Update on Asbestos

Current Issues in Contaminated Land Risk Assessment - 2014

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SoBRA recommendations for further work – October 2013

- Focus on how to better understand the soil/air relationship for asbestos release
- Reduce uncertainty/provide greater context to exposure estimates

1. Collection of existing fibre-release from soil data
2. Collection of existing dust-release from soil
3. Project trials to obtain/support empirical field data
4. UK soils background project
5. UK background air concentrations
6. UK soil moisture content
7. Policy decision on ‘tolerable’ air concentration

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SoBRA sub-group initiatives

- Summer workshop 2013 – report publication imminent…
- Follow on work:

  - Review of RIVM empirical data
  - Open access database of activity-based asbestos fibre and dust release
  - Sampling protocols of air monitoring of dust and asbestos fibre
  - Soil sampling protocol
  - Activity-based sampling protocol
  - Qualitative risk ranking frameworks

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RIVM data

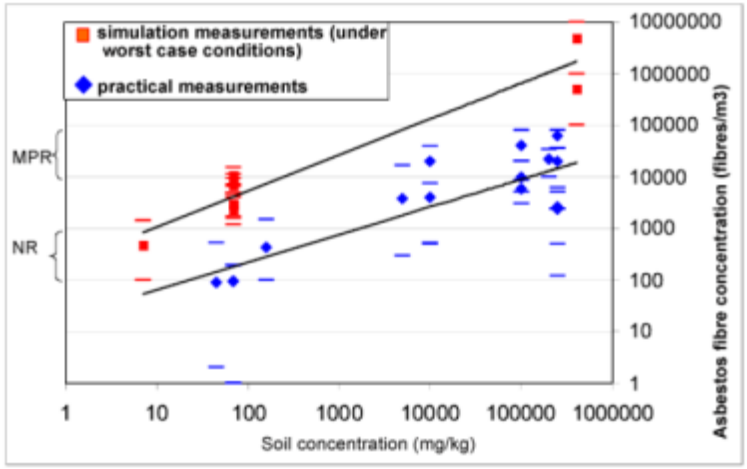

Figure 4.1: *Asbestos fibre concentration (in fibres with length > 5 µm per m³ of air) for all measurements in which asbestos in the air was measured as a function of the unbound asbestos content in mg of asbestos per kg of soil and/or rubble material.*
[Based on 85 measurements with various activities with unbound asbestos and under various measurement conditions with a positive measurement result (so-called worst case measurements). The measurements are broken down into simulation

- Data from 30 studies
- 1000 individual measurements
- 85 selected for unbound asbestos with +ve air result
- Mostly associated with dry soil, dry weather and ‘plenty of activity’

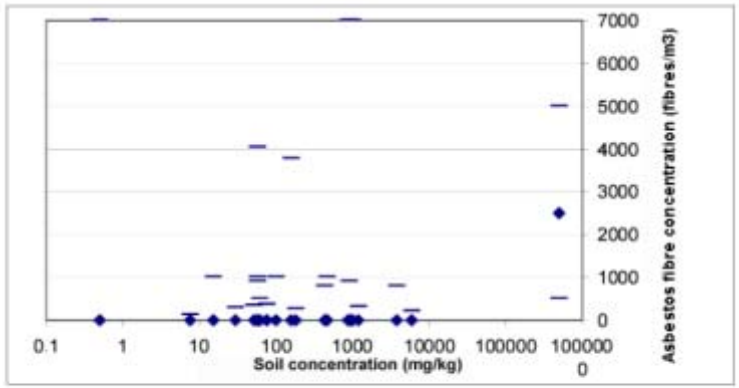

Figure 2.2 *Asbestos fibre concentration (in fibres with a length > 5µm per m³ of air), as a function of the bound asbestos content in mg of asbestos per kg of soil and/or rubble material.*
[Based on 350 practical measurements for various activities and under different measuring conditions. The small bars indicate the 95% reliability interval of the

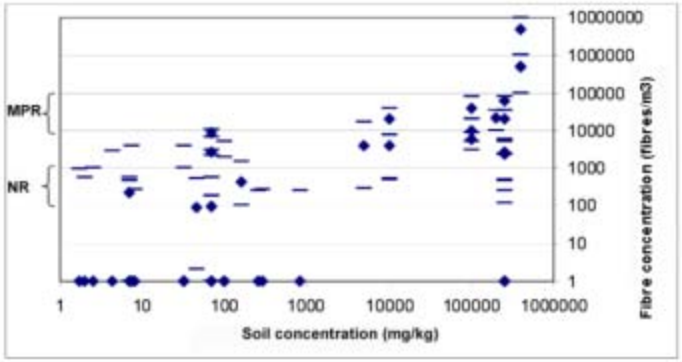

Figure 2.3: *Asbestos fibre concentration (in fibres with a length > 5µm per m³ of air), as function of the unbound asbestos content in mg of asbestos per kg of soil and/or rubble material (log scale).*
[Based on 200 practical measurements for various activities and under different measuring conditions. The asbestos fibre concentrations are averages based on

Figures from RIVM 711701034, 2003

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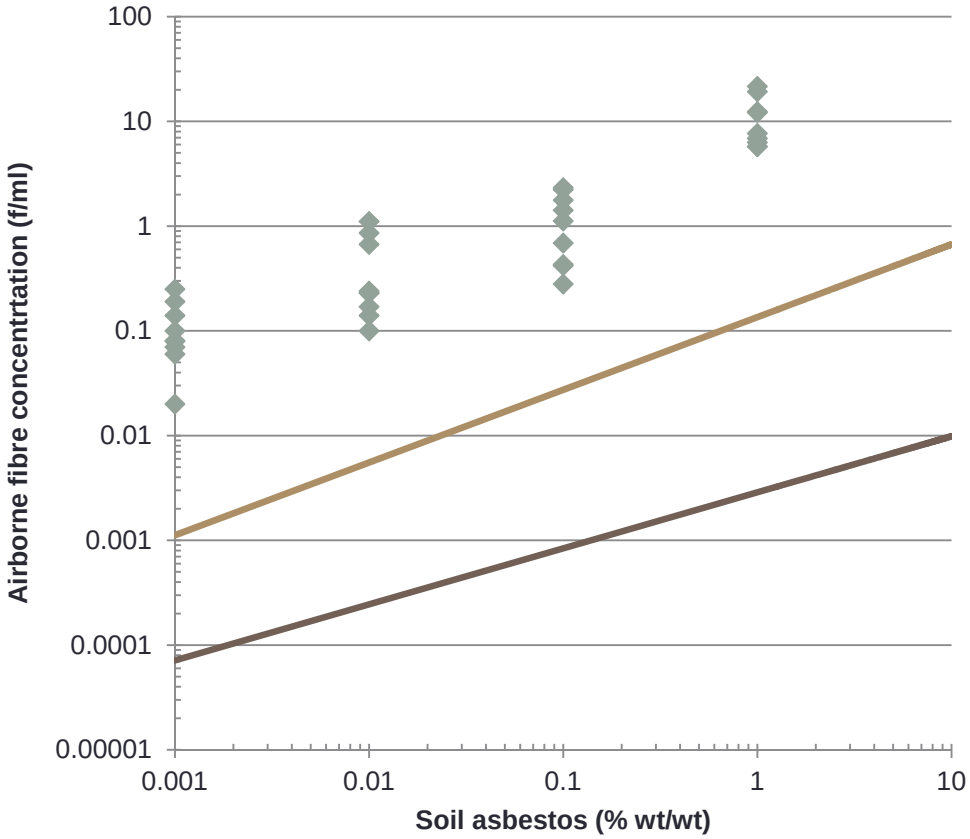
Comparison between Addison et al and RIVM



