

Joint Northern Contaminated Land Fora Summer Conference 2018

Waste and Material Reuse

The analysis of asbestos in soil and C&D materials: what's in a number?

The Carriageworks, Leeds

10th July 2018

Steve Forster BSC, MSc, CEnv, FGS, MIEnvSc
Director, Remedia Group Ltd/Chair, JIWG

Outline

Snapshot of some relevant background

- History and framework of some key numbers

‘Blue Book Method’: Asbestos Quantification in Soil

- Update on amendments and republication
- Some key issues for analysts and clients (data users)

HSL Asbestos in Soils [Proficiency Testing] Scheme

- Recent Round Robin results

Simple data manipulation for decision making

- CAR-SOIL/JIWG Decision Support Tools
- Waste classification, beneficial reuse on-site

Conclusions

Analysis of Asbestos in Soil

Snapshot history and framework of some key numbers

- **Addison et al, IOM, 1988**

A study performed by Addison, *et al*, in 1988 demonstrated that dried soils containing as little as 0.001 % by weight asbestos could release fibres at an average concentration exceeding the current control limit of 0.1 fibres/cm³, when compressed air was blown through the samples to produce respirable dust concentrations of >5 mg/m³. This study was conducted on a range of soils (sandy, intermediate, and clay), but there may be limitations to conclusions applied to a much wider range of materials/soil types.

- Used to support ICRCL 64/85, Second Edition 1990
- Worst-case figures highlighted; dry sandy soils
- Laboratory results do not match site air concentrations
- Led to the adoption of <0.001% = 'inert' and/or 'safe', for landfill and marketing and sale of recycled aggregate

Analysis of Asbestos in Soil

Snapshot history and framework of some key numbers

- **Problem?**
- Very few laboratories offered a validated and accredited method to $<0.001\%$ LOQ in soils
- Asbestos laboratories: identification of asbestos, +/-
- The 'Asbestos Screen'; cheap and 'meaningless!
- *"Tell me if it is under or above the Hazardous Waste threshold of 0.1% w/w!"*
- **Inconsistent laboratory estimates based on variable mass % of fibres in ACMs only**

Analysis of Asbestos in Soil

Snapshot history and framework of some key numbers

- **Problem?**
- **Analysis based on mass % of fibres analysis and calculation in ACMs alone not compatible with regulatory framework (WM3) ...**
 - *“Where the waste contains identifiable pieces of ACM then ... hazardous if ... asbestos in the piece of ACM is 0.1% or more.”*
 - *“If waste contains free dispersed fibres then the waste will be hazardous if (it) contains $\geq 0.1\%$ asbestos.”*

Analysis of Asbestos in Soil

Snapshot history and framework of some key numbers

- **CAR-SOIL 2016, Watch Point 2:**
 - “... if no fragments of ACMs are isolated ...
 - ... **fewer than three asbestos fibres** identified during ...
 - ... **detailed and extended identification and gravimetric analysis** procedures combined,
 - mass concentration of asbestos fibre is **likely to be** many orders of magnitude **below the 0.0001%** w/w LOD.
 - such material ... **not strictly an ACM** that falls under the definition of asbestos in the Regulations.”
- **Always ‘trace’ – CAR DO NOT APPLY!**

Analysis of Asbestos in Soil

Snapshot history and framework of some key numbers

- *“... isolated or ‘trace’ asbestos fibres and/or isolated or random individual pieces of ACMs, **might fall outside the scope of the Regulations**”*
- *dependent on what is considered ‘reasonably practicable’ in each case ...*
- ***assuming a suitable and sufficient investigation and assessment of the site has been carried out.**”*
- **May be ‘trace’, but** must use ...
- diligence, lines of evidence, robust assessment.
- For CAR2012 compliance, **NOT** environmental!

SCA Blue Book Method - Asbestos

HSG248 Analysts' Guide and 'trace' asbestos

If, after careful searching, only 1 or 2 fibres/bundles are found in the sample, this should be reported as '**asbestos found at the limit of detection**' in accordance with HSG248, Second Edition, 2018/2019*, and it may not be necessary to continue with quantification. Asbestos fibres above this level should be identified before continuing with Stages 2 and 3 of the quantitative analysis. The oven dried weight of the sample is also determined, although the visual examination can be performed on the as-received or dried sample, depending upon suitability of the sample.

