The Distribution of Asbestos in Soil – what can the data mining of sample results held by UK laboratories tell us?

Discussion Paper by the SoBRA asbestos sub-group

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Introduction

SoBRA identified a number of research gaps in 2013 that had direct relevance to the risk management of asbestos in soil. One of these was the lack of a collective understanding on what typical background concentrations of asbestos in soil across the UK were. To help resolve this SoBRA collaborated with SAGTA and Defra to initiate Defra Research Project SP1014 (Establishment of typical background levels of dispersed asbestos fibres in urban and rural soils in England and Wales) in 2015 which aimed to mirror previous projects by the British Geological Survey (BGS) to map background concentrations of contaminants in soil across the UK. This study (published by Defra in January 2020) purposefully targeted areas of public open space, avoiding areas of naturally occurring asbestos and areas known or suspected to be affected by historic asbestos-contaminating uses. To provide a complementary line of evidence SoBRA issued a request to major UK soil laboratories to provide SoBRA with anonymised asbestos in soil data (i.e. compilations of data pertaining to samples submitted to them for asbestos in soil analysis from multiple sites across the UK). Five laboratories kindly provided this data to SoBRA, and SoBRA extends its gratitude to those laboratories: ALS, DETS, Envirolab, i2, and REC. This paper is a discussion paper, and a continuation of the series of discussion papers that the SoBRA asbestos sub-group has published since 2015. The principal aim of this paper is to provide a factual presentation of the data provided by the laboratories. The information presented may be used by risk assessors and decision makers as a line of evidence as they see fit.

General comments on laboratory analysis

Industry good practice for the laboratory testing of asbestos content in soil is described by the SCA Blue Book Method[1] which defines a three-stage analytical method. Stage 1 is the qualitative identification of the presence of asbestos in the sample. Stage 2 is the gravimetric quantification of asbestos in the sample. Stage 3 is the quantification of individual loose fibres in the sample. Whilst the intention of the Blue Book method is to harmonise the analytical method it is noted that the method has not been finalised and ratified by all laboratories who participate in the SCA and that laboratories all undertake the analysis of asbestos in soil using their own bespoke methodologies. The differences in these laboratory-specific methodologies and the significance to data

[1] Standard Committee of Analysts, The Quantification of Asbestos in Soil (2017). Available via http://www.standingcommitteeofanalysts.co.uk/

interpretation and use in risk assessment was the subject of a laboratory industry survey that SoBRA undertook in 2018 (a separate SoBRA paper is being drafted on this).

The stages of analysis are sequential. It is therefore uncommon for samples to be analysed at Stages 2 and/or 3 if a negative result is produced at Stage 1. It is also not always the case that Stage 3 is scheduled even if asbestos is detected at Stage1 and/or Stage 2.

Presentation of Laboratory Data

The data provided by each laboratory (in no specific order) is presented as a series of figures. The figures presented are a reflection of the data provided by the laboratory and therefore directly comparable information for each laboratory is not always available. Typically, the data presented for each of the five laboratories includes:

- Summary table of the raw data provided (dataset, number of samples, data type)
- Asbestos identification data (percentage of soil samples in which possible asbestos containing materials (ACM) were detected)
- Asbestos type identified per number of samples with a positive identification
- Stage 2 test results
- Stage 3 test results

Not all data listed above was provided by each laboratory.

Laboratory 1:

Dataset:	All samples submitted for asbestos in soil analysis between 2011 and 2015
Data size	Approximately 4000 samples
Data type	Qualitative (600 results) and quantitative (4000 results) analysis, including gravimetric and free fibre analysis

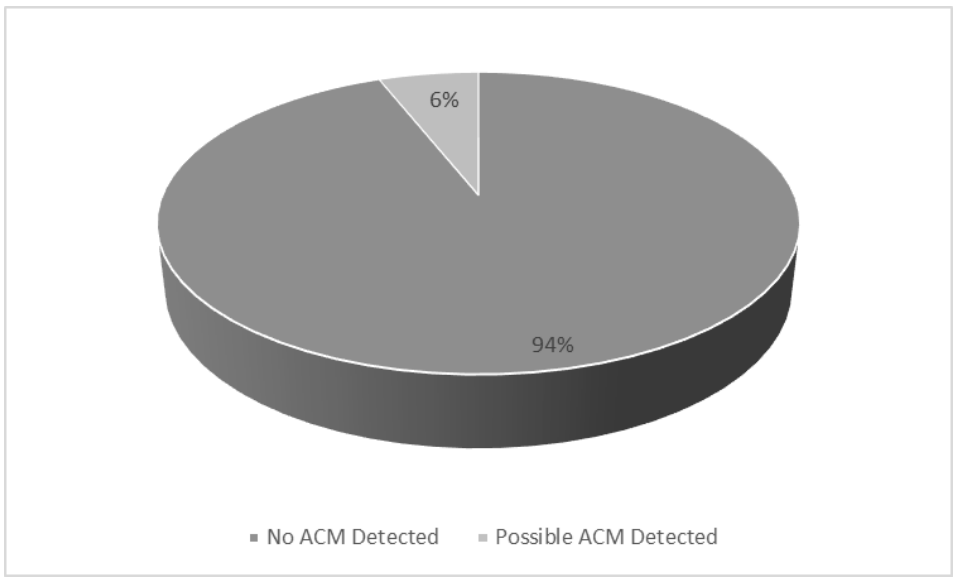


Figure 1 – Asbestos identification data[2]

