SoBRA
The Society of Brownfield Risk Assessment

Discussion Paper – Example of a Part 2A Decision Algorithm for Asbestos Cement Fragments in Residential Garden Soils

Introduction:

This discussion paper presents a decision algorithm for asbestos cement fragments[1] in residential garden soil designed to support a staged investigation strategy for land being investigated under Part 2A of the Environmental Protection Act 1990.

The algorithm builds upon decision algorithms previously published by the US EPA[2], VROM/RIVM[3] and Western Australia[4], and is intended to provide a pragmatic mechanism for directing and interpreting site investigation data, and in particular determining whether asbestos in soil contamination poses an unacceptable risk to human health (i.e. might fall within Category 2 as defined by Defra statutory guidance, April 2012[5]).

The primary objective of the decision algorithm is to consolidate existing scientific understanding of asbestos fibre release from soil and provide a staged and proportionate mechanism for estimating reasonable worst-case airborne fibre exposure and associated health risk.

Background:

The balance of the decision algorithm is such that it is designed to meet the requirements of the Part 2A statutory guidance where possible; namely:

"1.3 Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment… Under Part 2A the starting point should be that land is not contaminated land unless there is reason to consider otherwise..."

"1.4 The overarching objectives of the Government's policy on contaminated land and the Part 2A regime are:
(a) To identify and remove unacceptable risks to human health and the environment.
(b) To seek to ensure that contaminated land is made suitable for its current use.
(c) To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development."

"1.6 Under Part 2A , the enforcing authority may need to decide whether and how to act in situations where such decisions are not straightforward, and where there may be unavoidable uncertainty underlying some of the facts of each case. In so doing, the authority should use its judgement to strike a reasonable balance between: (a) dealing with risks raised

[1] Asbestos cement assumed to contain chrysotile fibres only. Trace amounts of other asbestos types acceptable.
[2] US EPA (2008) Framework for Investigating Asbestos-Contaminated Superfund Sites, OSWER Directive #9200.0-68, September 2008
[3] VROM (2009) Soil Remediation Circular; and RIVM (2003) Assessment of the risks of soil contamination with asbestos, Report 711701034/2003
[4] WA (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia
[5] Defra (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012

by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the potential impacts of regulatory intervention... The authority should take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case…"

"3.1 Part 2A takes a risk-based approach to defining contaminated land. For the purposes of this Guidance, "risk" means the combination of: (a) the likelihood that harm…will occur as a result of contaminants in, on or under the land; and (b) the scale and seriousness of such harm…if it did occur."

"3.2 All soils contain substances that could be harmful to human or environmental receptors, although in the very large majority of cases the level of risk is likely to be very low. In conducting risk assessment under the Part 2A regime, the local authority should aim to focus on land which might pose an unacceptable risk."

"3.3 Local authorities should have regard to good practice guidance on risk assessment and they should ensure they undertake risk assessment in a way which delivers the results needed to make robust decisions in line with Part 2A and this Guidance.

3.4 Risk assessments should be based on information which is: (a) scientifically-based; (b) authoritative; (c) relevant to the assessment of risks arising from the presence of contaminants in soil; and (d) appropriate to inform regulatory decisions in accordance with Part 2A and this Guidance."

"3.12 The process of risk assessment involves understanding the risks presented by land, and the associated uncertainties... The understanding of the risks is developed through a staged approach to risk assessment, often involving a preliminary risk assessment; a site visit and walkover; a generic quantitative risk assessment; and various stages of more detailed quantitative risk assessment. The process should normally continue until it is possible for the local authority to decide: (a) that there is insufficient evidence that the land might be contaminated land to justify further inspection and assessment; and/or (b) whether or not the land is contaminated land."

"3.13 For land to proceed to the next stage of risk assessment there should be evidence that an unacceptable risk could reasonably exist. If the authority considers there is little reason to consider that the land might pose an unacceptable risk, inspection activities should stop at that point…"

"3.15 As a general rule, inspections should be conducted as quickly, and with as little disruption, as reasonably possible whilst ensuring that a sufficiently robust assessment is carried out…"

"3.16 The local authority should seek to ensure that its risk assessment is relevant to the land in question, and that it is based on risks that are reasonably likely to exist..."