**This is the effective definition of 'trace asbestos' and may be subject to change in the final published version of HSG248, Second Edition, 2018/2019.*

- **“Asbestos found at the limit of detection”** may = 'trace asbestos' = not an ACM, CAR2012 do not apply
- Stage 1 of the Blue Book Method, but HSG248 is not quantification method
- **CAUTION: respirable fibres not identified by Stage 1; 'detection' ≠ quantification!**

SCA Blue Book Method - Asbestos

Standing Committee of Analysts

The Quantification of Asbestos in Soils
and Associated Materials (2018)

Methods for the Examination of Waters and Associated Materials

- In development for ‘several’ years
- Published 2017
- Working Group chaired by Hazel Davidson, EIC ELWG
- Laboratories and consultants
 - HSL, IOM, BOHS
- Used by a number of ‘early adopters’ pre-publication
- **LOD 0.001%, but 0.0001% possible with validation**

SCA Blue Book Method - Asbestos

Standing Committee of Analysts

The Quantification of Asbestos in Soils
and Associated Materials (2018)

Methods for the Examination of Waters and Associated Materials

- **CAUTION!**
- Currently being reviewed and amended
- Steve Forster/Laurie Davies, HSL
- EIC ELWG review
- SCA approval
- Publication 2018?
- Concurrent and consistent with CL:AIRE CAR-SOIL
- Text may change!

SCA Blue Book Method - Asbestos

Material descriptions and maximum asbestos content

Appendix 5 Maximum percentage of asbestos in different ACMs (taken from HSG264)

Material	% max
Loose Insulation	100
Textile; blanket, tape, cloth, rope and string	100
Paper, Felt, excludes any non-asbestos composite component	100
Millboard	97
Compressed Fibre Gaskets	90
Sprayed Coating	85
Thermal Insulation - Composite	85
Thermal Insulation - Caposil/Caposite	85
Loose fibrous asbestos debris*	85
Brake Pads, Clutch Plates	70
Cement – high asbestos content material	50
Insulating Board (excludes any non-asbestos composite component)	40
Asbestos sheeting/board debris**	40
Cement - 'Asbestos Wood'	25
Thermoplastic Floor Tiles	25
Thermal Insulation - Sectional	15
Cement – standard material	15
Reinforced Plastic and Resin Composites	10
Bitumen Felt, DPC etc.	8
PVC Vinyl Floor Tiles	7
Textured Decorative Coatings	5
Magnesium Oxychloride Flooring	2
Bitumastic Adhesives	2

*Material/Debris not readily identifiable as asbestos coatings or insulation

** Material/Debris not readily identifiable as AIB or any other asbestos board type

Note: Asbestos content is assumed as a worst-case scenario, and these maximum values of asbestos should be used in relevant calculations, not HSG264.

SCA Blue Book Method - Asbestos

Subjective Descriptions for Degradation

Degree of Degradation or Weathering of Asbestos Containing Materials

The client may request that the laboratory provides subjective information on the degree of degradation or weathering of ACM in the sample in order to facilitate assessments of the licensing status of work on contaminated materials. The following is taken from the CAR-SOIL industry guidance:

‘Degraded’ at the outset means materials which are not generally intact. It applies to the current condition of the material (and not the original state) e.g. fragments of asbestos cement would be regarded as intact units. Also, ‘weathered’ asbestos cement is not regarded as degraded as it still retains its basic inherent integrity.

For the purposes of definition of non-degraded and degraded, reference is made to the following degrees of degradation descriptors in the JIWG Work Category assessment Decision Support Tool:

1. Intact (very good condition ACM/ACM fragments)
2. Weathered (slight degradation in ACM; material still retains its basic integrity)
3. Degraded (significant degradation in ACM; material has lost its basic integrity)
4. Disaggregated (dominated by loose fibrous material; extreme degradation in ACM and/or free asbestos fibres/fibre bundles)

SCA Blue Book Method - Asbestos

Data reporting: what might we need to make robust assessments?

Reports may include the following information, with respect to each and all stages of the analysis, subject to customer contract review:

- Total dry mass of sample
- Total mass % of material removed (if applicable)
- Asbestos type (from PLM analysis) in each ACM type, if required
- Total mass % of asbestos
- Total mass % of amphibole asbestos
- Total mass % of chrysotile asbestos
- Total gravimetric (ACM) mass %
- Total gravimetric (ACM) % of each ACM type
- Total mass % of free fibres
- Total mass % (or fibres/g) of respirable fibres, if required
- Any anomalies or problems, e.g. clay or chrysotile clumping

- Not routinely provided by laboratories
- Extensive follow-up/interrogation, wastes time!