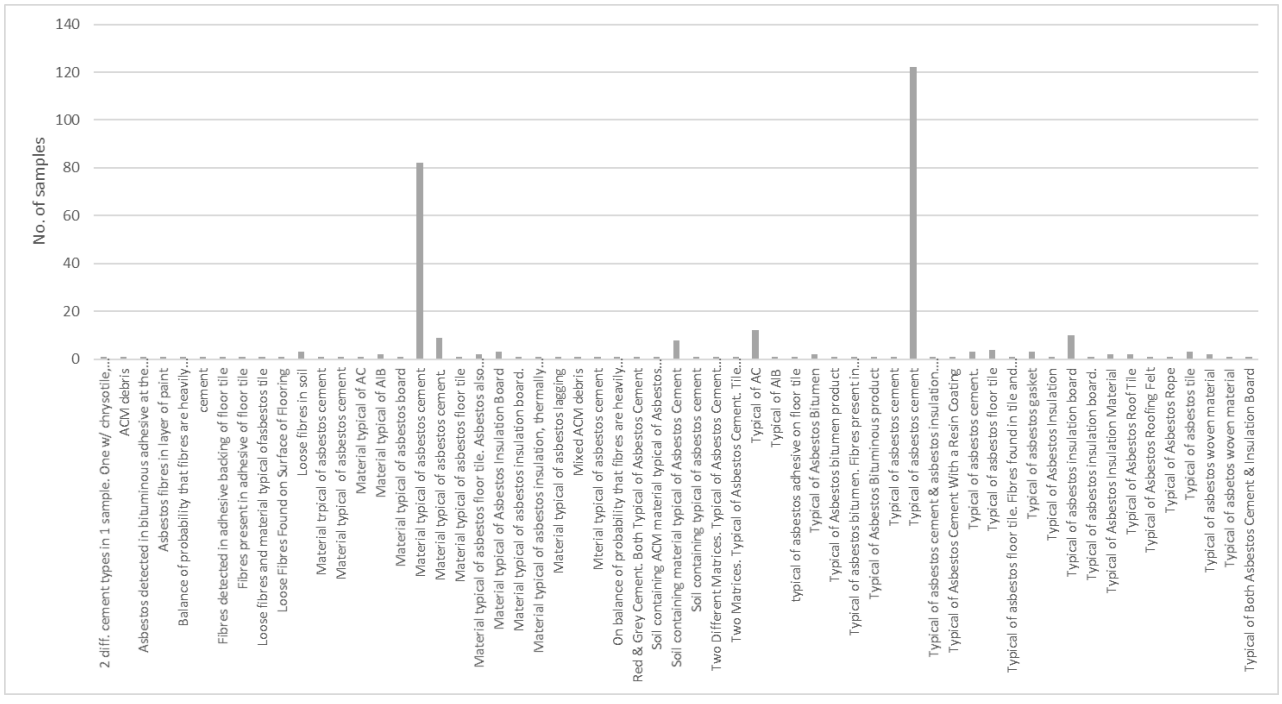


Figure 2 – Asbestos ID descriptions[3]

[Figure 2 is reproduced at larger scale in Annex 1]

[2] Note that for this dataset "ACM" refers to any asbestos content in the sample, not just fragments of asbestos containing materials such as asbestos cement or asbestos insulation board.

[3] Note that there are some repetitions in the descriptions on the x-axis as this is collation of the individual descriptions as written by the laboratory's analysts (some descriptions may only differ by the use of a space between words)

