15483	<20000	inaccessible	
58	Wall 35	17991	20000	26000 (brick)	Room empty
59	Wall 29	16995	22000	25000(brick)	Room empty
60	Wall 25	15047	20000	20000	Room empty
61	Wall 30	10250	20000		Cardboard boxes in room
62	Locked- no	Key available			
63	Wall 31	18789	22000		
64	Wall 25	18938	25000	21000	Room empty
Cohen lecture theatre	Wall 35	17584	24000	24000	

Coupland 1: 1st Floor

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
51	Floor 30 Wall 33 (B) Sink 28	18958	20000 sink 20000	20000	
51A	27	16739	20000	19000	bench tops 19000
51B	Bench & floor 30 Walls 25	17700	21000	20000	Bench tops 22000
52	Sink 33 Wall& floor 30	18481	20000	21000	Sink & bench 23000
52A	28	18605	21000	20000	Sink 20000 Bench 23000
52B	29	17962	20000	20000	
53	22	11326	15000		Storage area
54	30	22589	22000		Benches
55	Not	accessible			
56	20.6	13372	20000	20000	
57	34 benches	14237	15000	15000	Benches
C 1.09	30	13830	20000	20000	

Coupland 1: Ground floor.

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
51	Walls 30	19332	24000	24000	Sink 22000
52	Walls 33	20394	23000	24000	
53	30	13363	20000		Limited access-storage room
54	27	15051			
54A		33567	>500000		Rutherford's laboratory.
55	Floor 1321 Wall 253 Other walls 44	33441	>500000 in corner of room		Rutherford's laboratory.
56	26	15493	25000	25000	
57	32	17489	20000		
57A	33		22000		
57B	31		25000		
CG.02 Mummy store	31	12815	20000	21000	most of floor inaccessible.
CG.02 Store	33	13304	19000	21000	
CG.03	36	10413	21000	23000	Most walls inaccessible.
CG.04	31	14673	21000	22000	Room in use.
H22 (Full of filing cabinets)	30	16719	16000	28000	
H23	Sink 36 Walls 33	20195	23000	22000	Sink 25000cpm
H24 (on two levels)	Corridor wall 31 Room 36	21925	Corridor 18000 Room 25000	Corridor 18000 Room 29000	
Side labs	31	16277	20000	20000	
Test room	34	16361	23000	24000	Empty room
H26	32	15317	20000	20000	Empty room

Coupland 1: Basement

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
CB.01	Walls 31	16314	19000	20000	Limited access to walls and floors
CB.02	27	15711	20000	20000	Storage centre
CB.03	24	11881	15000		Storage centre and walls.
CB.04	Walls and sink 30	17729	22000	20000	Sink & bench 22000
CB.05	30	17536	25000	23000	Pipework 30000cpm
CB.06	Walls 31	16856	22000	20000	
CB.07	Walls & sink 28	17394	20000	23000	Storage boxes limiting access to floor.
Switch room	Walls max 39 (glazed tiles)	20009	22000	26000	
CB.09	32	17583	25000 under sink		Museum storage bays, benches.
CB.10	37	25996	50000 far end of room	29000	Benches 30000 Sink 28000
CB.11	30	18124	20000		Room empty
CB.12	26	19253	20000	20000	Entrance room
CB.13	22	12204	15000	Show cases	
CB.14	24	14055	21000	21000	Sink 20000
Cleaners room	30	18303	20000	20000	Lockers, benches
Store room		17971	21000	Walls inaccessible	
Boiler room	31	15292			

Lower Ground floor annex

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
Bone room 1	Walls 18 Sink & bench 22	14856	15000	14000	Limited access to floor and walls
Bone room 2	Full of	Polystyrene	Fillings.		
Bone room 3	19 sink 22	10323	12000	12000	
Bone room 4	21	12059	15000	15000	
Test room	20	12780	12000	10000 sink 15000	
Plant room	24	14258	15000	15000	
Constructor's workshop	23	11070	12000	15000	Limited access.

Ground floor annex.

NOTE: The rooms along this corridor are all in use and so the monitoring of the walls and floor was limited by office equipment.

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
GA1	20	11282	15000	15000	Coffee room
GA2	18	10288	15000	12000	Office
GA3	21	9043	12000	10000	Storage room
GA4	18	10364	10000	10000	Office V. Horie
GA5	20	9324	12000	12000	Benches
GA6	20	10061	12000	12000	labs
Corridor			Reading in cupboards 15000		Mainly cupboards

First floor annexe

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
C. Johnson	22	9071	12000	10000	Limited access to walls and floor
Office	Sink 22 Wall 14	9204	10000	13000	Limited access to walls and floor
Study room	20 sink 25	6295	12000	12000	
Storage area	24	5870	12000	12000	
Passageway	12	9441	10000	15000	Cupboards along length
Spirit room	20	7854	12000	12000	

Old Dental Hospital.

Basement.

NB. Most of the rooms surveyed in the old dental hospital are still in use and hence there was limited access to the floor and walls.

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
DB.01	23	11583	17000	16000	Contained dinosaur
DB.02	Not	monitored			Sub station
DB.03	20	11807	15000	15000	Storage, limited access
DB.04	Not	accessible			
DB.05	Not	accessible			
DB.06	23	12569	18000	18000	
DB.07	23	13872	15000	19000	
DB.08	25	9645	10000		Storage room
DB.09	Safe- not	accessible			
DB.10	Not	monitored			
DB.14	-	14692	18000	25000-glazed brick 15000-concrete	corridor
DB.15	-	16504	20000	18000	corridor
DB.16	Not	monitored			Stair case

Ground floor.