SCA Blue Book Method - Asbestos

Accreditation

Note 1: Prior to using this method, it is necessary to perform the identification of asbestos fibres, fibre bundles, or asbestos containing material (ACM) in the relevant sample using Polarised Light Microscopy as per the method described in the HSE guidance document HSG248: *The analysts' guide for sampling, analysis and clearance procedures (Second Edition, 2018/2019)*. It is important to note that any commercial laboratory undertaking asbestos identification must be accredited to ISO 17025.

Note 2: It is important to note that Regulation 21 of the Control of Asbestos Regulations 2012 (CAR 2012) requires that every employer who requests an external organisation to analyse a sample of any material to determine whether it contains asbestos must ensure that the organisation is accredited by an appropriate body* as competent to perform work in compliance with ISO 17025. Although not mandatory under CAR 2012, it is strongly recommended that the organisation is accredited for quantification, as well as identification (which is mandatory).

- Clients must ensure laboratories have appropriate accreditation, including extended scope for soils

SCA Blue Book Method - Asbestos

Accreditation

Note 3: Although not required for compliance with CAR 2012, there may be other requirements for the assessment of land contaminated by asbestos, imposed by regulators such as the Environment Agency (in England), Natural Resource Wales, the Scottish Environmental Protection Agency, the Northern Ireland Environment Agency, or Local Authorities with respect to the accreditation of laboratories for asbestos quantification analysis of soil and/or C&D materials.

These regulatory bodies all have policies requiring that laboratories conducting analysis for regulatory purposes should have their methodologies accredited, including quantification of asbestos in soil and C&D materials (accreditation for identification is already mandatory).

It is likely, therefore, that full-scope UKAS accreditation for the quantification of asbestos in soil and C&D materials will be a requirement of national environmental and local authority regulators alike where such analysis is conducted in support of the preparation and submission of land quality assessment reports in accordance with BS10175, CLR11 and supporting technical guidance documentation, when used for regulatory purposes.

- Regulatory default is UKAS accreditation ...
- ...for environmental purposes, **NOT** CAR2012 compliance!

SCA Blue Book Method - Asbestos

Accreditation

UKAS Asbestos Technical Bulletin Issue 1, April 2010

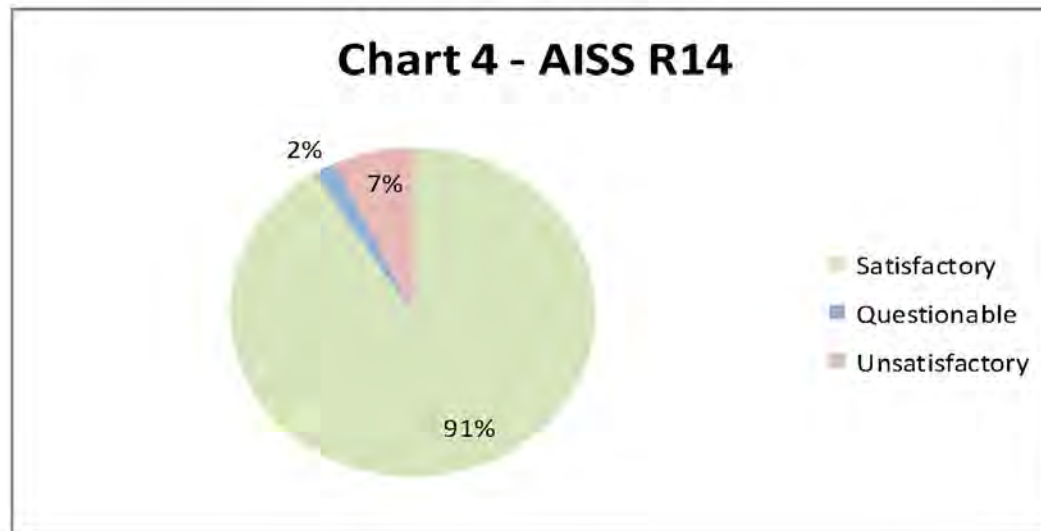
- Advice on ‘screening, identification and quantification’
- Extracted ACM fragments analysis under mandatory UKAS/HSG248
- Report for ‘screened ACMs’, +/-, not soil matrix
- For fibres in soil, must have extension to UKAS scope ...
- ‘*Soil – screening and identification*’ reports, no quantification
- For quantification analysis accreditation, must have further extension to UKAS scope ...
- ‘*Soil – screening, identification and quantification*’ reports
- Laboratory participation in PT Schemes ... **HSL AISS**

HSL – Asbestos in Soils Scheme

Round 14 Results – November 2017

4. Quantitative Results

Chart 4 illustrates of the 45 laboratories who submitted a quantification result for sample S028, 41 labs (91%) achieved a satisfactory result i.e. a z score of $< \pm 2$. 1 laboratory (2%) achieved a questionable result with a z score of between ± 2 and ± 3 . 3 laboratories (7%) achieved an unsatisfactory result with a z score of $> \pm 3$.

