

Details of a lead block recovered from the attic-space above the Cohen Lecture Theatre, Coupland I Building.

In May 2005, an unmarked block of lead (*Figure 1*) was retrieved from the roof-space above the Cohen Lecture Theatre, Coupland I Building, by NIRAS, during their contract to survey and remove any radiologically contaminated material from this area. Whereas the bulk of the material removed during the remediation process was secured in polythene bags and transferred to storage in a dedicated iso-container, the physical nature of the block made it unsuitable for such storage. It was therefore placed in the care of the university Radiation Safety Unit (RSU). No accompanying paperwork was received by the RSU.



Figure 1: Lead block retrieved from the roof-space above the Cohen Lecture Theatre, Coupland I Building

The dimensions of the lead block are 16 x 11 x 8 cm. One of the faces of the block appears to have been hollowed out and then back-filled with lead. Prior to receipt by the RSU, the block had been covered with duct-tape on the five 'intact' faces, and at the time of receipt was verbally described by NIRAS as 'radioactively contaminated'.

Upon receipt of the block by the RSU in May 2005, it was securely stored behind lead shielding in the fume cupboard within the RSU's designated Supervised Area laboratory. Radiological investigation of the block at the time of receipt revealed an uneven radiation dose rate from the six faces, and this was considered to reflect the possibility of variable levels of contamination on each surface. The highest radioactive count rate of 270 counts per second (cps)

above background was obtained on the filled surface (i.e. that which had not been covered in duct-tape prior to receipt by the RSU). The radiation counts at the remaining five (taped) surfaces were considerably less (50 cps above background (faces 1 and 6) and 5-8 cps (faces 2,3 and 4) (see Appendix 1).

It should be emphasised that no documentation was provided to the RSU in relation to this item; at the time of receipt, therefore, there was no evidence to indicate that the item might be anything other than a radioactively-contaminated artefact of unknown provenance. It was therefore retained by the RSU under secure laboratory conditions as low-activity radioactive waste for eventual disposal. In February 2010, during routine laboratory maintenance, space became available within the storage safe housed within the RSU Supervised Area, as used to house other low-activity radioactive artefacts. Details of the block were added to the inventory of the safe contents at the time of transfer. The safe is kept locked, and very infrequently accessed. It had previously been accessed, and an inventory taken, on 14th April 2003.

In June 2010, discussion with Dr Neil Todd, a co-author of the 2008 report *"Possible Health Risks due to ionising radiation in the Rutherford Building (formerly Coupland Building I) at the University of Manchester"* revealed that the lead block could have historical value in that it may contain encapsulated Radium-226 and its daughter products.

In August 2010, the surface tape was removed from the block by RSU technical staff, and retained for further analysis. The exposed surfaces of the block (*Figure 2*) were carefully cleaned with a mild soap solution; this removed all remaining dust from the previously taped areas. Further swabbing of all surfaces other than the filled surface failed to reveal any further dust-associated radioactivity. For the filled surface, radioactivity levels in cleaning swabs were reduced from 270 cps to 49 cps after repeated cleaning, though could not be reduced further. Although surface unfixed radioactive contamination has been removed from the block, some surface-radioactivity remains; this appears to be fixed, and resistant to the cleaning procedures used.

Please see Appendix 1 for further details of the cleaning procedure and subsequent radioactive count/radiation dose rates.

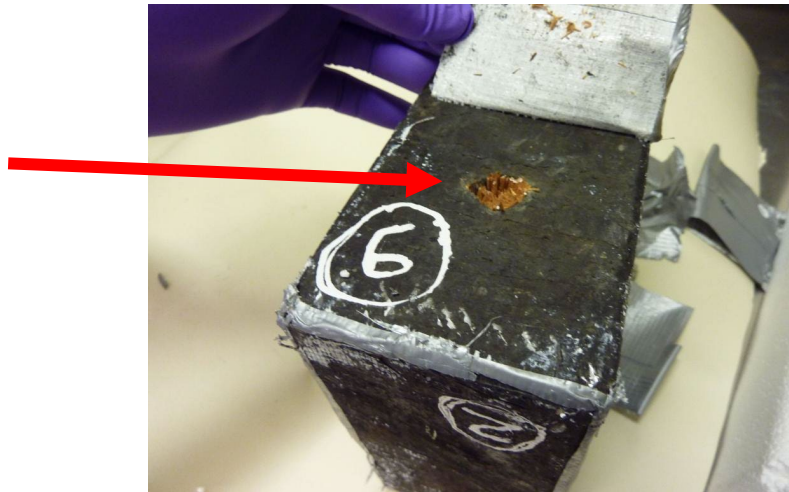


Figure 2: Face 6 of the Lead block after removal of surface tape, showing evidence (arrowed) of a wooden insert.

Interestingly, removal of the surface tape has revealed evidence of a wooden insert on one of the faces (see *Figure 2*); there is no evidence of any enhanced radioactivity associated with this area.

As an item of radioactive waste, the university would wish to dispose of this material to an approved contractor at the earliest opportunity, but there is currently no provision for this within the university's Permit under the Environmental Permitting Regulations 2010 (EPR10). The university is therefore required to apply to the Environment Agency for a variation of its Environmental Permit, a process that is currently in progress. The Environment Agency has also requested the university to provide them with details of (i) the physical nature of the embedded radioactive material (Radium 226) embedded in the lead block, (ii) the activity of the Radium 226 source embedded in the lead block, (iii) identification of a disposal route for the radioactive waste, and (iv) details of the contractor who has been contacted to arrange the disposal of the radioactive waste. These requests are currently being addressed.

Appendix 1

Lead Block Investigation

Determination of potential surface contamination on the Rutherford Building lead block.

11th August 2010

The faces of the block were numbered following the same pattern as previously. The duct tape was removed from one face at a time and the tape monitored with a Nuclear Enterprises Selectra type 1A, serial number 546/K153 monitor set to detect alpha and beta emission.

The following results were recorded:

Face 1= 50 cps above background

Face 2, 3 and 4 = 5 to 8 cps above background.

Face 6 = 40 to 50 cps above background.

There was no tape on face 5 which is the back-filled lead side.

Each face of the block was carefully cleaned with a mild soap solution and sponge swabs.

The counts from Faces 1,2,3,4,6 were reduced to background level (8 to 9 cps) as detected on the swab.

After four attempts at cleaning face 5 the count rate was reduced from approx. 270 cps down to approx. 45 cps detected on the swab. It was considered that further cleaning would not reduce the count rate significantly unless a more vigorous procedure was used.

The radiation dose-rate detected on face 5 before cleaning was 20 $\mu\text{Sv/h}$ on a Radiagem dose-rate monitor, serial number 2323. Following cleaning it was recorded at 16 $\mu\text{Sv/h}$.

The duct tape and the sponge swabs from the most significantly contaminated sides have been retained for future analysis.

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