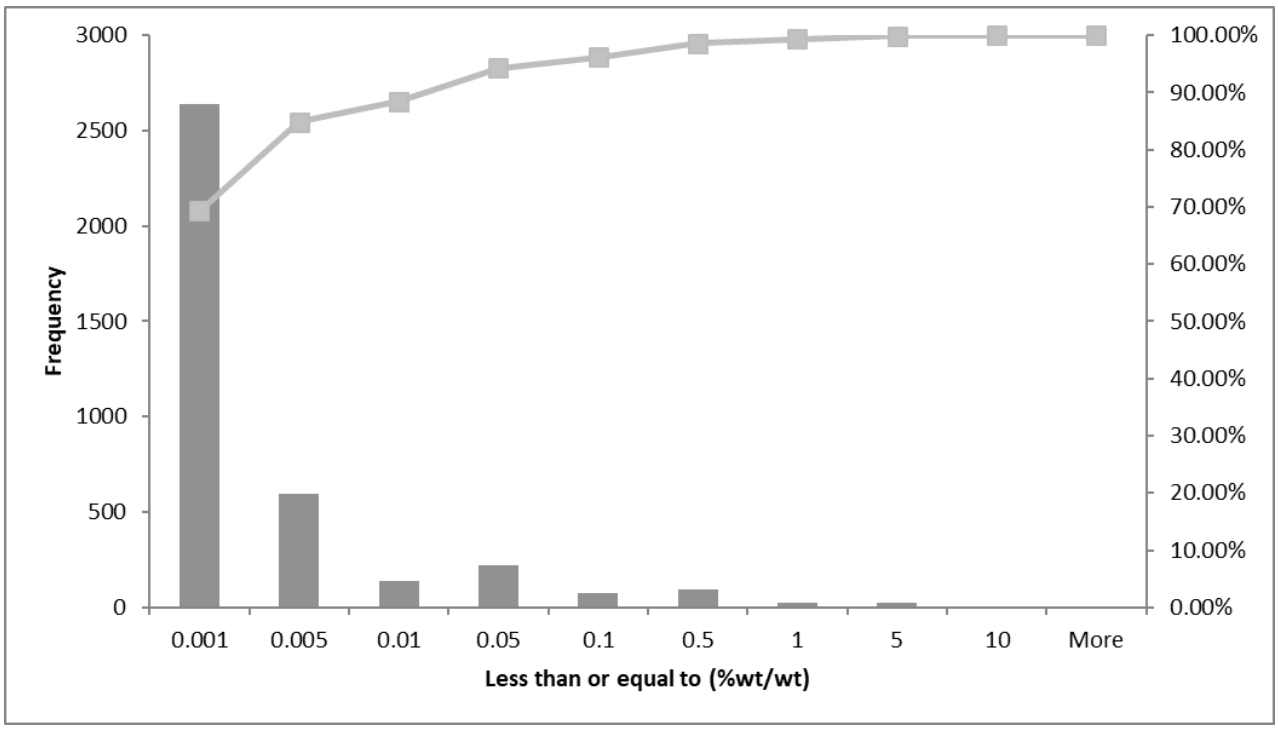


Figure 3 – Stage 2 gravimetric quantification data

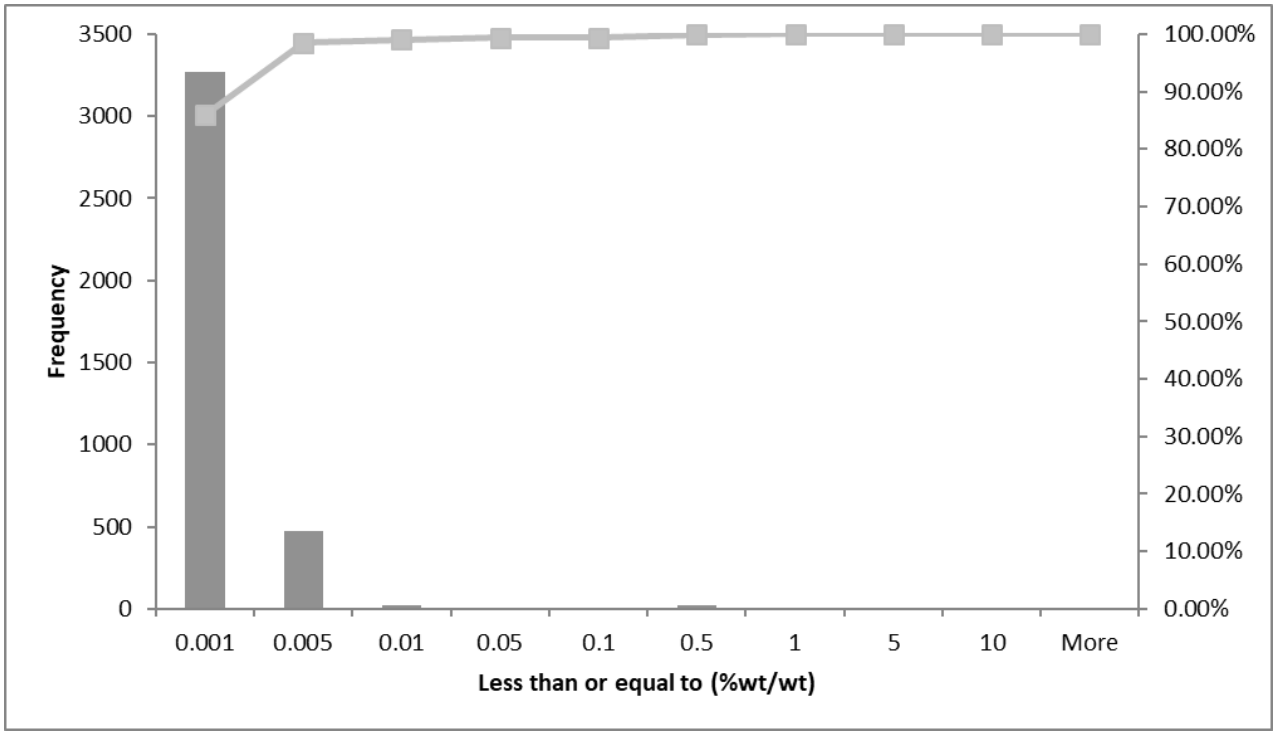


Figure 4 – Stage 3 PCM fibre counting quantification data

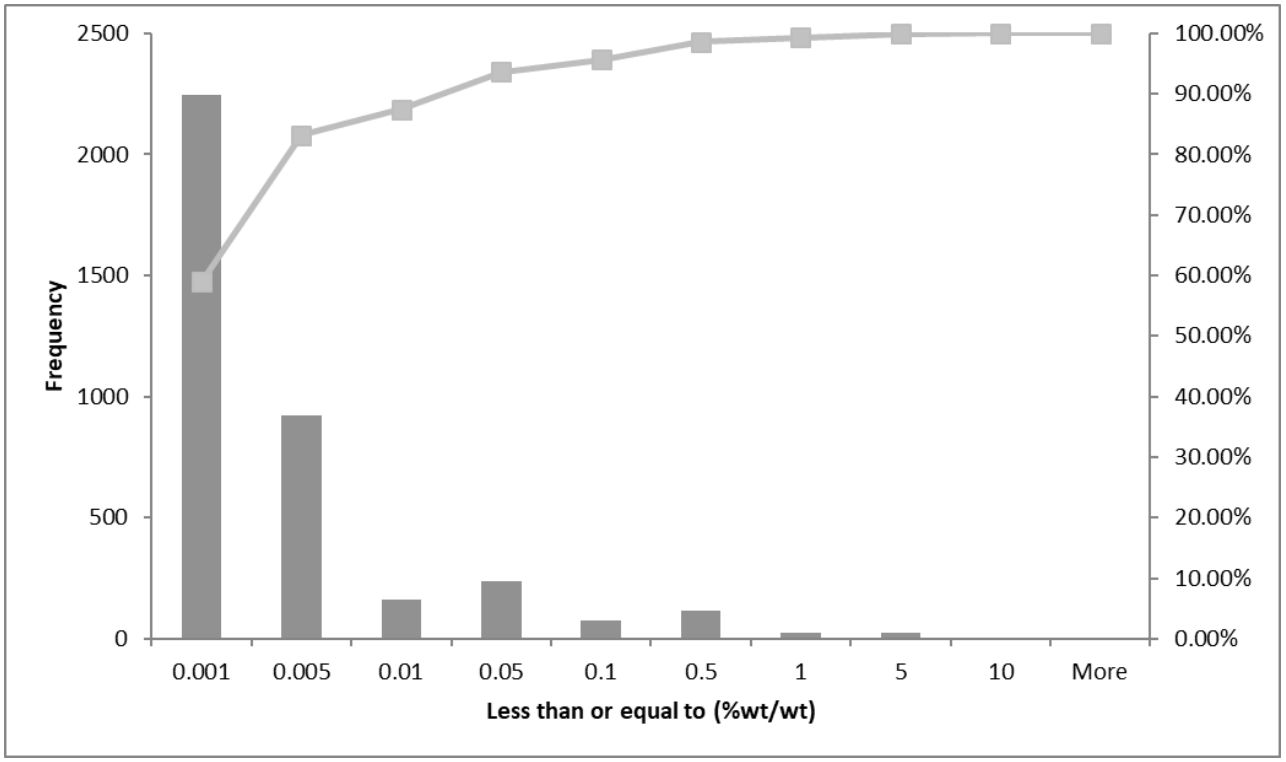


Figure 5 – Stage 2 and Stage 3 quantification concentrations summed

Laboratory 2:

Dataset:	All samples submitted for asbestos in soil analysis between 2011 and 2015
Data size	Approximately 19,000 samples
Data type	Qualitative (19000 results) and gravimetric quantitative (2000 results) analysis