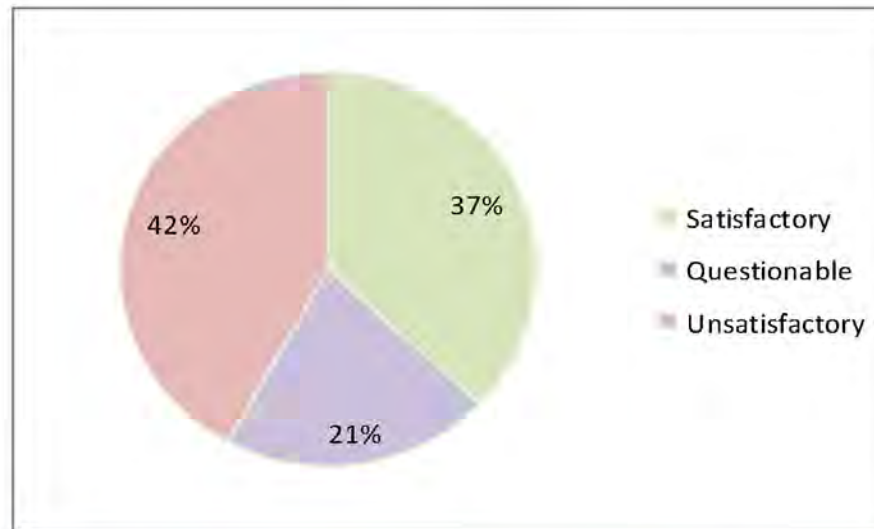


HSL – Asbestos in Soils Scheme

Round 15 Results – February 2018

4. Quantitative Results

Chart 4 illustrates of the 43 laboratories who submitted a quantification result for sample S030, 16 labs (37%) achieved a satisfactory result i.e. a z score of $< \pm 2$. 9 laboratory (21%) achieved a questionable result with a z score of between ± 2 and ± 3 . 18 laboratories (42%) achieved an unsatisfactory result with a z score of $> \pm 3$.



HSL – Asbestos in Soils Scheme

Round 15 Results – Supplementary Report, March 2018

- “... *the Information Book for Participants which states “the method used by UK laboratories undertaking quantitative asbestos analysis should be based on The SCA Blue Book method ...”*”
- “... the **SCA Blue Book method Appendix 4 [5]** lists the percentage of asbestos in different ACMs with a minimum and maximum figure and states “Highlighted lines indicate where **asbestos content is assumed as a worst case scenario, and maximum value of asbestos should be used in relevant calculations.**””

HSL – Asbestos in Soils Scheme

Round 15 Results – Supplementary Report, March 2018

- ***“a number of labs used several percentage figures with a range including 10%, 15%, 25%, 40% and 50%.***
*We ... are testing against a method that states as a worst case scenario 50% should be used and **we expect all labs to be applying the same figure.**”*