"3.17 In undertaking risk assessments, local authorities should ensure that the time and resource put into assessment is sufficient to provide a robust basis for regulatory decisions…"

"3.21 The Part 2A regime was introduced to help identify and deal with land which poses unacceptable levels of risk. It is not intended to apply to land with levels of contaminants in soil that are commonplace and widespread throughout England or parts of it, and for which in the very large majority of cases there is no reason to consider that there is an unacceptable risk."

"3.22 Normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise…"

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"3.23 For the purpose of this Guidance, "normal" levels of contaminants in soil may result from:
…(b) The presence of contaminants caused by low level diffuse pollution, and common human activity other than specific industrial processes."

"3.28 Local authorities may use GACs and other technical tools to inform certain decisions under the Part 2A regime, provided: (i) they understand how they were derived and how they can be used appropriately; (ii) they have been produced in an objective, scientifically robust and expert manner by reputable organisations; and (iii) they are only used in a manner that is in accordance with Part 2A and this Guidance."

"3.30 New technical tools and advice may be developed and used in accordance with paragraph 3.28 above to help regulators and others apply and conform to this Guidance. This may be undertaken by government bodies, regulators or other organisations in the land contamination sector."

"3.31 All risk assessments of potentially contaminated land will involve uncertainty... The authority should seek to minimise uncertainty as far as it considers to be relevant, reasonable and practical; and it should recognise remaining uncertainty, which is likely to exist in almost all cases. It should be aware of the assumptions and estimates that underlie the risk assessment, and the effect of these on its conclusions."

"3.32 The uncertainty underlying risk assessments means there is unlikely to be any single "correct" conclusion on precisely what is the level of risk posed by land, and it is possible that different suitably qualified people could come to different conclusions when presented with the same information. It is for the local authority to use its judgement to form a reasonable view of what it considers the risks to be on the basis of a robust assessment of available evidence in line with this Guidance."

"4.9 In deciding whether or not a significant possibility of significant harm to human health exists, the local authority should first understand the possibility of significant harm from the relevant contaminant linkage(s) and the levels of uncertainty attached to that understanding, before it goes on to decide whether or not the possibility of significant harm is significant."

"4.11 The term "possibility of significant harm" as it applies to human health, for the purposes of this guidance, means the risk posed by one or more relevant contaminant linkage(s) relating to the land. It comprises:

(a) The estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question.
(b) The estimated impact if the significant harm did occur i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it..."