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
DG.01	19	11542	15000	15000	
DG.02	19	11542	15000	15000	Paint store
DG.03	Walls 19 Sink 30	10851	13000	14000	Teaching room
DG.03a	24	11311	15000	15000	Conference room
DG.04	Not	monitored			
DG.05	Not	Accessible	Store room-	full	
DG.06	21	10508	15000	16000	
DG.07	17	9468	12000	12000	
DG.08	18	7257	12000	12000	
DG.09	17	10176	10000	11000	kitchen
DG.10	23	10176	15000	12000	
DG.11	20	11542	15000	15000	Cleaner's store
DG.12	19	11542	15000	15000	corridor
DG.15	27- tiles	-	18000		corridor

Note- room DG.13, DG.14, DG.17 and DG.18 were not monitored as these form part of the Gallery.

1st Floor

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
D 1.01	21	9646	10000	10000	Offices
D 1.02	18	9646	10000	10000	Offices
D 1.03	19	10599	11000	14000	Offices
D 1.04	Not	monitored			
D 1.05	21	10752	12000	14000	Office
D 1.06	18	9005	10000	11000	
D 1.07	Toilets	Not	monitored		
D 1.08	-	12870	13000	17000- tile	Kitchen
D_1.09	20	10385	15000	15000	Printing room
D 1.10	18	10361	12000	12000	Photo studio
D_1.11	-	12574	14000	13000	Limited access
D_1.12	18	11943	13000	11000	Dark room-limited access
D_1.13	19	12062	12000	11000	Limited access

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
D_1.14	Staircase- not	monitored			
D_1.15	30- tiles		14000	18000-tile	Corridor
D_1.16	Staircase-not	monitored			

2nd Floor

Room Number	Berthold (cps)	Bicron (1 min count)	Bicron reading Floor (cpm)	Bicron reading Wall (cpm)	Comments
D_2.01	18	8103	10000	10000	v. limited access
D_2.02	17	8107	11000	11000	v. limited access
D_2.03	22	12589	15000	15000	v. limited access
D_2.04	23	11397	14000	15000	v. limited access
D_2.05 office	77 in corner	8996	77000	14000	v. limited access
D_2.06	Not	monitored			Toilets
D_2.07	19	7139	12000	12000	
D_2.08	14	8195	12000	12000	
D_2.09	21	11372	15000	15000	
D_2.10	19	9138	13000	Sink 11000	Room full of storage boxes
D_2.11	19	8631	12000	12000	
D_2.15	-		11000	13000	Corridor

Note D_2.13 (corridor), D_2.14 (corridor) and D_2.16 (staircase) were not monitored.

Summary of the Radiological Survey.

Contamination was detected in the rooms described below.

Coupland 1 Building.

Basement.

Room CB. 10

A hot spot was found on the floor towards the far end of the room. The Bicon gamma flux meter gave a maximum reading of 50000cpm.

Further investigation gave no reading for either beta or alpha radiation.

The dose rate measured, using a Series 1000R mini monitor gave $<0.5\mu\text{Sv/hr}$.

Ground floor.

Room 54. (Rutherford's lab)

A hot spot was found on the floor in the corner of the room. The Bicon gamma flux meter gave a maximum reading of 500000cpm. The Berthold gave a maximum reading of 80cps on the wall.

Further investigation gave a maximum reading of 50cps for beta particles and no reading was observed for alpha, although this cannot be eliminated as the floor was covered with lino.

A series 1000R dose rate meter gave a reading of $50\mu\text{Sv/hr}$ at contact.

Room 55. (Rutherford's lab)

Again a hot spot was found on the floor, directly opposite the dividing wall from the room above. The Bicon gave a reading of 500000cpm and the Berthold gave readings of 1321cps on the floor and 253cps on the wall.

Further investigation gave a maximum reading of 250cps using the series 900 beta monitor and no reading on the series 900 alpha monitor. Again alpha cannot be eliminated as the floor is covered with lino.

A series 1000R dose rate meter gave a reading of $50\mu\text{Sv/hr}$ at contact.

1st Floor

Room C. 1. 10 (NNC Decommissioned room).

An area is marked on the far wall. The Bicon gave a maximum reading of 25000cpm and the Berthold gave readings of 1338cps at contact and 98cps at 10cm.

The series 900 alpha detector detected localised hot spots with readings of 15, 20 and the maximum of 100cps.

The series 900 beta monitor again detected localised hot spots with readings of 200cps and the maximum $>500\text{cps}$.

2nd Floor.

Room 52 and 53.

The Bicon detected a localised area of raised gamma flux on the floor, beneath the black boards, in rooms 52 and 53. These are back to back with the partition wall. The maximum Bicon reading in rooms 52 and 53 was 40000cpm. No readings were observed for beta and similarly for alpha, although alpha cannot be eliminated as the floor was carpeted.

Old Dental Hospital.

2nd Floor Room D_2.05.

The Bicon detected an area of elevated gamma flux in the corner of the room, giving a reading of 90000cpm. No beta or alpha radiation was detected, although the floor was carpeted so alpha cannot be eliminated. The series 1000R dose rate meter gave a maximum reading of 1μSv/hr.