

**HEALTH PROTECTION AGENCY
MONITORING PROGRAMME FOR POLONIUM-210 CARRIED OUT BY HPA IN
PREMISES AND OTHER SITES RELEVANT TO PUBLIC HEALTH.**

Executive Summary

Introduction

Prior to beginning its comprehensive monitoring for Po-210 contamination, the Health Protection Agency (HPA) undertook an assessment of potential consequences for health of different levels of surface contamination. This was undertaken by assessing radiation doses that could occur in a range of different situations and for individuals of different ages. The assumptions made in this assessment were necessarily cautious. It would not be expected that any individual, including infants, would receive doses exceeding 1 mSv (i.e. the annual dose limit for members of the public).

Proposed approach

Po-210 emits alpha radiation and can only deliver a dose if the substance is eaten, inhaled or taken into the body through a wound. Such intakes may occur following contact with a contaminated surface. Surface monitoring is therefore carried out to assess the risk. A reference contamination level of 10 Bq cm⁻² (Becquerels per square centimetre) was proposed by HPA for monitoring and decontamination. Levels of contamination below this value do not need remediation on health grounds, although it is good practice to remove contamination where this is easily achievable. Risk assessments are carried out for surfaces where the contamination detected is 'fixed' and greater than the reference level to determine the optimum action. This may involve disposal of portable items, storage of items until the radioactivity has decayed away, covering the surface to prevent re-mobilisation of the contamination, or decontamination of the surface. This may need to be carried out by specialist teams.

Supporting Evidence

We now have a large body of monitoring data. This evidence shows that after any initial simple cleaning measures at the time of monitoring very little of the contamination is currently removable by day to day activities. Also the contamination is largely in small patches, rather than being uniformly spread. Both these factors indicate that the original assessment incorporated robust safety factors. Equally, experience has shown that the reference level was practical to implement.

Implementation

The proposed reference level was reviewed by the Gold Command, within its Clearance Group chaired by Westminster City Council. The reference level has been adopted as a standard to work to.

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Health consequences of exposure to Polonium-210

Polonium-210 is essentially a pure alpha emitting radionuclide. The very short range of alpha particles, less than a few tens of microns in tissue, means that polonium-210 does not pose a hazard when external to the body. The alpha particles do not penetrate intact skin. The important processes whereby it can enter the body and become a hazard, are inhalation, ingestion and through wounds. It follows that detecting polonium-210 on surfaces such as floors or furniture does not in itself mean that there is a risk to health: the polonium-210 has to be removable and then transferred into the body for this to be the case.

The contamination that is currently being found tends to be extremely patchy, ie small spots of contamination on an otherwise uncontaminated surface. Since the total amount of contamination that individuals might come into contact with is dependent on both the level of contamination and the area contaminated, small spots of contamination pose a lower potential hazard than widespread contamination at the same level. As indicated in the second part of this note, the patchiness or otherwise of the contamination is an important consideration in deciding on whether to remediate, and the type of remediation most appropriate.

Polonium-210 decays to stable lead with a physical half-life of 138 days. This means that after 138 days only half of the radioactivity originally present is left. Four-five years from now the polonium-210 will have essentially decayed away. Therefore, even if identified contamination is left where it is, after four-five years there will be no further potential hazard.

Monitoring for Polonium-210

Monitoring would normally only be carried out in areas and for surfaces where there is credible reason to believe there may be contamination. Where significant contamination is found in such areas, it may be prudent, for reassurance purposes, to sample other locations within the premises that are not expected to be contaminated.

Surface contamination detectors measure total surface activity within the area of the detector probe. The initial measurement therefore does not distinguish between contamination that is mobile and therefore potentially available for causing harm, and contamination that is fixed to the surface and therefore poses minimal hazard. This initial measurement does not give any information about levels of contamination elsewhere on the surface – i.e. this may be one small spot of contamination on an otherwise contamination-free surface, or wider areas of the surface may be contaminated at varying levels. Having quantified the level of surface contamination, the next step is to determine both the extent of the spread of the contamination and the fraction of this contamination that is mobile. The extent of spread is determined by additional surface monitoring, whilst the fraction that is mobile can be determined by wiping the surface and measuring the level of contamination that remains.