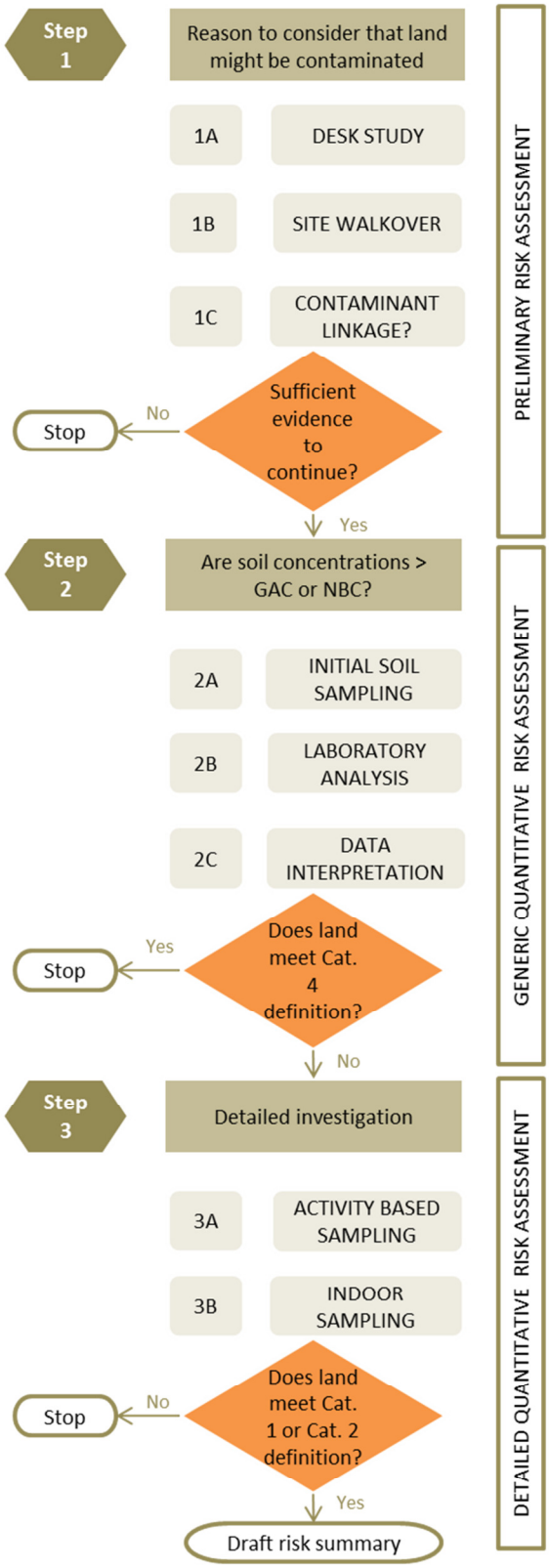
"4.12 In estimating the likelihood that a specific form of significant harm might occur the local authority should, among other things, consider:
(a) The estimated probability that the significant harm might occur: (i) if the land continues to be used as it is currently being used; and (ii) where relevant, if the land were to be used in a different way (or ways) in the future having regard to the guidance on "current use" in Section 3.
(b) The strength of evidence underlying the risk estimate. It should also consider the key assumptions on which the estimate of likelihood is based, and the level of uncertainty underlying the estimate."

"4.19 The local authority should assume that a significant possibility of significant harm exists in any case where it considers there is an unacceptably high probability, supported by robust science based evidence, that significant harm would occur if no action is taken to stop it… Land should be deemed to be a Category 1: Human Health case where:
(a) the authority is aware that similar land or situations are known, or are strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere; or
(b) the authority is aware that similar degrees of exposure (via any medium) to the contaminant(s) in question are known, or strongly suspected on the basis of robust evidence, to have caused such harm before in the United Kingdom or elsewhere;
(c) the authority considers that significant harm may already have been caused by contaminants in, on or under the land, and that there is an unacceptable risk that it might continue or occur again if no action is taken."

"4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:
(a) Land where no relevant contaminant linkage has been established.
(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.
(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.
(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives)."

Excerpts from Defra (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.

Algorithm Outline:



Notes:

Assumption that asbestos may be present in the ground

Historical site activities which may have potentially lead to asbestos being present in the ground

Visual observation of asbestos in ground?
Presence of materials in the ground commonly associated with asbestos?

Is there at least one plausible source-pathway-receptor linkage present?

Develop robust conceptual model.
Identify lines of evidence.
Does evidence justify further inspection and assessment?
Does a possibility of significant harm exist?

Is possibility of significant harm negligible?

Design appropriate soil sampling strategy based on pre-determined data quality objectives

Ensure chosen laboratory analysis is fit for purpose

Data consistency, data representativeness, spatial variability, uncertainty, and lines of evidence

Does equivalent free fibre concentration across exposure averaging area exceed the practical quantification limit of 0.001% wt/wt?
Does equivalent bulk ACM concentration exceed 0.1% wt/wt*? [* see footnotes 11 & 13]

Provide necessary robust information for determining whether the land meets the definition of Category 1 or 2.

Ascertain site-specific fibre-release potential

Determine potential contribution to exposure from indoors

Is estimated cumulative exposure and contribution from soil substantially above background?

Specific Elements:

Consideration should be given to the following factors:

Sensitivity of receptor – the location of receptor relative to soil source; the receptor's age (risk from asbestos exposure is related to the time of first exposure, therefore children are more at risk than adults in this regard[6]); the likely exposure frequency and duration of exposure events; the exposure averaging time (i.e. the period of time over which the exposure events are expected to take place); and the nature of activities likely to be undertaken by receptor (i.e. the potential of those activities to generate soil dust).