HSL – Asbestos in Soils Scheme

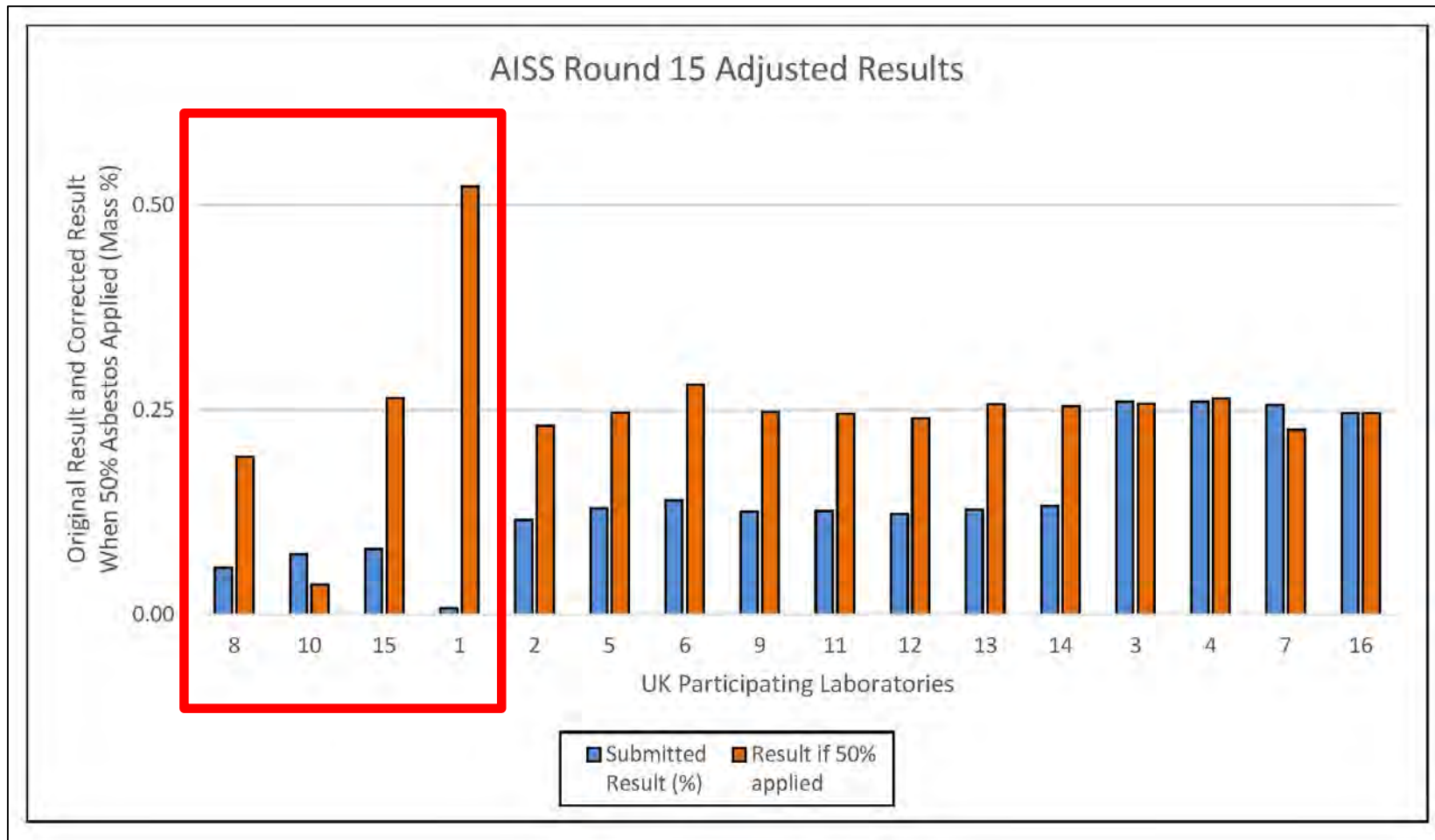
Round 15 Results – Supplementary Report, March 2018

- UK laboratories data...

Lab	Country	Weight of Sample (g) - assumed dry	Weight of ACM (g)	ACM % applied in submitted result	Submitted Result (%)	Result if 50% applied	z Score if 50% applied
8	UK	284.77	1.10	15	0.058	0.193	-0.57
10	UK	285.71	0.21	15	0.074	0.037	-2.15
15	UK	300.30	1.59	15	0.080	0.265	0.15
1	UK	308.00	3.22	25	0.008	0.523	2.75
2	UK	294.24	1.36	25	0.116	0.231	-0.19
5	UK	295.45	1.46	25	0.130	0.247	-0.03
6	UK	294.46	1.65	25	0.140	0.281	0.31
9	UK	302.00	1.50	25	0.126	0.248	-0.02
11	UK	300.00	1.47	25	0.127	0.245	-0.05
12	UK	299.70	1.44	25	0.123	0.240	-0.1
13	UK	285.30	1.47	25	0.128	0.257	0.07
14	UK	299.20	1.52	25	0.133	0.255	0.05
3	UK	295.00	1.52	50	0.260	0.258	0.08
4	UK	279.97	1.48	50	0.260	0.264	0.14
7	UK	300.65	1.36	50	0.256	0.226	-0.24
16	UK	297.24	1.46	50	0.246	0.246	-0.04