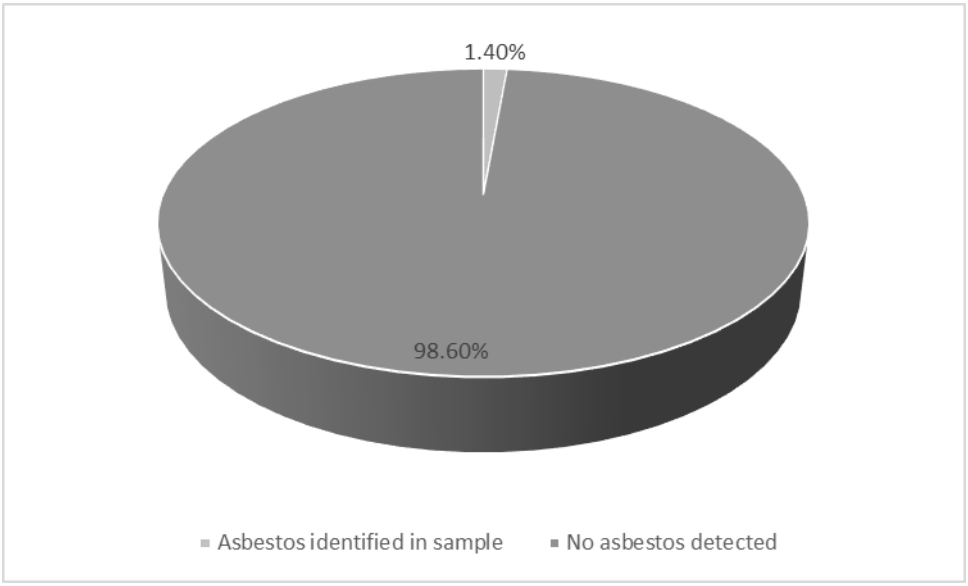


Figure 6 – Asbestos identification data

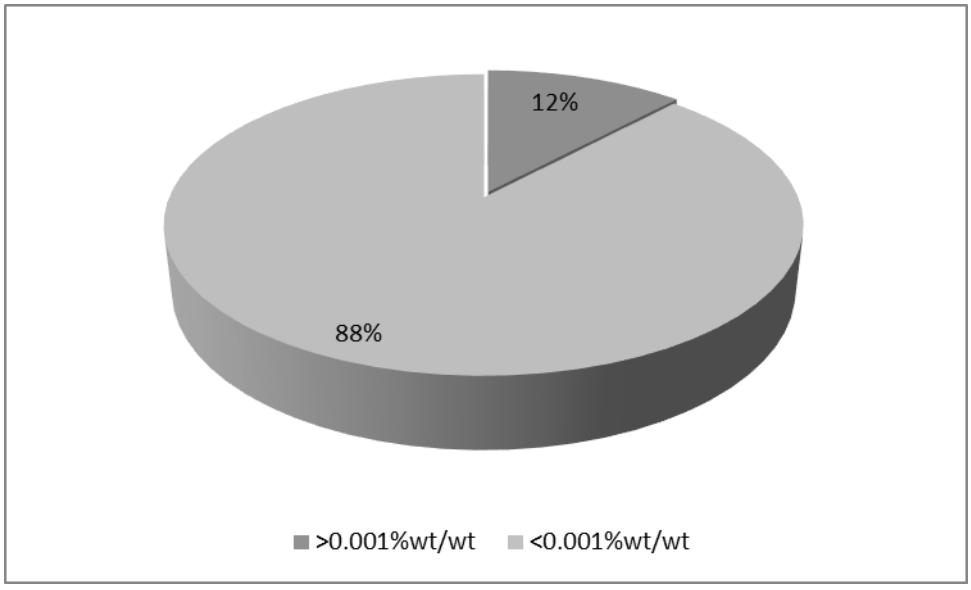


Figure 7 – Gravimetric quantification data

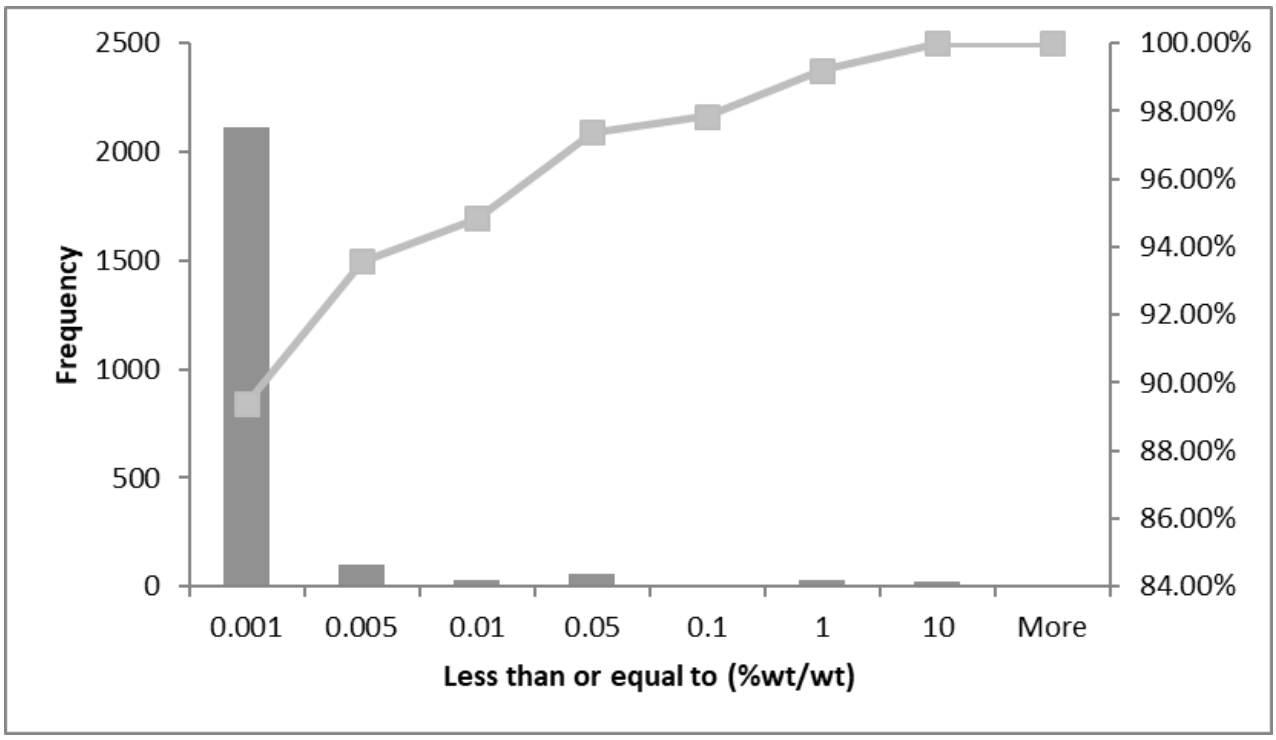


Figure 8 – Gravimetric quantification data in more detail

Laboratory 3:

Dataset:	All samples submitted for asbestos in soil analysis in 2015
Data size	Approximately 5000 samples
Data type	Qualitative ID analysis

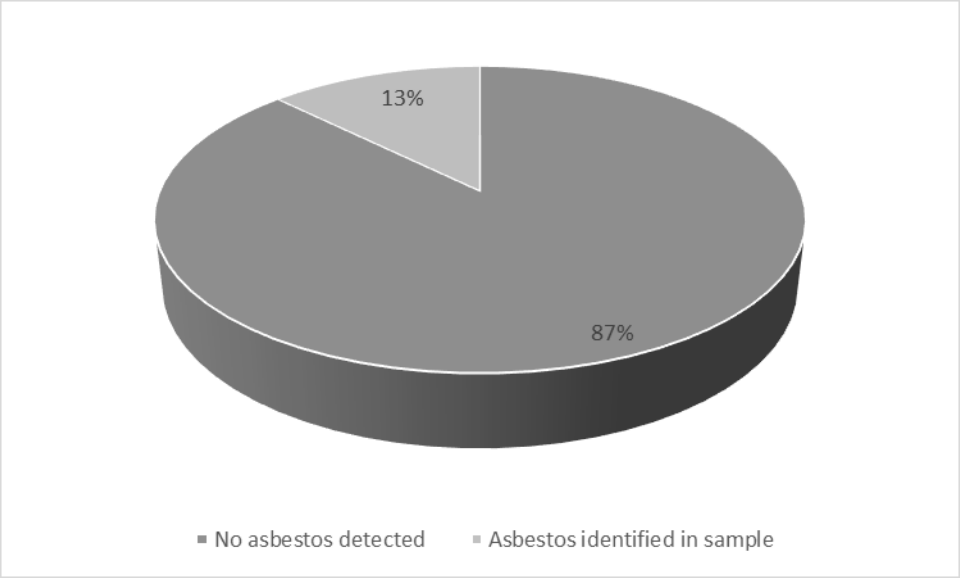


Figure 9 – Asbestos identification data

Laboratory 4:

Dataset:	All samples submitted for asbestos in soil analysis between 2011 and 2015
Data size	110,000 samples
Data type	Qualitative ID analysis