Plausible exposure pathways – the mechanisms for exposure to airborne asbestos fibres such as: mechanical/physical disturbance of soil; and wind erosion and dispersion[7].

Source characterisation – the depth to asbestos; the types and form of asbestos present; the degree of degradation in the asbestos materials and likely future degradation; the friability of the asbestos materials and the ability for the material to release fibres; the respirable fibre fraction within the asbestos materials; the presence of vegetation or hard standing cover and likely durability of such; the soil classification and implication for seasonal variability in moisture content; and climatic conditions (specifically air temperatures and rainfall patterns).

Consider whether it is likely that asbestos fibre concentrations in air at the point of exposure will be higher than background.

Soil sampling strategy should be capable of identifying the asbestos content of the soil at a scale that is relevant to the exposure activities assigned to the identified receptor, and should be capable of identifying variation in soil asbestos content with depth.

In terms of sample size, for residential gardens, the recommended approach is to sample 10 litres of soil (2-thirds of a standard bucket), and for this to be weighed and then carefully placed out on a disposable plastic sheet or shallow tray[8].

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[6] Reference can be made to the COC (http://www.iacoc.org.uk/papers/) and HSE WATCH (http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/agendas.htm) on the effect of age at first exposure and the potential susceptibility of children to asbestos exposure. One proposal by Robin Howie and considered by COC is children exposed at age 0 are 7x more susceptible to developing mesothelioma for a given exposure dose.

[7] Empirical relationships such as those published by IOM and RIVM, and dust models such as those published by the US EPA, EA (CLEA model), and the EU funded ART model, can be used to estimate dust generation levels for a given activity.

[8] An acceptable alternative is for the 10 litre sample to be double bagged, labelled in accordance with HSE guidelines and sent to a suitable laboratory for subsequent analysis as described.

The soil should be carefully picked through[9] and identifiable pieces of ACM segregated into a separate sample tub for subsequent laboratory identification and gravimetric analysis. A descriptive record should be kept of the number and sizes of fragments of ACM picked out. This record should use a pre-formatted field record sheet that harmonises the size categories in which the ACM fragments are counted (for example <1cm^2, >1<4cm^2, >4<10cm^2, >10cm^2).

Once all visible pieces of ACM have been removed, a 1 litre composite sample of the remaining soil should be taken for subsequent laboratory analysis. The asbestos content of the visibly identifiable ACMs should be determined as per HSG248. The laboratory method used to determine the asbestos content of the 1 litre composite sample should be accredited and be capable of a reliable method reporting limit of 0.001% wt/wt.

The sampling should be designed where possible to target discrete soil layers and encompass as wide a surface area as possible. For example 10 litres of soil is equivalent to a sample surface area of 1m^2 and a sample depth of 1cm (akin to surface sampling) or a sample surface area of 0.1m^2 (approximately 30cm x 30cm) and a sample depth of 10cm.

For further information on soil sampling for asbestos, refer to SoBRA's Soil Sampling Protocol for Asbestos in Soil[10].

The soil sample results should be interpreted in a manner that is relevant to the identified exposure averaging area. The statistical approach to the handling of the data will be dependent on the soil sampling strategy adopted.

The generic screening criterion for loose/free fibres in soil is the practicable (i.e. achievable and cost-effective) method reporting limit for HSE method 83/1996 of 0.001% wt/wt (equivalent to 10 mg/kg)[11]. Given the uncertainties in determining dust generation and the potential for asbestos fibre release during typical residential garden activities, the current analytical method reporting limit is considered to be a reasonable trigger level in the context of this specific decision algorithm.

The equivalent screening criterion for ACM fragments should be 0.1% wt/wt[12] (i.e. one hundred times the free fibre limit)[13].

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[9] By an appropriately competent person.

[10] Soil Sampling Protocol for Asbestos in Soil, April 2015 – available on SoBRA website.