Substantial differences due to different dust generation and other experimental factors

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RIVM data

Bijlage 4 Beschouwde meetresultaten

Locatie	Locatie eigenschappen			Datum	Asbesthoudende materialen			Asbestconcentratie (mg/kg ds)							Bodemkarakteristieken	
Naam	Oppervlak (m2)	Volume (m3)	type lokatie		type1	type2	type3	totaal	Hecht	niet hecht	Vezels > 100µm	Chrysotiel	crocidoliet	amosiet	type	vochtgehalte
Fabriekshal Schijf	2500		Toplaag	27-11-02	AC	verweerd AC	vezelbundels	78-1900	13-300	65-1600		72-1700	6-140		zand	droog matig vochtig
Fabriekterrein Schijf	2500		Toplaag	27-11-02	AC	verweerd AC	vezelbundels	510-6700	290	220-6700		470-6200	38-480		klei	matig vochtig
Gronddepot Oisdorp 1			depot /absmulatie	dec 02	AC			1200	1200			940	210		zanderig	0% (gedroogd)
Gronddepot Oisdorp 2			depot /absmulatie	dec 02	AC	vezels		45	45	0.2		45		0.2	zanderig	0% (gedroogd)
Gronddepot Oisdorp 3			depot /absmulatie	dec 02	AC			180	180			140	38		zanderig	0% (gedroogd)
Woonwijk Goor 1			Bovenlaag	12 dec 02	draasel	puipachtig		810-2600		810-2600						bevroren: 10-15%
Woonwijk Goor 2			Bovenlaag	12 dec 02	draasel	puipachtig		0.6-20								bevroren: 10-15%
Woonwijk Goor 3			topl aag /absmulatie	jan 03	draasel	puipachtig	vezelbundels	620	330	290		280	340			5%
Speeterrein IJmuiden	3750		Bovenlaag	17 aug 00	AC	zachtboard	isolatiekoord	16-800	6-780	10-16					zand	droog
Terrein Karendal	1500		Topl aag	10 mei 01	AC			58 (0-250)	58 (0-250)			58 (0-250)			teelaarde	droog
Terrein Karendal	1500		topl aag	15 mei 01	AC			58 (0-250)	58 (0-250)			58 (0-250)			teelaarde	vochtig
Terrein Karendal	1500		topl aag	15 mei 01	AC			58 (0-250)	58 (0-250)			58 (0-250)			teelaarde	vochtig
Parkeerterrein Beuningen	10.000		bovenlaag	5 mei 01	AC	zachtboard		32 (0-96)	24	8 (0-9)				8	granulaat	veldvochtig
Depots Arrhem 1		33.000	depots	15 sep 99	vloerzeil	zachtboard	pakkingen	32 (0-194)		32 (0-194)				16 (0-68)	granulaat	vochtig
Depots Arrhem 2		33.000	depots	sep 99	vloerzeil	zachtboard	pakkingen	32 (0-194)		32 (0-194)				16 (0-68)	granulaat	vochtig
Hedemanterrein Arnelo 1	110.000		bovenlaag	5 dec 01	isolatie			2 (0.8-17)		2 (0.8-17)	<0.01	0.5	0.3	1.2		vochtig
Hedemanterrein Arnelo 2	110.000		bovenlaag	12 dec 01	isolatie			2 (0.8-17)		2 (0.8-17)	<0.01	0.5	0.3	1.2		vochtig
Hedemanterrein Arnelo 3	110.000		bovenlaag	21 jan 02	isolatie			2 (0.8-17)		2 (0.8-17)	<0.01	0.5	0.3	1.2		vochtig
Partij puin Voordrempt 1		200	depot	1999	AC			50-100	50-100			50-100			puin	veldvochtig
Partij puin Voordrempt 2		200	depot	1999	AC			50-100	50-100			50-100			puin	veldvochtig
Partij puin Emmeloord		2300	depot	1996	AC			10-50	10-50			10-45	2-5		puin	veldvochtig
Industrieterrein Amsterdam 1	18.000	11.000	bovenlaag (0-1mtr)	mei/jun 01	isolatie	vezelbundels		1-9600		1-9600					zand	bevochtigd
Industrieterrein Amsterdam 2	18.000	11.000	bovenlaag (0-1mtr)	jul 01	isolatie	vezelbundels		130-52000		130-52000					zand	bevochtigd
Industrieterrein Amsterdam 3	18.000	11.000	bovenlaag (0-1mtr)	aug/dec 01	isolatie	vezelbundels		1-340		1-340					zand	bevochtigd
Baggerspecie	27.000	700	bovenlaag	jan 01	isolatie	vezelbundels		1000-10000		1000-10000		1000-10000			bagger	nat
Partijen grond Weringermeer 1			depots	jun/aug 00	AC	zachtboard	isolatie	700 (1-5300)	1-5300	<5300					grond	bevochtigd
Partijen grond Weringermeer 2			depots	jun/aug 00	AC	zachtboard	isolatie	700 (1-5300)	1-5300	<5300					grond	bevochtigd
Partijen grond Rotterdam			depots	jun 00/dec 01	AC			5000 (8-47800)	8-47800						grond	bevochtigd
Asbestweg Gemert	9650		bovenlaag	2001	AC			450-1320	450-1320			450-1320			granulaat	vochtig
Puinpad De Mortel	500		bovenlaag	2001	AC			35-830	35-830			35-830			granulaat	vochtig
Terrein Hendrik Ido Ambacht	5000		bovenlaag	13 jun 01	AC	sporen vezelbundels		25-1800	25-1800	<1		25-1800			grond	
Terrein Rotterdam	2500		bovenlaag	19 jun 01	AC	sporen vezelbundels		3740 (0-7000)	3740	<1		3740			grond	
Terrein Den Haag	5000		bovenlaag	4 jul 01	AC			550 (170-2400)	170-2400			170-2400			grond	
Terrein Maastricht	3500		bovenlaag	2001	AC			1010	1010			1010			grond	
Depot Steenbergen		950	depot	22 feb 01	AC	sporen vezelbundels		0.1-1	0.1-1	<1		0.1-1			grond	
Depot grond, Brabant 1			partij	okt 97	AC			15	15			15			grond	droog/veldvochtig
Depot grond, Brabant 2			partij	mrt 98	AC			100	100			100			grond	droog/veldvochtig
Depot zand, Lelystad 1		250	partij	17 jul 01	AC			22-100	22-100			22-100	2-10		zand/BSA	droog/veldvochtig
Depot klei, Lelystad 2		130	partij	18 jul 01	AC			2-100	2-100			2-100	0.2-1		klei/BSA	veldvochtig
Depot puinhoud grond Utrecht			partij	mrt 03	AC			470	470			300	170		zand/BSA	droog/veldvochtig
Woonwagenterrein Hoods Zoelen	100		bovenlaag	Mrt 03	isolatie<4	Board <4mm		160		160		45	45	70	Puin/grond	droog/veldvochtig