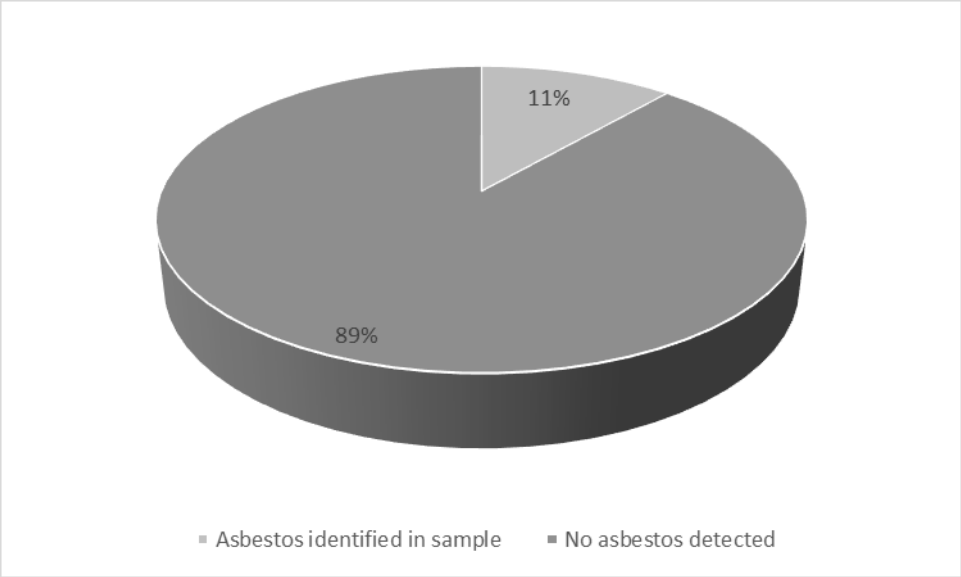


Figure 10 – Asbestos identification data

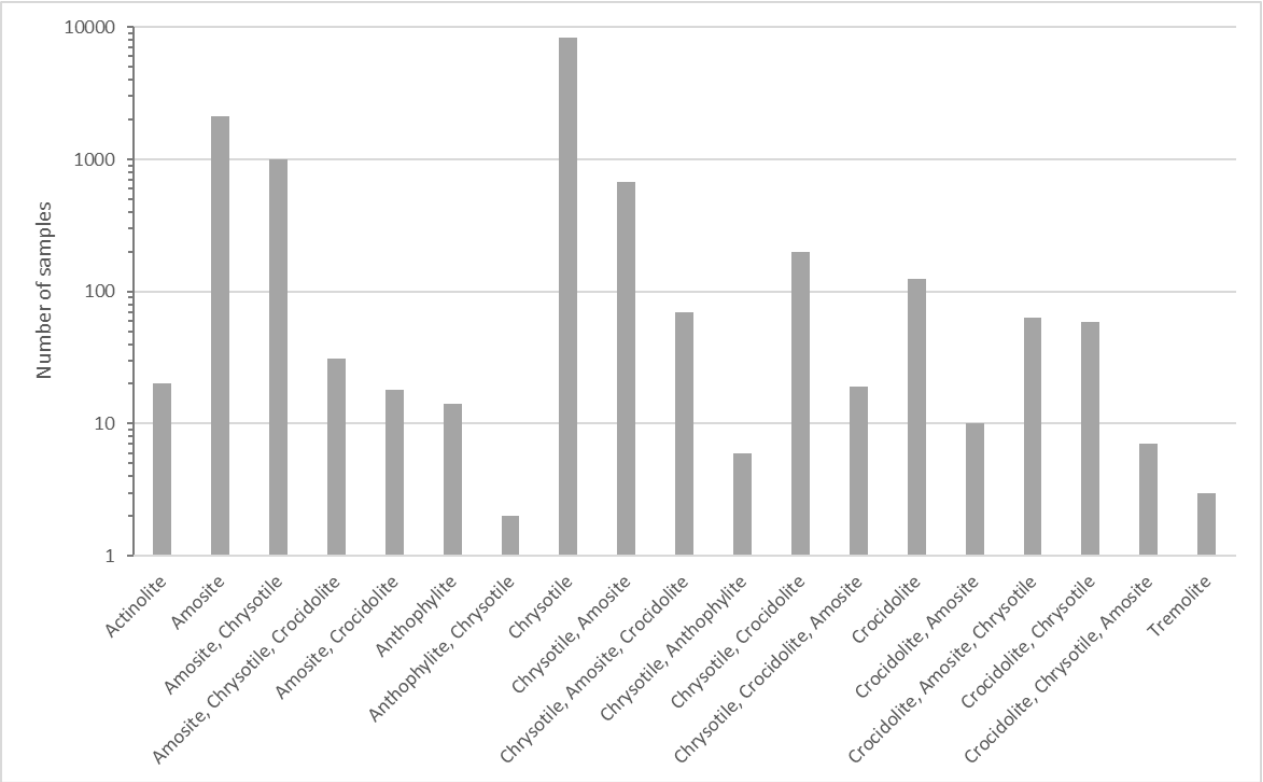


Figure 11 – Asbestos identification descriptions[4]

Table 1 – further breakdown of data from Laboratory 4

% of total number of samples tested that contained free fibres at Stage 3	**4.40**
% total of samples tested found to contain fibre bundles and or ACM fragments at Stage 2 that also contained free fibres	**38.42**

[4] note log scale on vertical axis to allow lower counts to be visible

Laboratory 5:

Dataset:	All samples submitted for asbestos in soil analysis in 2017
Data size	Approximately 37,000 samples
Data type	Qualitative ID analysis (37,000 samples) and quantitative analysis (11,000 samples) data