[11] The work of Addison et al (1988) has demonstrated that fibre release from dry soil with an asbestos content of 0.001%wt/wt has the potential to result in airborne fibre concentrations of approximately 0.1f/ml if the soil disturbing activity is such that it is capable of generating airborne dust levels of approximately 5mg/m^3. However, the explicit assumption is that such exposure in a garden would be sporadic (transient and infrequent). Considering the likely much higher exposure frequency for indoor dust exposure and the possibility of tracked back asbestos fibres indoors, taking the CLEA default assumption for indoor dust concentrations in homes of 50µg/m^3 and making the assumption that reported Addison et al relationship between respirable dust concentration and asbestos fibre concentration is applicable to house dust, the acceptable limit for asbestos fibres in dust (and correspondingly the soil asbestos content) is approximately 0.001% wt/wt.

[12] The application of the 0.001% wt/wt criterion for asbestos cement fragments in addition to free fibres is an alternative option but is considered unreasonable in the context of Part 2A due in part to the lack of consideration of the potentially significant difference in free fibre release potential of asbestos cement compared to free fibres in soil. The 0.1% wt/wt criterion for asbestos cement fragments is a factor of one hundred greater than the free fibre screening criterion and is supported by the evidence published by RIVM (711701034/2003) and Swartjes & Tromp (2008) that for bound asbestos materials in soil, no asbestos fibres were encountered in air during reported activity-based sampling with soils containing up to 10,000 mg/kg (1% w/wt) of bound asbestos fragments).

Where ACM fragments are present in soil, the aim should be for both the ACM and free fibre criteria to be met. However, where the criterion for free fibres in soil is met, but the criterion for ACM fragments is not, it is reasonable to include an assessment of the free fibre concentration to be used as an indicator of the fibre release rate from the ACM fragments over the time in which those fragments have been present in the soil. Where the lines of evidence suggest negligible free fibre accumulation in the soil matrix the assessor may choose to take into account that maximum likely respirable fibre content of the ACM fragments. Based on the evidence reported by RIVM (2003), the respirable fibre content of asbestos cement is typically nil and does not exceed 0.1%. Taking this into account an upper tolerable concentration of 1% wt/wt can be derived[14].

Before adopting the 1% wt/wt criterion, the assessor should include strong consideration of the likely time over which the ACM fragments have been present in the ground, and the likely disturbance to that ground during that time.

For this assessment to be relevant, the free fibre results must pertain to soil samples containing ACM fragments. Such assessment is not relevant if the elapsed period of time is

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[13] 0.001% wt/wt would equate to a permissible cumulative ACM fragment size of 1cm^2 in a 10 litre soil sample (or one hundred and forty 1cm^2 fragments in 1m^3 of soil) based on the calculation assumptions below. 0.1% (1,000 mg/kg) of asbestos in asbestos cement fragments within a 10 litre sample of soil is approximately equivalent to a fifteen 3cm x 3cm fragment or one hundred and forty 1cm^2 fragments; assuming a sampled soil bulk density of 1.5g/cm^3, asbestos content in cement of 15%, a typical thickness of asbestos cement sheeting of 6mm and bulk density for semi-compressed ACM of 1.2g/cm^3. In 1m^3 of soil this would equate to approximately fourteen thousand 1cm^2 fragments or nine hundred 4cm x 4cm fragments (i.e. at this concentration it is reasonable to assume that the soil contains frequent ACM fragments and warrants further assessment).

[14] 0.1% of 1% wt/wt is 0.001% wt/wt. The proposed upper tolerable 1%wt/wt criterion for asbestos cement fragments is based on the assumption that the maximum content of respirable fibres for weathered asbestos cement does not exceed 0.1% (RIVM, 2003), such that even if the asbestos fragments disintegrated to release all held fibres, the respirable free fibre content of the soil should not exceed the free fibre screening criterion of 10mg/kg. In reality it is expected that the chrysotile fibres present in the cement will decompose (via dissolution) alongside the cement binder (evidence suggests that it might take 300-600 years for a 6mm asbestos cement sheet fragment to decompose completely in the environment (150-300 years if erosion of both sides of the sheet is assumed to occur simultaneously, thus slowly releasing asbestos fibres into the soil, but also that chrysotile fibres undergo weathering in the soil environment such that their physical and chemical structure changes [HSL report 2007/11 http://www.hse.gov.uk/research/hsl_pdf/2007/hsl0711.pdf, Holmes et al Canadian Journal of Soil Science (2012) 92:229-242, and Australian Safety and Compensation Council (2008) http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/194/LiteratureReview_AirborneAsbestosFibres_2008_PDF.pdf]).