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RIVM data dissection

Chart A - All data with asbestos fibre data > detection limit and asbestos concentration in soil data (no simulations)

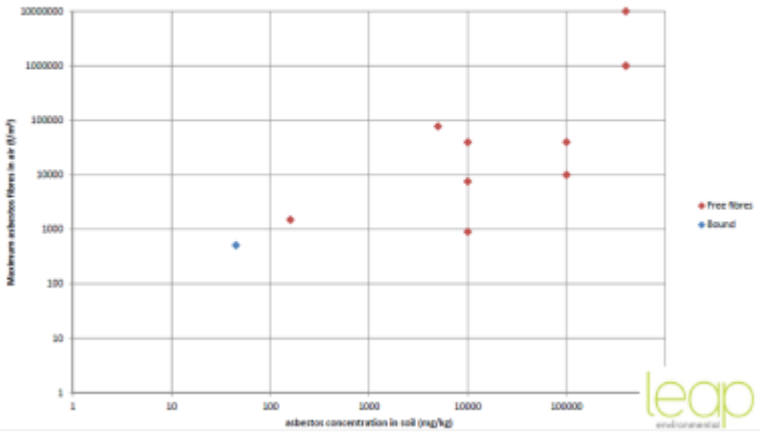


Chart B - Asbestos concentrations in soil and air by soil matrix and moisture content

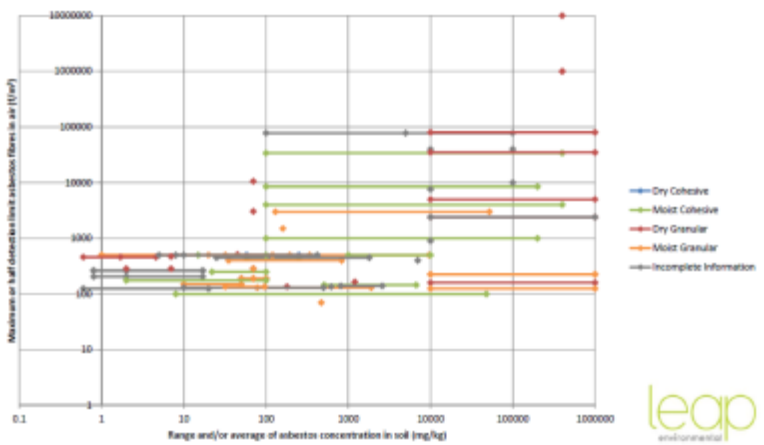


Chart C - All data with asbestos fibre detection limits ≤1000

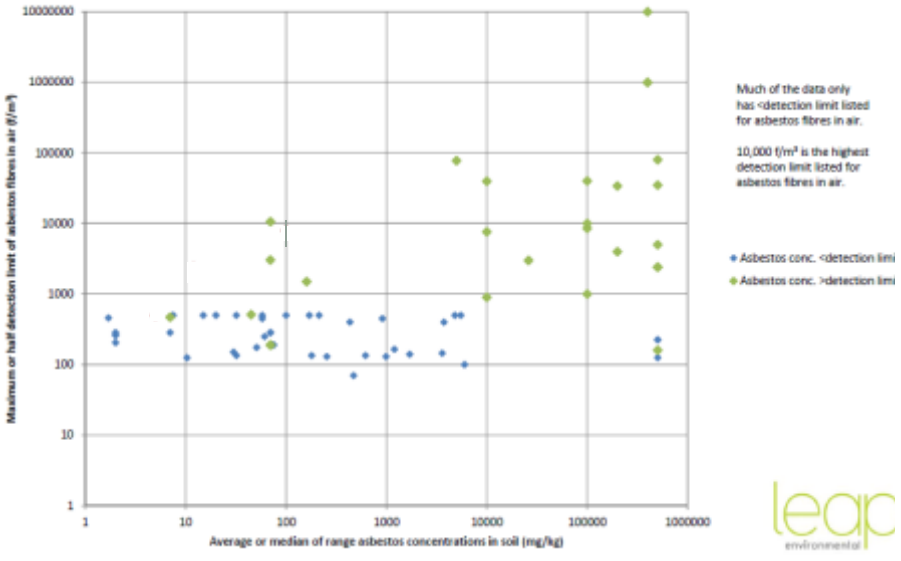
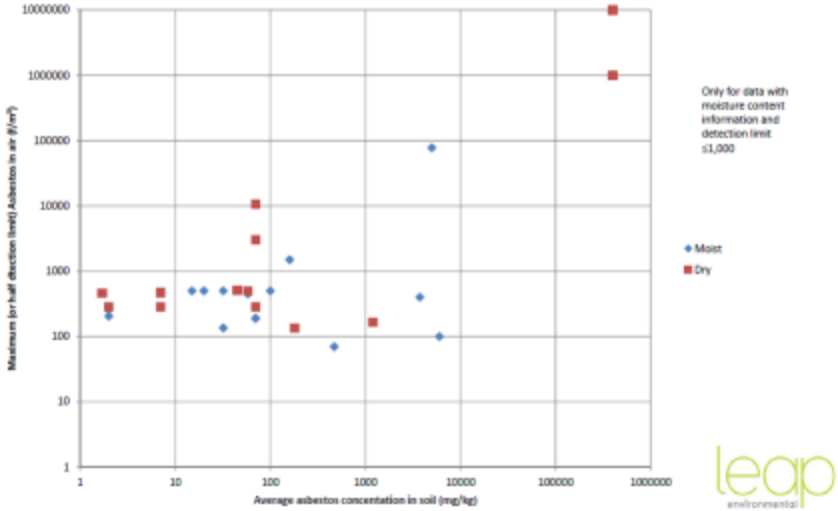


Chart D - Data by moisture content



Open access database

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SITE DESCRIPTION				
Project description	Site history / believed reason for asbestos	Site location (county)	Built environment dropdown (urban, rural)	Elevation dropdown (low or high lying)