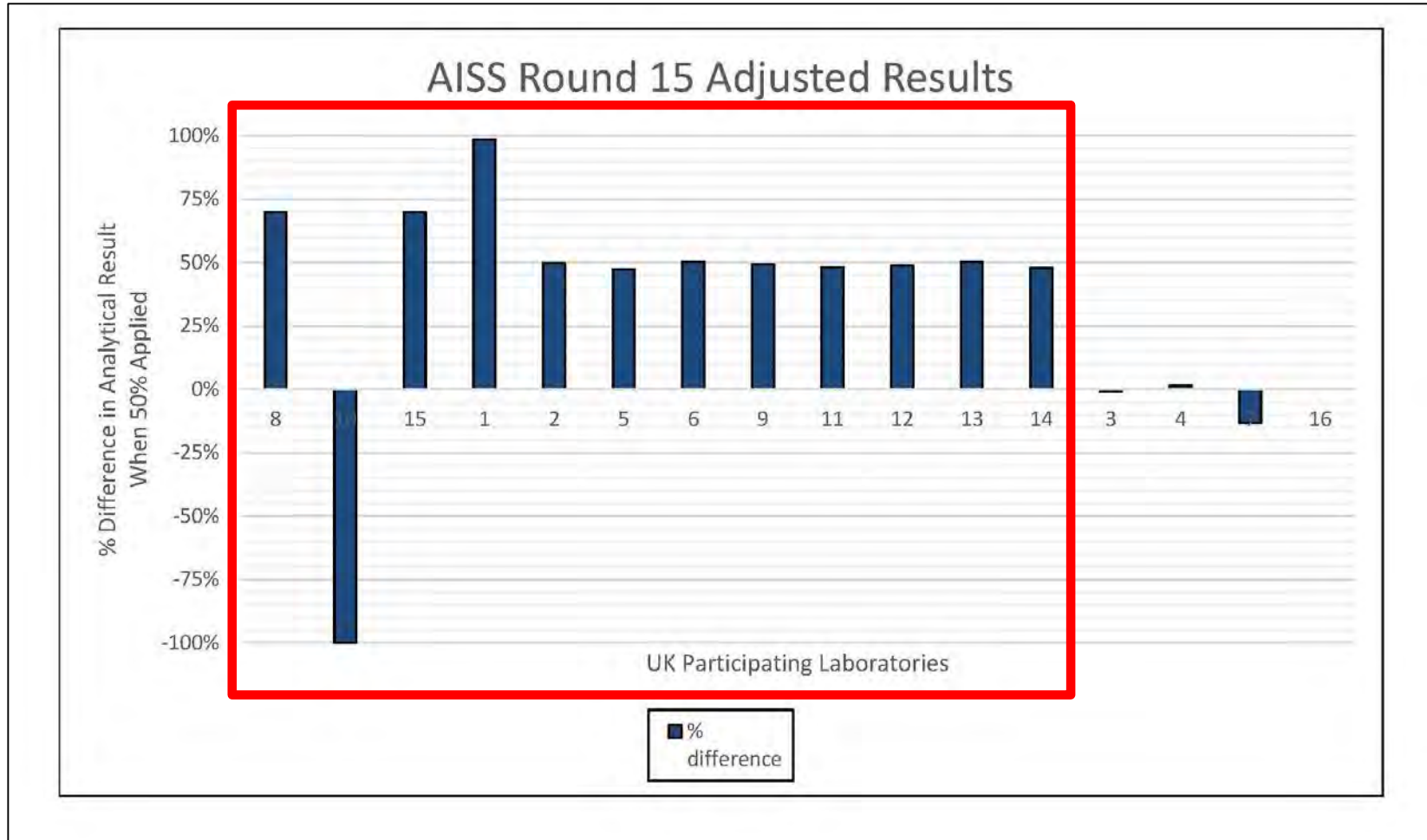
HSL – Asbestos in Soils Scheme

Round 15 Results – Supplementary Report, March 2018



HSL – Asbestos in Soils Scheme

Round 15 Results – Supplementary Report, March 2018



CAR-SOIL, 2016

JIWG Work Category Spreadsheet – DST

Aids compliance with CAR 2012 and asbestos licencing regime; RA and POW, safe working practice, controls

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Project Reference: _____
Site Name: _____
Client: _____
Run by: _____
Date: _____
Scenario details: _____

Decision Support Tool for CAR2012 Work Categories

Stage 1
Hazard Ranking

Select ACM type (run model for each type to generate 'Worst Case' output):
Extent of degradation of ACMs at outset of work:
Friability and degree of bonding by matrix (ACM matrix, not ground material):
Distribution of Visible Asbestos Fibres Affected Area:
Amount of asbestos fibre in selected ACM/fibre type as % of host material:

Score	Options
3	Loose fibrous asbestos debris
4	Disaggregated (dominated by loose fibrous material; extreme degradation in ACM and/or free asbestos fibres/fibre bundles)
4	Friable ACM or ACM with fibres not linked in any matrix (free dispersed fibres/fibre bundles)
2	Scenario 1: random occurrences of visible contamination by ACMs
2	No visible ACM/fibre bundles
15	Scenario 2: frequent occurrences of visible contamination by ACMs

Sub-total: _____

Note: the asbestos licencing regime is unaffected by the type of asbestos fibre present in ACMs.