Derivation of Reference Level for Polonium-210

Because the residual hazard is from mobile polonium-210, HPA recommends that areas should not be declared safe for general access (i.e. for access by non-specialists or those not supported by specialists) unless the mobile component of the detected polonium-210 is removed. Options for removal include: wiping, washing, 'bagging' of contaminated objects and their removal to safe temporary storage to await appropriate decontamination or disposal). This removal of mobile contamination should be carried out by specialists. Cleaning materials used should be 'bagged' and removed to safe temporary storage pending decontamination or appropriate disposal. Note that the appropriate management/disposal of contaminated wastes is subject to legislation and should be discussed with the Environment Agency.

Once mobile contamination has been removed, the contaminated areas should be re-monitored and the residual, fixed contamination levels determined. Whilst fixed polonium-210 contamination does not pose a current hazard, depending upon circumstances and the nature of the surface, it is possible that very small fractions of the fixed contamination may gradually wear off over time. Whilst the contamination will gradually decay away over a period of four-five years, it is also possible that during that time the item or surface that is contaminated may be transferred elsewhere and/or damaged in such a way as to release the contamination for uptake by people. It is therefore important to have a reference level for fixed contamination to aid decisions on whether, and what form of, further remediation may be required.

HPA-RPD recommends a value of 10 Bq cm^{-2} to be used as a reference level for measured levels of fixed surface contamination of polonium-210. This value is based on cautious calculations carried out to estimate levels of dose that might be received from exposure to contamination at this level. A number of scenarios have been considered involving people of different ages, engaged in a range of behaviours, resulting in inhalation of resuspended material, direct entry of contamination into wounds or ingestion of material. On the basis of these assessments, it is not expected that any individual would receive doses exceeding 1 mSv (i.e. the annual dose limit for members of the public) for a level of contamination of 10 Bq cm^{-2} , if the contamination is currently fixed to a hard surface.

Soft furnishings require special mention. For these items, it is more likely that apparently fixed contamination could become available for intake, particularly by children. It is recommended that if contamination is detected on soft furnishing, this contamination should be treated as potentially mobile. Either the area affected or the whole item should be removed, 'bagged', and taken to safe temporary storage to await disposal. If there is some reason why the contaminated furnishing should not be damaged or disposed of (e.g. emotional value or historical significance), it is advised that the item is suitably covered to prevent any spread of contamination and then removed to safe storage until the radioactivity has decayed away.

Application of Reference Level

The 10 Bq cm^{-2} reference level should be applied as follows.

1. This reference level applies to fixed contamination. All mobile contamination should be removed by specialists and stored appropriately until it can be disposed of appropriately, in discussion with Environment Agency.

2. Surfaces contaminated with fixed contamination above 10 Bq cm^{-2} should be remediated. The form of remediation will depend on a number of factors, most importantly: the degree to which the contamination level exceeds 10 Bq cm^{-2} , the extent of contamination (is it small spots or more widespread?), and the wishes of key stakeholders, in particular the owners of the premises/items. In many cases, it will be sufficient to provide additional reassurance that the contamination is truly 'fixed', eg by applying a coat of paint, rather than decontaminating the surface, we recommend that the paint areas are mapped. In other cases, particularly if the item is portable and of low value (both in terms of replacement cost and emotional value) the optimum remediation will be to remove the item, with the intention of appropriate disposal. A further option is, as described above for soft furnishings, that the item is suitably covered to prevent any spread of contamination and then removed to safe storage until the radioactivity has decayed away. In all cases, any remediation should be carried out by specialists, and, where decontamination is carried out, the surface should be re-monitored after decontamination to check both the residual level of contamination and that no remaining contamination is mobile.
3. Surfaces contaminated with fixed contamination below 10 Bq cm^{-2} (other than soft furnishings, where it is advisable to treat all contamination as potentially mobile) do not require remediation on health grounds. However, there may be other reasons, such as reassurance or commercial concerns for further remediation. If further remediation is carried out, the comments in (2) apply.
4. For any surface that is not decontaminated to a level of fixed contamination below 10 Bq cm^{-2} , consideration should be given as to whether it is appropriate to document the location of the contamination and to review/re-monitor it at appropriate intervals to check whether any circumstances have changed such as to make it more likely that the contamination will become mobile again (eg paint flaking off the surface), and whether any (and how much) contamination is wearing off the surface over time. In making this decision a number of factors should be considered, most importantly: the degree to which the contamination level exceeds 10 Bq cm^{-2} , the extent of contamination (is it small spots or more widespread?), and the wishes of key stakeholders, in particular the owners of the premises/items.

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