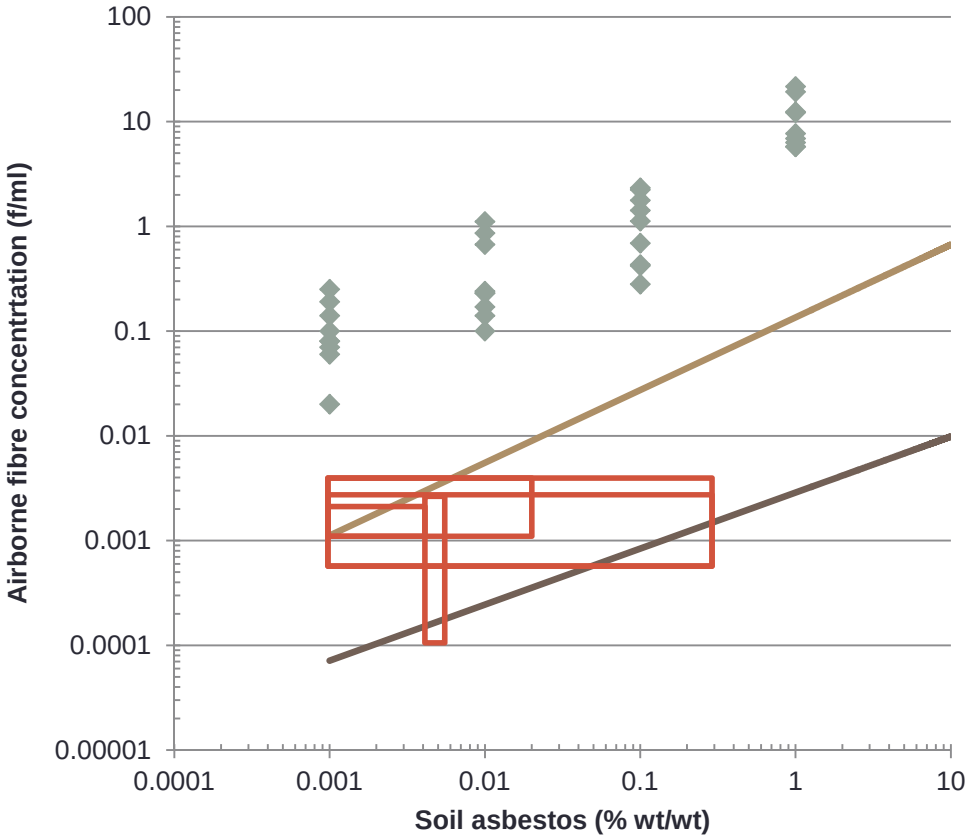
WORKS DESCRIPTION					
Brief description of works involving ground disturbance	Area of ground being disturbed (m2)	Date of fieldwork	Exposure scenario work is applicable to (dropdown of 1-6 plus a 7th for baseline)	Description of site activity during asbestos in air sampling	If none, provide details of vegetation / hardcover

METEREOLOGICAL		
Precipitation on sampling day and preceding 3 days	Wind direction and speed	Temp (oC)

SOIL DATA													
Soil data		Laboratory analysis - soil ID					Laboratory analysis - quantification						
Soil moisture content (%)	Soil type	Number analysed	Number detected	Asbestos type (dropdown)	Asbestos form (drop down)	Occurrence (discrete / dispersed, coating, lagging etc)	Number analysed	Min result (%)	Max result (%)	Mean result (%)	PCOM	SEM	

AIR DATA							DESIRABLE (data on a sample by sample basis for asbestos analysis)			
Laboratory analysis - air										
Air volume (litres)	Number of graticules counted	Min result (f/ml)	Max result (f/ml)	Mean result (f/ml)	PCOM	SEM	Asbestos in soil laboratory results	Quantification in soil result (%)	Air monitoring results (F/ml)	PM10 concentration (mg/m3)

Open access database – results so far…



Data from PCM analysis & WHO counting method

SEM data suggest 10 x lower asbestos fibre concentrations

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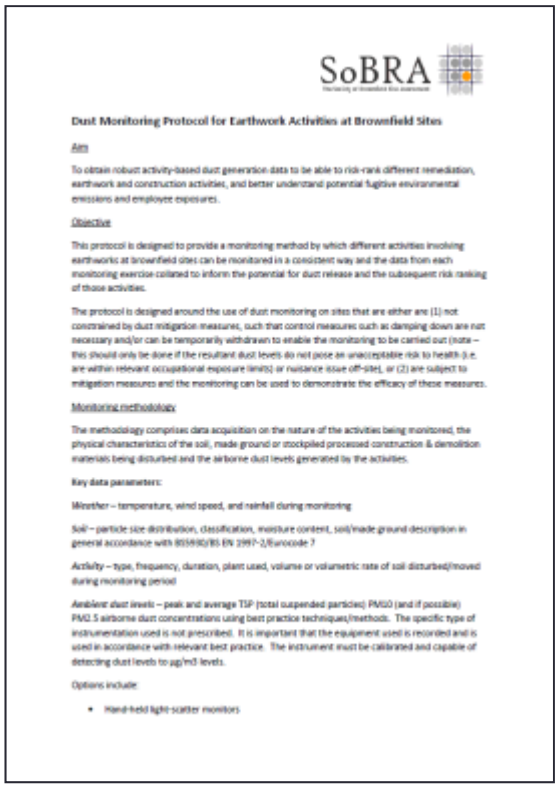
Sampling protocols – airborne dust



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Dust Monitoring Protocol for Earthwork Activities at Brownfield Sites

Aim

To obtain robust activity-based dust generation data to be able to risk-rank different remediation, earthwork and construction activities, and better understand potential fugitive environmental emissions and employee exposures.

Objective

This protocol is designed to provide a monitoring method by which different activities involving earthworks at brownfield sites can be monitored in a consistent way and the data from each monitoring exercise collated to inform the potential for dust release and the subsequent risk ranking of those activities.

The protocol is designed around the use of dust monitoring on sites that are either are (1) not constrained by dust mitigation measures, such that control measures such as damping down are not necessary and/or can be temporarily withdrawn to enable the monitoring to be carried out (note – this should only be done if the resultant dust levels do not pose an unacceptable risk to health (i.e. are within relevant occupational exposure limits) or nuisance issue off-site), or (2) are subject to mitigation measures and the monitoring can be used to demonstrate the efficacy of those measures.

Monitoring methodology

The methodology comprises data acquisition on the nature of the activities being monitored, the physical characteristics of the soil, made ground or stockpiled processed construction & demolition materials being disturbed and the airborne dust levels generated by the activities.