Hazard ranking: _____

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Stage 2
Exposure Factors

Score	Options
2	<0.1 fibres/ml (4 Hr TWA) or <0.6 fibres/ml (10 minute STEL)
4	0.01 fibres/ml
0	<0.01 fibres/ml
1	<0.1 fibres/ml (4 Hr TWA) or <0.6 fibres/ml (10 minute STEL)
4	<0.1 fibres/ml (4 Hr TWA) or <0.6 fibres/ml (10 minute STEL)

Best description of primary host material matrix (soil/made ground): _____
Respirable fibre index for ACM - RIVM report 711701084 (2003): High

Sub-total: _____

Exposure ranking: _____

Combined hazard and exposure ranking: _____

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Stage 3
Risk Assessment Outputs

Probable Licensing Status	Non-Licensed Work
RPE*	EN149 type FFP3 disposable
Dust Suppression**	Manual/localised dust suppression
Hygiene/Decontamination***	Localised and basic personal decontamination facilities

*Where RPE has to be worn continuously for long periods (e.g. more than 1-hour), then powered RPE may be necessary.
**Reduction in control measures possible if natural mitigation factors are present (e.g. raining, wet ground)
***Guide only; suitability of selected personal hygiene measures may be reviewed on a site/contamination-specific basis

CAR-SOIL, 2016

JIWG Receptor Risk Ranking – DST

Supports RA and POW; off-site receptors and non-occupational exposures during works

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Receptor Risk Ranking

Receptor Category	Score
Use of asbestos fibre in enclosed ACMs (fibre type or fibre loss allowed)	2
Asbestos fibre loading to ACM (HVA report 2711201016 2009)	4
Activity type and duration/duration frequency	2
Level of disturbance of primary host material matrix	4

Sub total: 12

Receptor ranking: High

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Receptor Risk Ranking

Receptor Category	Score
Receptor category	Residential No score required
Age of Receptor	Infant (under 5) 4
Duration of exposure/site occupancy	>> 10 hours per day (e.g. 24 hour residential exposure) 4

Receptor ranking: 8 High

Combined hazard, exposure and receptor ranking: Medium

Pathway	Score
Pathway: Distance of Receptor from Source	In or within 10m of area of disturbance 4
Pathway: Depth to impacted material	Surface 0

Pathway ranking: 4E High

Overall ranking: High

JIWG
Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Decision Support Tool for Receptor Risk Ranking