The mechanical breakage of the ACM is expected to result in the release of unaltered chrysotile fibres (HSL 2007/11). The likelihood of mechanical breakage of the fragments will be dependent on the soil disturbance activity being assessed. In relation to residential garden use, it is not expected that domestic garden activities would be capable of causing mechanical breakage of the ACM fragments in the soil on a frequent basis. Applying the reported environmental erosion rate of 0.02mm/yr to both sides of a cumulative ACM fragment area of 150,000cm^2 within 1m^3 of soil (i.e. ~1% wt/wt asbestos in soil), the resultant fibre release rate might approximate to an average soil concentration of 0.005% wt/wt per year, assuming an asbestos content of 15% in the ACM, an ACM bulk density of 1200kg/m^3, an in-situ soil bulk density of 2000kg/m^3 and no fibre degradation. The release of respirable fibres into the soil would be expected to be less than 0.000005% wt/wt per year based on the same assumptions and a maximum respirable fibre content of 0.1%.

1% wt/wt (10,000 mg/kg) of asbestos in asbestos cement fragments within a 10 litre sample of soil is approximately equivalent to approximately fifteen 10cm x 10cm fragments or one thousand five hundred 1cm^2 fragments; assuming a sampled soil bulk density of 1.5g/cm^3, asbestos content in cement of 15%, a typical thickness of asbestos cement sheeting of 6mm and bulk density for semi-compressed ACM of 1.2g/cm^3. In 1m^3 of soil this would equate to approximately one thousand five hundred 10cm x 10 cm fragments – equivalent to a single ACM sheet of 15m^2 (i.e. at this concentration it is reasonable to assume that the soil contains very frequent ACM fragments and warrants action on a precautionary basis).

small compared to the expected lifetime of the current land-use. If sufficient doubt exists (i.e. the lines of evidence are not strong enough), the assessment should proceed to Step 3.

Irrespective of the bulk ACM fragment soil concentration, proportionate risk management measures should be put in place whereby visible surface fragments of ACM should be removed and appropriately disposed of; consistent with the principle of ALARP for non-threshold substances.

Step 3

The empirical evidence published by RIVM (711701034/2003) and Swartjes & Tromp (Soil & Sediment Contamination, 17:137–149, 2008) suggests that airborne fibre release from bound asbestos is likely to be negligible (i.e. below typical detection limits and minimal risk levels). Where elevated levels of ACM fragments and/or free fibres have been identified in soil above the screening criteria detailed in Step 2, it is considered appropriate to obtain robust site specific evidence that the fibre release potential and the possible point of exposure fibre in air concentrations are within acceptable limits.

The suggested acceptable limit for airborne fibre concentrations is the current WHO guideline of 500 f/m^3 (PCMe). The point of exposure concentration or aggregated point of exposure concentration for multiple exposure scenarios (i.e. TWA) to which the WHO guideline should be compared should be expressed as an annual average concentration.

Step 3 includes activity-based sampling and/or indoor air sampling. Outdoor activity-based sampling can be conducted as per the ABS protocol developed by SoBRA[15].

Indoor air sampling should be a consideration if tracked back soil is considered to be a potentially significant source of indoor dust[16].

Air sampling should be consistent with Appendix A of HSG248, with the additional consideration that the counted fibres on the filter should be separately assessed to identify the proportion of asbestos and non-asbestos fibres[17].

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[15] Design of an Activity-Based Sampling Protocol for the Testing of Asbestos Fibre Release Potential from Residential Garden Soil, SoBRA, April 2015 – available on the SoBRA website.

[16] Taking the CLEA default assumption for indoor dust concentrations in homes of 50µg/m^3 and making the assumption that reported Addison et al relationship between respirable dust concentration and asbestos fibre concentration is applicable to house dust, the acceptable limit for asbestos fibres in dust is approximately 0.001% wt/wt.