Key data parameters:

Weather – temperature, wind speed, and rainfall during monitoring

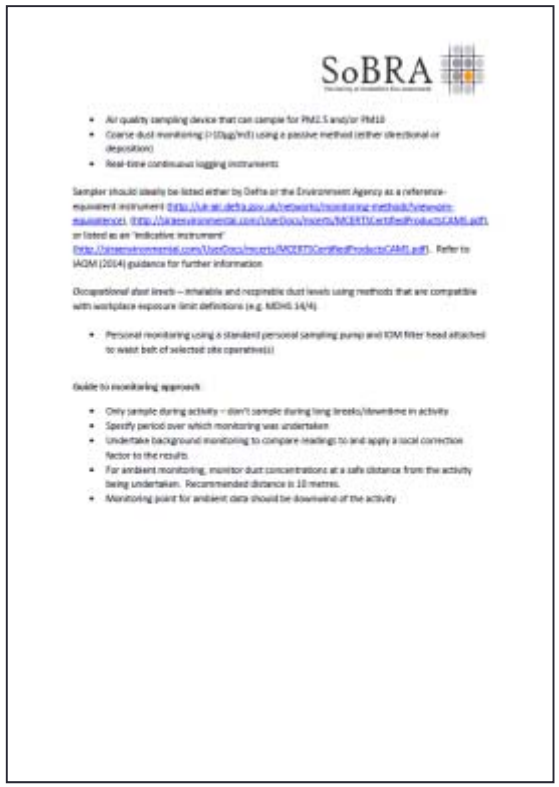
Soil – particle size distribution, classification, moisture content, soil/made ground description in general accordance with BS5930/BS EN 1997-2/Eurocode 7

Activity – type, frequency, duration, plant used, volume or volumetric rate of soil disturbed/moved during monitoring period

Ambient dust levels – peak and average TSP (total suspended particles) PM10 (and if possible) PM2.5 airborne dust concentrations using best practice techniques/methods. The specific type of instrumentation used is not prescribed. It is important that the equipment used is recorded and is used in accordance with relevant best practice. The instrument must be calibrated and capable of detecting dust levels to µg/m3 levels.

Options include:

- Hand-held light-scatter monitors



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- Air quality sampling device that can sample for PM2.5 and/or PM10
- Coarse dust monitoring (>10µg/m3) using a passive method (either directional or deposition)
- Real-time continuous logging instruments

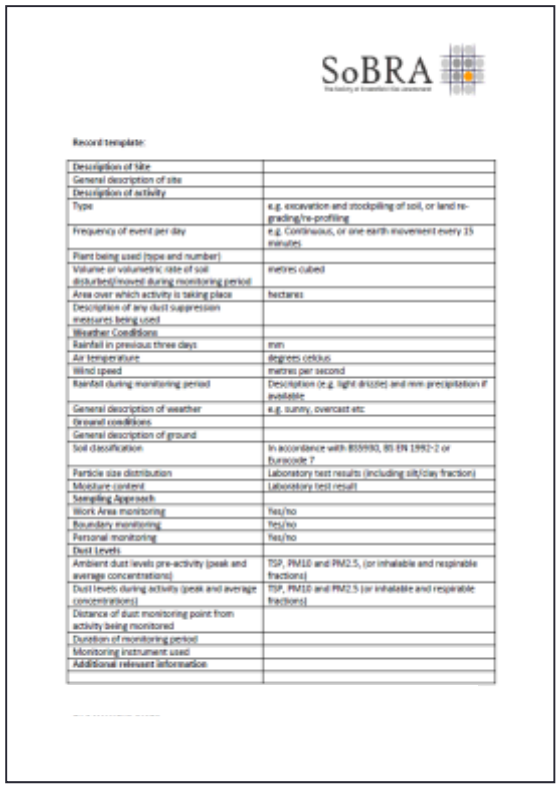
Sampler should ideally be listed either by Defra or the Environment Agency as a reference-equivalent instrument (http://uk-air.defra.gov.uk/networks/monitoring-methods?view=ref-equivalence). (http://laqmenvironmental.com/UserDocs/Inserts/MCERTSCertifiedProductsCAM1.pdf) or listed as an "indicative instrument" (http://laqmenvironmental.com/UserDocs/Inserts/MCERTSCertifiedProductsCAM1.pdf). Refer to IAQM (2014) guidance for further information

Occupational dust levels – inhalable and respirable dust levels using methods that are compatible with workplace exposure limit definitions (e.g. MDHS 14/4)

- Personal monitoring using a standard personal sampling pump and IOM filter head attached to waist belt of selected site operative(s)

Guide to monitoring approach

- Only sample during activity – don't sample during long breaks/downtime in activity
- Specify period over which monitoring was undertaken
- Undertake background monitoring to compare readings to and apply a local correction factor to the results
- For ambient monitoring, monitor dust concentrations at a safe distance from the activity being undertaken. Recommended distance is 10 metres.
- Monitoring point for ambient data should be downwind of the activity



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Record template:

Description of Site	
General description of site	
Description of activity	
Type	e.g. excavation and stockpiling of soil, or land re-grading/re-profiling
Frequency of event per day	e.g. Continuous, or one earth movement every 15 minutes
Plant being used (type and number)	
Volume or volumetric rate of soil disturbed/moved during monitoring period	metres cubed
Area over which activity is taking place	hectares
Description of any dust suppression measures being used	
Weather Conditions	
Rainfall in previous three days	mm
Air temperature	degrees celcius
Wind speed	metres per second
Rainfall during monitoring period	Description (e.g. light drizzle) and mm precipitation if available
General description of weather	e.g. sunny, overcast etc
Ground conditions	
General description of ground	
Soil classification	In accordance with BS5930, BS EN 1992-2 or Eurocode 7
Particle size distribution	Laboratory test results (including silt/clay fraction)
Moisture content	Laboratory test result
Sampling Approach	
Work Area monitoring	Yes/no
Boundary monitoring	Yes/no
Personal monitoring	Yes/no
Dust Levels	
Ambient dust levels pre-activity (peak and average concentrations)	TSP, PM10 and PM2.5, (or inhalable and respirable fractions)
Dust levels during activity (peak and average concentrations)	TSP, PM10 and PM2.5 (or inhalable and respirable fractions)
Distance of dust monitoring point from activity being monitored	
Duration of monitoring period	
Monitoring instrument used	
Additional relevant information	

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Sampling protocols – airborne asbestos fibres

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Airborne Asbestos Fibre Monitoring Protocol for Earthwork Activities at Brownfield Sites

Aim

To obtain robust activity-based airborne asbestos fibre generation data to be able to risk-rank different remediation, earthwork and construction activities, and better understand potential fugitive environmental emissions and employee exposures. (Note that it is a requirement under the Control of Asbestos Regulations 2012 (Regulation 19) to monitor airborne fibre levels if it suspected that air concentrations might exceed the control limit of 0.1 f/ml). The expectation is that most activities monitored will not meet this requirement – the purpose of this protocol is not to meet the requirements of Regulation 19.