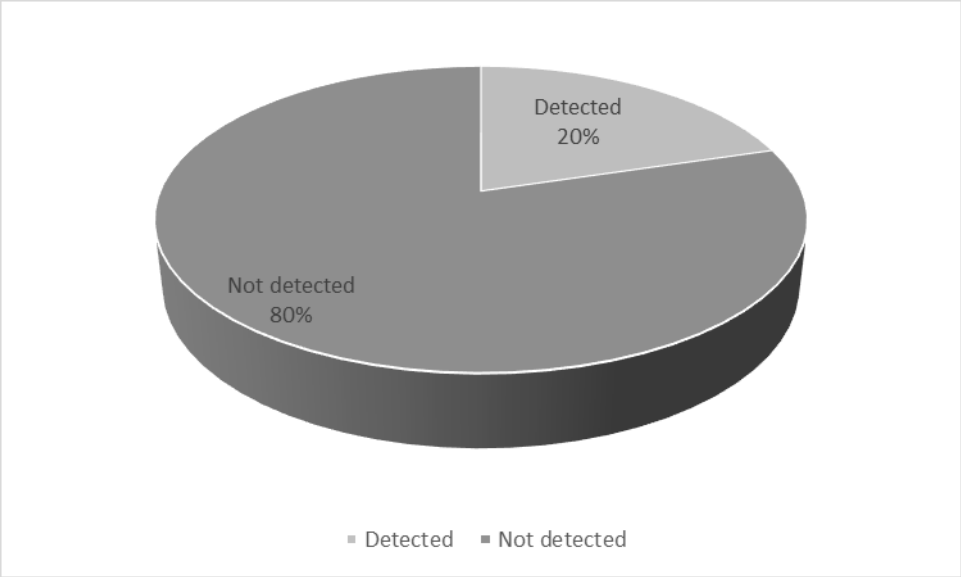


Figure 12 – Asbestos identification at Stage 1

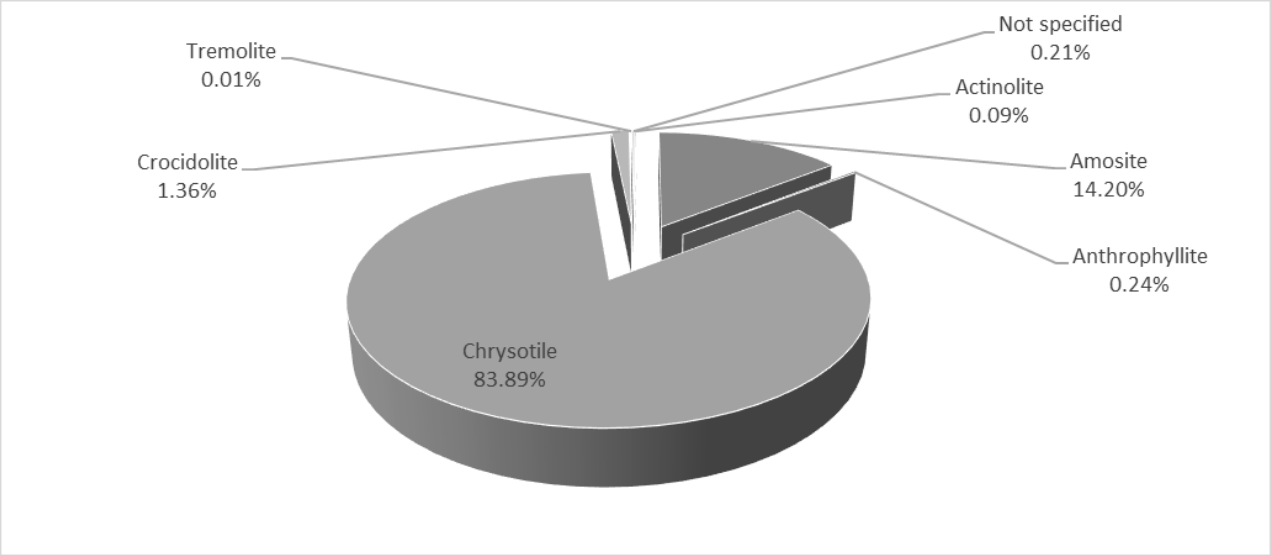


Figure 13 – Breakdown of asbestos type identified at Stage 1

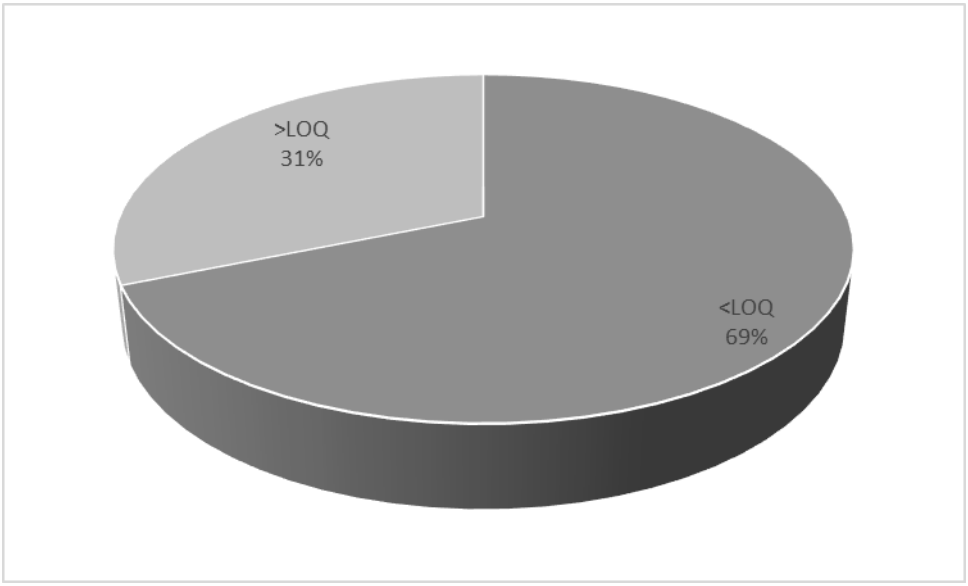


Figure 14 – Percentages of quantification results less than and greater than the quantification limit of 0.001%wt/wt

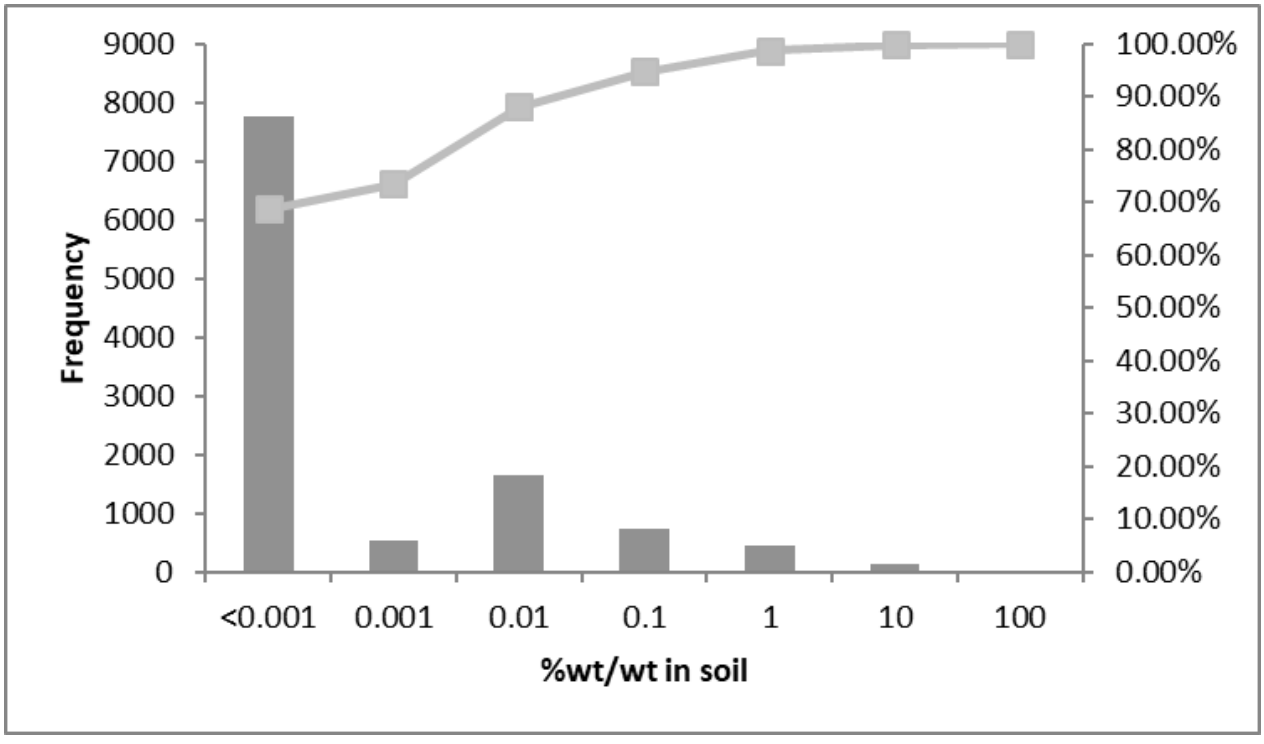


Figure 15 – Distribution of quantification results

Concluding Remarks

This paper does not set out to present a detailed data analysis and a number of important considerations should be noted when interpreting this data:

- The data is a collection of anonymised set of data kindly shared by five UK laboratories following a request from SoBRA. The datasets are from different periods of time and are a result of different laboratory methods or sub-sets of methods (for example qualitative identification analysis compared to gravimetric and/or free fibre quantification analysis.
- The methods used for the periods for which data has been provided are not necessarily the methods currently used by the laboratories. The methods used may also vary from the SCA Blue Book method (SoBRA has presented on and is in the process of drafting a discussion paper on our survey of analytical methods used by UK laboratories undertaken in 2018).
- The datasets do not distinguish between sample origin – be that a greenfield site or a brownfield site. The datasets do not distinguish between large datasets from one or a small number of sites and small datasets from a larger number of sites. The datasets do not distinguish between the geographical location of the sites from which the data relates to.
- The datasets could be biased from the results of one large site (either positive or negative bias). The effect of this is not known.
- The datasets therefore do not indicate what the range or average presence of asbestos on any one site might be. The datasets are however a starting point or one line of evidence in our improved understanding of the nature of asbestos contamination of in natural soil and/or made ground in sites investigated across the UK.
- The collated data does indicate that:
    - Asbestos is not detected in the majority of samples submitted to the five laboratories
    - The majority of asbestos that is detected is chrysotile
    - The majority of reported concentrations of free fibres detected in soils that have undergone Stage 3 analysis are below the method reporting limit of 0.001%wt/wt. (Note that these samples are typically those that have had a positive ID at Stage 1. It is rare for samples with a negative ID at Stage 1 to progress to Stages 2 or 3).
- Anecdotal information from the industry suggests that asbestos is detected at the majority of brownfield sites that are investigated. This data suggests that, on average, asbestos is detected in a small (but nevertheless potentially significant) proportion of samples from those sites.