[17] Air sampling requires a sample volume of 12500 litres to obtain a method reporting limit equal to the WHO AQG of 500 f/m^3. This will likely require a sampling duration of 12-24 hours using a high volume sampler. It is possible to achieve a detection limit of 0.0005f/ml by using SEM analysis and a sample volume of 2400 litres (4hrs @10 litres/min). Alternative sampling arrangements could be to reduce the sample volume and increase the number of fields analysed on the filter to achieve a similar limit of detection, and/or aggregate the sample results from more than one sampler. Sample volumes and hence sampling duration and sampling rates can be determined by the formula in A1.35 of HSG248:

$$C(f/ml) = 1000.N.\frac{D^2}{V.n.d^2}$$

N = method sensitivity for minimum fibre count
D^2 = diameter of filter (mm)
V = sample volume (litres)
n = number of graticules inspected

Dust sampling should be carried out in conjunction with the asbestos fibre sampling to determine the airborne dust concentration at the time of sampling using an IOM filter head for inhalable dust, and a cyclone filter head for respirable dust [18]. Note that the sampling method should be such that a sufficiently low detection limit is achieved that is capable of supporting the risk assessment assumptions. A suggest range for the LOD is 10-100µg/m^3.

Outdoor ambient air sampling should also be undertaken in parallel to the indoor sampling to ascertain the potential contribution to indoor air concentrations.

Indoor activity-based sampling could be considered in conjunction with the indoor ambient air sampling, if appropriate.

Irrespective of the air sampling results, proportionate risk management measures should be put in place whereby visible surface fragments of ACM should be removed and appropriately disposed of; consistent with the principle of ALARP for non-threshold substances.

Health and Safety:

All work should comply with the Control of Asbestos Regulations (CAR) 2012. The requirements and specification for PPE and other protective measures should be detailed in the site-specific Health and Safety Plan developed for the sampling activities.

Quality Assurance and Control:

Appropriate levels of quality control and quality assurance should be maintained commensurate with the reliance on the sampling results. The data quality objectives should be clearly defined as part of the sampling and quality plans for the specific sampling being undertaken.

Samples should be taken in duplicate or triplicate at a sufficient frequency to estimate sampling error. Sample blanks should be analysed to determine the background fibre count on air sampling filters. This is relevant to the estimation of the sensitivity of the laboratory analysis undertaken.

All instruments and equipment should be used in accordance with operating instructions, including calibration requirements.

All works should be undertaken by suitably competent persons.

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d = graticule diameter (µm)

Sampling and analysis should be in general accordance with HSE248 Appendix 1 and Determination of airborne fibre number concentrations: A recommended method, by phase-contrast optical microscopy (membrane filter method) World Health Organisation 1997. Fibre discrimination should be carried out as outlined in MDHS87.

[18] Dust filters should be analysed by an appropriately accredited gravimetric method, in general accordance with MDHS 14/3.

Limitations:

This protocol has been developed by the SoBRA Asbestos-in-soil sub-group. It details an approach to the assessment of asbestos cement fragments found in residential garden soil that has been developed as a result of discussions between the group members. It is provided freely on the SoBRA website to help promote discussion on what should constitute good practice in the assessment of asbestos-contaminated soil in the UK. Users of this protocol must satisfy themselves that the protocol is appropriate for the intended use and no guarantee of suitability is made.

Note – the approach provided is an example calculation to illustrate how a free fibre threshold concentration might be converted to an asbestos cement fragment equivalent. It does not constitute a recommended threshold at this time.

Feedback:

Feedback on this protocol is welcomed and should be submitted to Simon Cole at simon.cole@aecom.com.

July 2015

Annex – Example field sheet for recording visual observations of ACMs:

Field Record for Visual Observations of ACM			
Site name/Project ID			
Date			
Time			
Location of field observation (include sketch or insert annotated site plan)			
Activity being undertaken at time of observation			
Description of ground being inspected (soil type, vegetation cover etc)			
Surface area of ground (m^2) or volume of soil being inspected (litres)			
Weight of soil sample being inspected (kg) (if relevant)			
ACM fragment count:			
<1cm^2	1-4cm^2	4-10cm^2	>10cm^2
Visual description of ACM fragments			
Field Engineer			