Objective

This protocol is designed to provide a monitoring method by which different activities involving earthworks at brownfield sites can be monitored in a consistent way and the data from each monitoring exercise collated to inform the potential for asbestos fibre release and the subsequent risk ranking of these activities.

The protocol is designed to complement the associated protocol for dust monitoring, and should be undertaken in parallel to the dust protocol when possible and where asbestos is suspected to be present in soil, made ground or stockpiled processed construction & demolition materials.

Monitoring methodology

The methodology comprises data acquisition on the nature of the activities being monitored, the physical characteristics of the material being disturbed and the airborne fibre levels generated by the activities.

Key data parameters

Weather – temperature, wind speed, and rainfall during monitoring

Soil – particle size distribution, classification, moisture content, soil/made ground description in general accordance with BS5930/BS EN 1997-1/Eurocode 7

Activity – type, frequency, duration, plant used, volume or volumetric rate of soil disturbed/moved during monitoring period

Ambient fibre levels – this requires long-duration, high volume static air samplers to be deployed at a safe distance from the area of work. Samples may be taken as paired filters to reduce sampling times.

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The monitoring should be undertaken by an appropriately accredited specialist and be designed such that the method reporting limit is at least 0.0005f/ml (5000f/m3) and preferably lower.

Scanning electron microscope (SEM) analysis of the filters will be necessary to achieve the low detection limit required and will also enable asbestos fibres to be distinguished from other fibres that might be present. Laboratory turnaround times for this analysis may be in the order of 2-5 working days.

Analysis of a portion of the sample filters on-site, with a portion of the filter being retained for subsequent SEM analysis, may give a rapid, on-site indication of the effectiveness of controls and whether additional controls are required.

Occupational fibre levels – respirable fibres in accordance with HSG 248. Note that the analytical laboratory should be requested to report the calculated air concentration as well as the UKAS accredited result.

As a minimum the sampling and analysis should be in general accordance with HSG 248, using PCOM to report airborne fibre concentrations down to 0.01f/ml, but preferably to at least 0.002f/ml.

Analysis should be undertaken using the 1997 World Health Organisation (WHO) recommended method.

Real-time monitoring – where possible it would also be useful to understand the shorter temporal variability in airborne concentrations during activities. Real-time monitors are available that can provide supporting information to the ambient and occupational sample filters.

Three such monitors are:

MIE Corp MIE0500

http://www.insconi.com/products-detail.php/aerosol/model-m-7400asl-realtime-fiber-monitor

Hanley Scientific FibreCheck PC II

http://www.airtest.com.au/userfiles/file/Catalogues/Air-Met%20Catalogue%202012.pdf

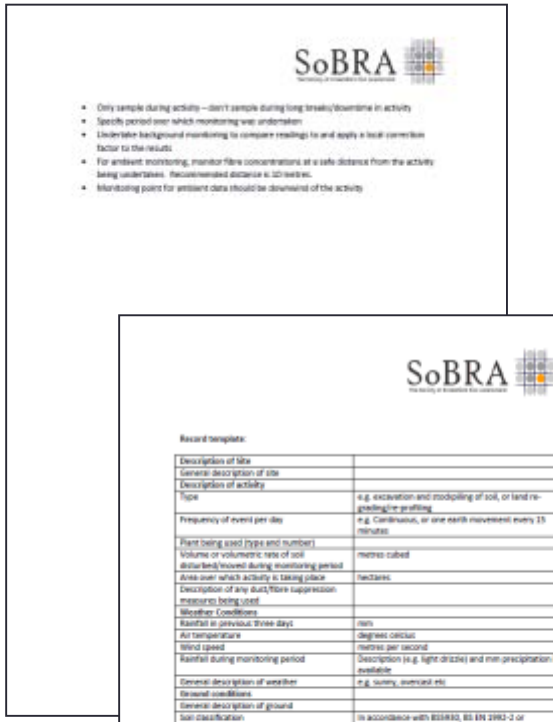
http://instanalysis.com/

http://www.demolitionnews.com/2013/04/27/uvir-unveils-updated-fibrecheck-system/

ALERT rapid asbestos detection

http://www.asbestos-alert.com/

Guide to monitoring approach



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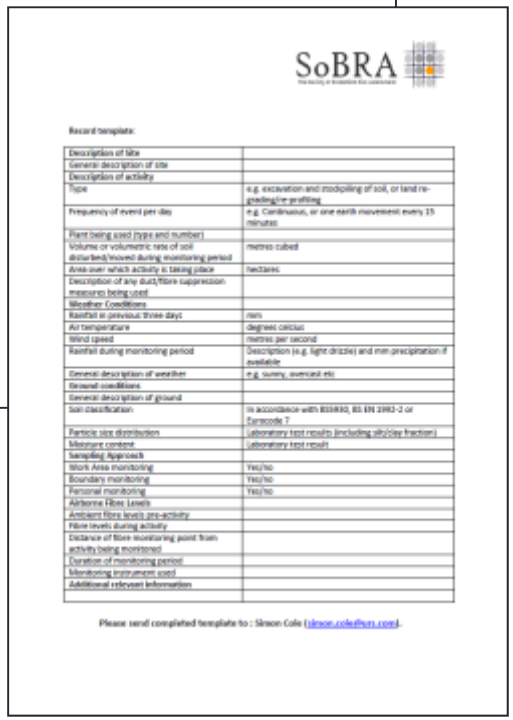

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Wind speed	metres per second
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General description of ground	
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Moisture content	Laboratory test result
Sampling Approach	
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Boundary monitoring	Yes/no
Personal monitoring	Yes/no
Airborne Fibre Levels	
Ambient fibre levels pre-activity	
Fibre levels during activity	
Distance of fibre monitoring point from activity being monitored	
Duration of monitoring period	
Monitoring instrument used	
Additional relevant information	

Please send completed template to : Simon Cole (simon.cole@urs.com).