On a more detailed level:

- The laboratories with the lowest detection rate also have the oldest data. This might or might not be a result of changes to the laboratory methods that has improved the detection of lower levels of asbestos in samples.
- The detection rates between laboratories vary from 1.4% to 20%. The reasons for this could include different balances in the origin of the samples in the datasets, and differences in the

ability of the laboratory methods to detect asbestos in the samples. Both these reasons could have a significant impact on the reported detection rate.

- Further data mining and/or further collation of data from laboratories might identify some of the reasons behind the variability in the data presented in this paper.

Limitations

This discussion paper has been developed by members of the SoBRA asbestos sub-group acting in a voluntary capacity, and details the views of the individual members, not those of their employers. It is provided freely on the SoBRA website to help promote discussion on what should constitute good practice in assessing the health risk from asbestos-contaminated soil in the UK. Users of the paper must satisfy themselves that the content is appropriate for the intended use and no guarantee of suitability is made.

Feedback

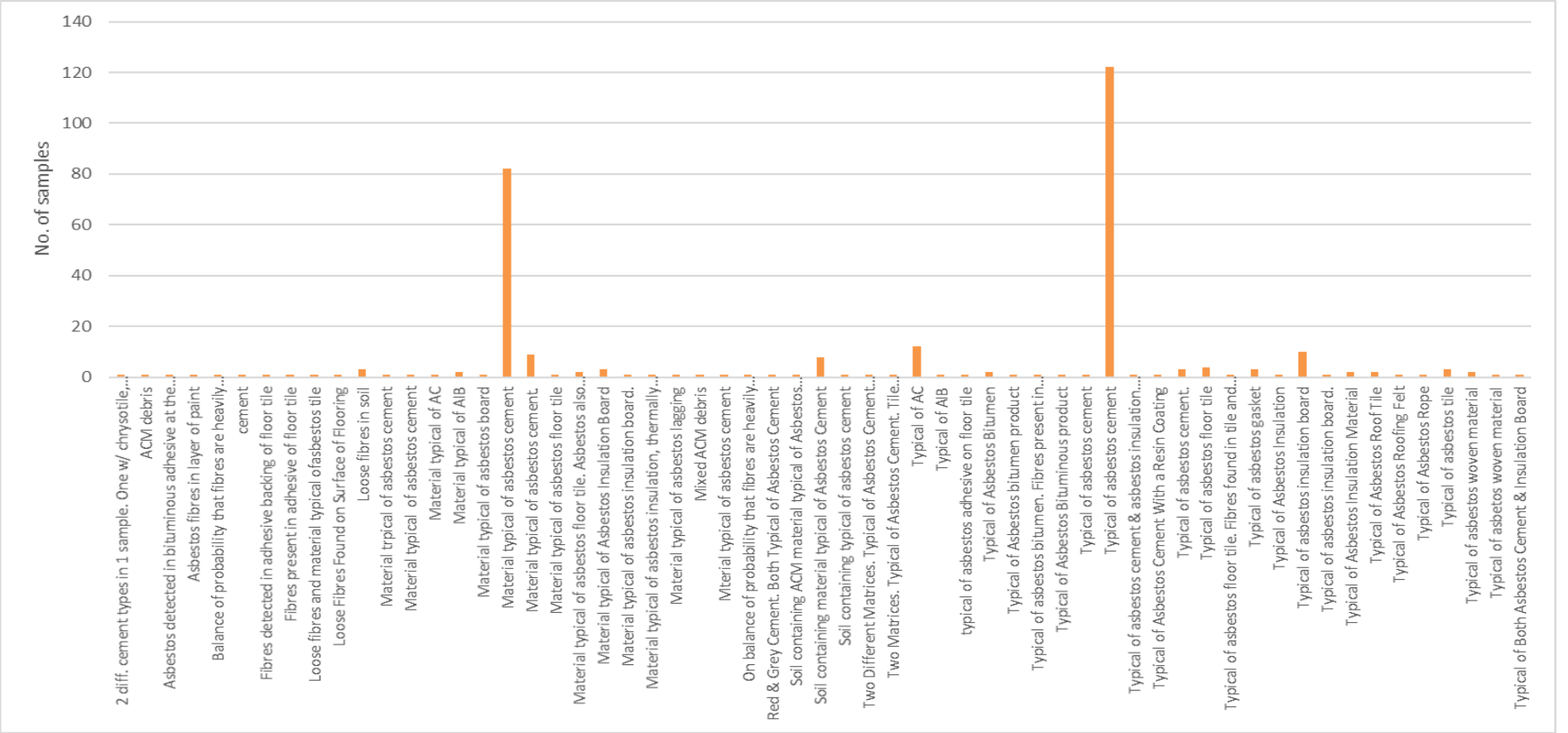
Feedback on this paper is welcomed and should be submitted to Simon Cole (as Chair of the sub-group) at simon.cole@aecom.com, or info@sobra.org.uk.

Acknowledgements

Members of the SoBRA sub-group who gave up their time to assist with the drafting and review of this paper.

The laboratories who kindly provided the anonymised data (ALS, DETS, Envirolab, i2, and REC).

Annex 1 – Figure 2 Asbestos ID descriptions[5] from Laboratory 1



[5] Note that there are some repetitions in the descriptions on the x-axis as this is collation of the individual descriptions as written by the laboratories (some descriptions may only differ by the use of a space between words)