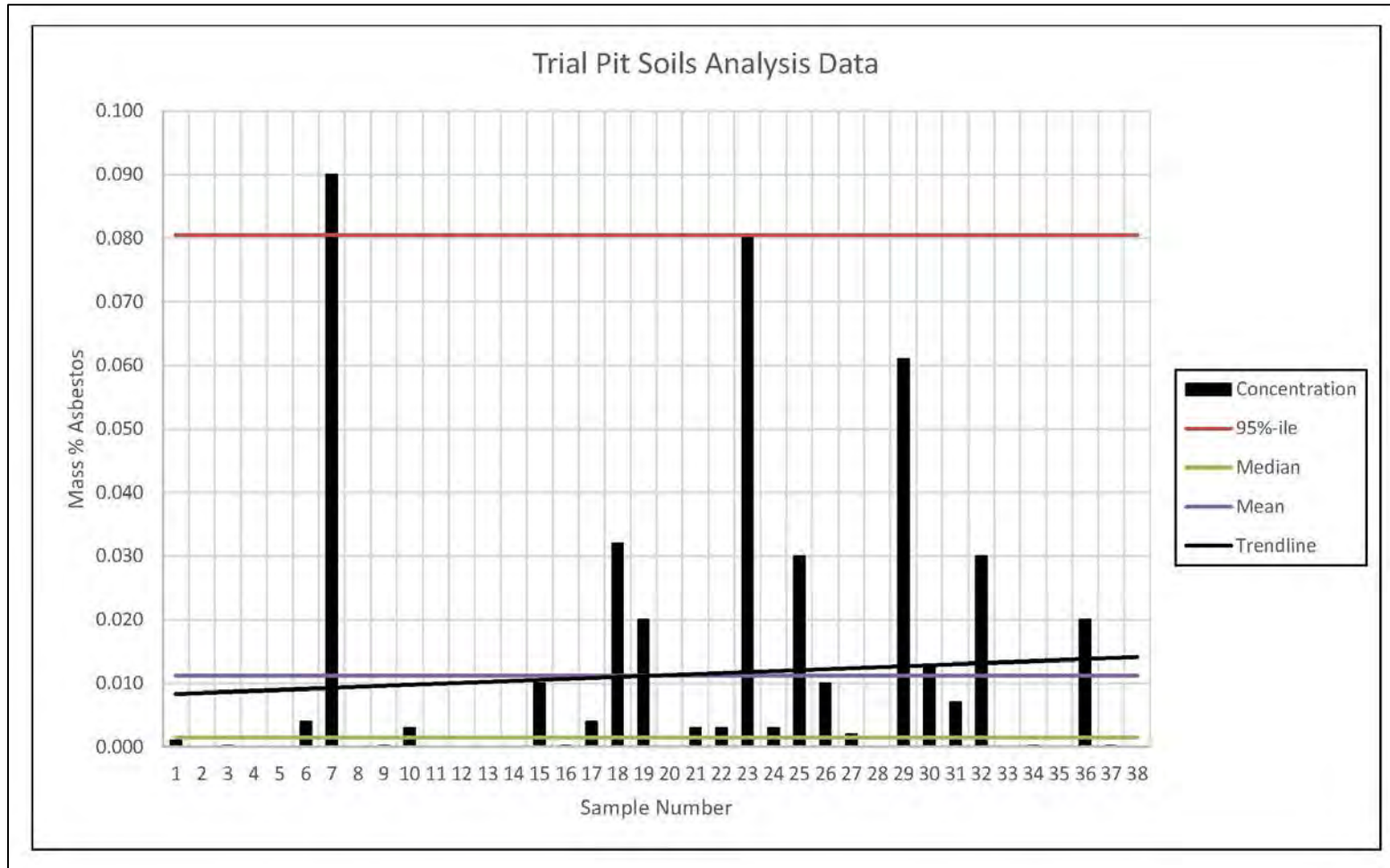
Receptor Category	Score
Use of asbestos fibre in enclosed ACMs (fibre type or fibre loss allowed)	2
Asbestos fibre loading to ACM (HVA report 2711201016 2009)	4
Activity type and duration/duration frequency	2
Level of disturbance of primary host material matrix	4

Sub total: 12

Receptor ranking: High

Asbestos in Soils Analysis

Data manipulation for decision making



Asbestos in Soils Analysis

Data manipulation for decision making

38 samples all below 0.1% free dispersed fibres

- 95%-ile at 0.081%; is this good enough?
- Median at 0.0015%
- Mean at 0.01%

All non-hazardous?

- Must also consider visible ACMs if could be present and off-site landfill disposal

Suitable for reuse on-site?

- Beneath residential gardens/cover system?
- Beneath POS/cover system?

Conclusions

1. CAR-SOIL and the SCA Blue Book Method for Asbestos Quantification aims at providing consistency.
2. Currently, many soils/asbestos labs are not using the method, or only in part.
3. Labs should use Appendix 4 [5] material descriptors and maximum asbestos content figures for ACMs, not HSG264.

Conclusions

4. Site Investigation practitioners must place more reliance on field visual identification and description of ACMs, not labs.
5. Labs must fully embrace BBM method framework and proactively offer fit-for-purpose, detailed analytical reports.
6. Labs should actively seek to acquire UKAS accreditation or seek amendments to scope to be consistent; embrace new BOHS P408 for soils.

Conclusions

7. Hopefully, revised HSG248 will help clarify?
8. Simple initial data manipulation and presentation can assist at a fundamental level in decision making, both for compliance with CAR2012 and for environmental compliance where contaminated materials are being reused on-site.
9. High quality air monitoring should support decision making process; ambient levels to 0.0005 f/ml for HHRA.

Thank you for listening

... contact details

Stephen Forster, Director, Remedia Group Ltd:
steve@remediagroup.co.uk

 @RemediaGroup

www.claire.co.uk/asbestos

Join the discussion on **LinkedIn**
JIWG Asbestos in Soil and Construction & Demolition Materials