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Soil sampling protocol

- In draft – will be available on website soon
- Soil sampling protocol focuses on importance of understanding:
  - Source of asbestos and likely pattern of distribution in soil
  - Taking of large initial samples if fragments of ACM suspected
  - Visual screening of soil and picking out of visible ACMs
  - Composite sub-sampling for smaller samples for lab analysis
  - Reality check – is sample, and therefore quantitative result, representative of relevant bulk volume of soil of interest?
- Draws on existing ICRCL, Dutch and Australian protocols

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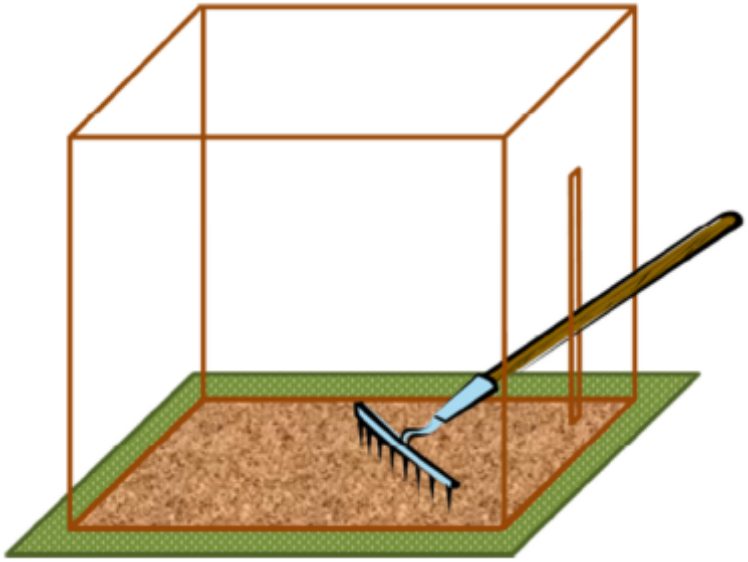
Activity-based sampling (ABS) protocol

- In draft – will be available on website soon
- Activity-based sampling protocol
  - Based on US EPA guidance for generic ABS
  - Construction of enclosure around small area of bare soil
  - Use of external high volume samplers with heads inside enclosure
  - Raking of soil from outside enclosure



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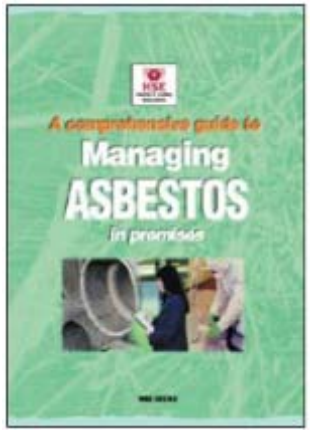
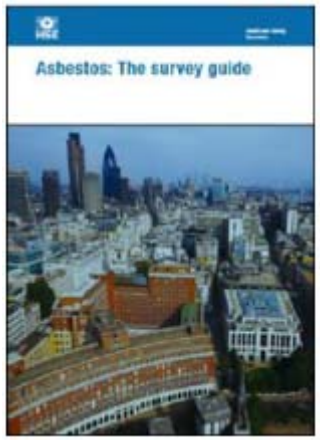
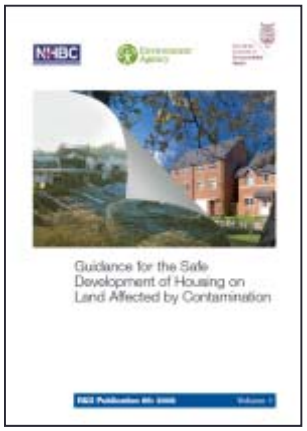
Risk algorithms

- Two sources for algorithms:
- Material and priority algorithms in HSG 227 and 264





- Qualitative risk assessment algorithms in R&D66



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HSG material and priority algorithms

- Material assessment – ease of fibre release
  - Product type
  - Extent of deterioration/damage
  - Surface treatment
  - Asbestos type
- Priority assessment – likelihood of ACM disturbance
  - Degree of disturbance (activity type)
  - Likelihood of exposure (location/accessibility of ACM)
  - Exposure potential (number of people, frequency of exposure)
- Numerical scoring system (1-3)

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JIWG risk scoring algorithm

JIWG

Joint Industry Working Group

Asbestos in Soil and Construction & Demolition Materials

Stage 1

Hazard Factors		Score
Predominant original ACM type	Textiles, paper, rope	2
Extent of deterioration	Raw (dominated by loose fibres)	4
Host material	Aggregate/ballast	4
Amount	Minor quantities	1
Asbestos Type	Chrysotile	1
Sub-total		12
Hazard ranking		Medium

No warranty, expressed or implied, or reliance, is provided in relation to the use of this tool.
It is contingent on users to statisfy themselves that the output from the tool is relevant and appropriate to the assessment being made.

Draft for consultation

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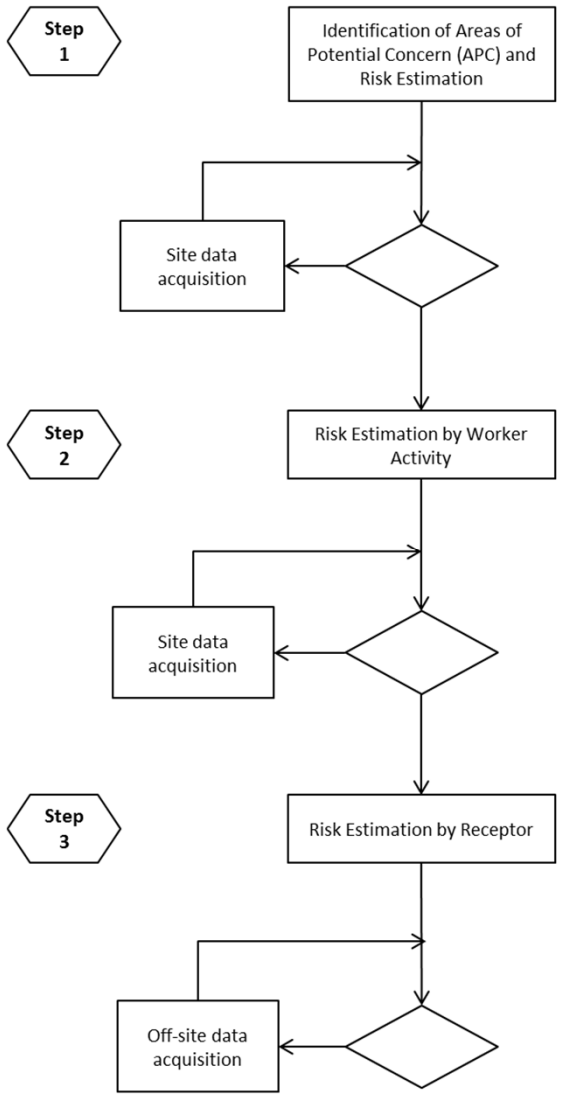
SoBRA qualitative risk assessment approach



Notes:

The site assessor must zone the site taking account of desk study and known site history information using Table 2 to estimate the residual asbestos risk and establish if further data collection is necessary

Are uncertainties acceptable taking account of risk?

The employer should consider all activities in a given APC in accordance with xxx identifying activities
- requiring mitigation; and
- any high risk activities requiring quantitative risk assessment

Quantitative assessment of exposure needed (Q_NRA)?

Annexe x of this document aims to identify the significant dust generating activities once consensus is achieved re dust emissions levels then exposure can be calculated from time and asbestos concentration.

Either to demonstrate Environmental Compliance or Quantitative assessment of exposure needed (Q_NRA)

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SoBRA qualitative risk assessment approach

		Consequence (Defined by requirement of each stage)			
		Minor	**Mild**	**Moderate**	**Severe**
Probability (Constant definition as per table 2)	**Very Unlikely**	Negligible risk	Negligible risk	Low risk	Medium risk
	Unlikely	Negligible risk	Low risk	Medium risk	Medium risk
	Possible	Low risk	Low/medium risk	Medium risk	High risk
	Likely	Low risk	Medium risk	High risk	Very high risk
	High Likelihood	Low/medium risk	Medium risk	High risk	Very high risk

Risk Descriptor	Required Primary Action	Secondary Action
Negligible risk	No mitigation measures required.	
Low risk	No mitigation measures required.	
Medium risk	Mitigation measures mandatory. Q_LRA mandatory.	Qualitative EMMP mandatory.
High risk	Mitigation mandatory. Q_NRA advised.	Quantitative EMMP mandatory
Very high risk	Mitigation and receptor Q_NRA mandatory.	Quantitative EMMP mandatory

*·Mitigation = site actions and PPE ¶
*·Q_LRA = Qualitative Risk Assessment ¶
*·Q_NRA = Quantitative Risk Assessment ¶
*·EMMP = Environmental Monitoring and Management Plan ¶

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SoBRA qualitative risk assessment approach

Table 1A APC Risk Estimation

		Site Risk by APC			
		Negligible	Low	Medium	High
Predicted Probability of Residual Asbestos	Very Unlikely	Negligible risk	Negligible risk	Low risk	Low/medium risk
	Unlikely	Negligible risk	Low risk	Medium risk	Medium risk
	Likely	Low risk	Low/medium risk	Medium risk	High risk
	Possible	Low risk	Medium risk	High risk	Very high risk
	High Likelihood	Low/medium risk	Medium risk	High risk	Very high risk

Table 1B Risk Descriptor and Required Actions by APC

Risk Descriptor	Required Primary Action	Secondary Action
Negligible risk	No further Assessment	
Low risk	No further Assessment	
Medium risk	Additional Data collection mandatory Activity Assessment Advised (QLRA)	Site reporting and asbestos control plan Mandatory
High risk	Additional Data collection mandatory Activity Assessment mandatory.	Site reporting and asbestos control plan Mandatory
Very high risk	Additional Data collection mandatory Activity Assessment mandatory.	Site reporting and asbestos control plan Mandatory

1. High Risk sites

Reason: These sites have high levels of energy generation and or fire protection e.g. large hospital site with multiple buildings

Asbestos Works
Chemical Works
Dockyards
Ship Yards
Oil refineries
Power Stations
Hospitals (suspected large scale boiler plant)
Disposal and Recycling Sites (uncertain history)
Metal Recycling sites

4. Negligible Risk Sites

Reason - Sites with no plausible expectation that asbestos would be present

Green space
Commercial Sites where only low levels of ACM might be expected <0.001% by strata

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Table 2A Estimation of "Significance of the Risk" by activity

		Consequence			
		Minor	**Mild**	**Moderate**	**Severe**
Probability of dust release from activity	**Very Unlikely**	Negligible risk	Negligible risk	Low risk	Medium risk
	Unlikely	Negligible risk	Low risk	Medium risk	Medium risk
	Possible	Low risk	Low/medium risk	Medium risk	High risk
	Likely	Low risk	Medium risk	High risk	Very high risk
	High Likelihood	Low/medium risk	Medium risk	High risk	Very high risk

Table 2BA Risk Descriptor and Required Actions

Risk Descriptor	Required Primary Action	Secondary Action
Negligible risk	No mitigation measures required.	
Low risk	No mitigation measures required.	
Medium risk	Mitigation measures mandatory.	Qualitative EMMP mandatory
High risk	Mitigation and Receptor QLRA mandatory	Quantitative EMMP mandatory
Very high risk	Mitigation and Receptor QLRA mandatory	Quantitative EMMP mandatory

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SoBRA qualitative risk assessment approach

- **Step 3 Assessment of Potential Receptor Impact**
- **1. Identify a list of vulnerable offsite receptors and consider probability of dust release impacting those identified**
- **¶**
- **Table 3A Estimation of "Significance of the Risk" by receptor type**

		Consequence			
		Minor	**Mild**	**Moderate**	**Severe**
Probability of dust impacting each vulnerable receptor	**Very Unlikely**	Negligible risk	Negligible risk	Low risk	Medium risk
	Unlikely	Negligible risk	Low risk	Medium risk	Medium risk
	Possible	Low risk	Low/medium risk	Medium risk	High risk
	Likely	Low risk	Medium risk	High risk	Very high risk
	High Likelihood	Low/medium risk	Medium risk	High risk	Very high risk

Table 3B Risk Descriptor and Required Actions

Risk Descriptor	Required Primary Action	Secondary Action
Negligible risk	No mitigation measures required.	
Low risk	No mitigation measures required.	
Medium risk	Mitigation measures mandatory. Q_LRA mandatory	Quantitative EMMP advised
High risk	Mitigation and Receptor Q_NRA mandatory	Quantitative EMMP mandatory.
Very high risk	Mitigation and Receptor Q_NRA mandatory	Quantitative EMMP mandatory.

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Supporting information

Effect of soil moisture

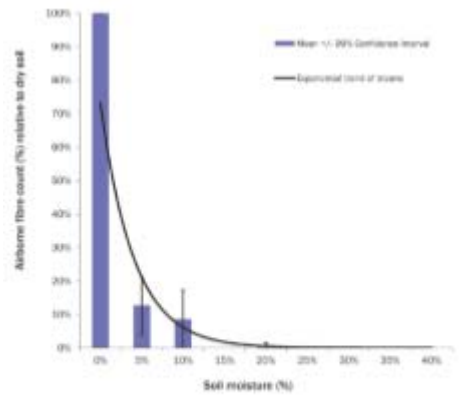

Figure 9.7 *Indicating the potential reductions in airborne fibre count with increasing soil moisture (from Table 4.3, Addison et al, 1988)*

Figure 9.7 from CIRIA C733

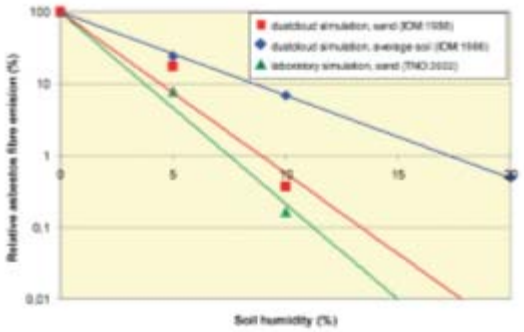

Figure 4. Relative airborne asbestos fiber emission during several simulation experiments with soil with a different level of humidity (data from Tromp, 2002; Addison et al., 1988).

Figure 4 from Swartjes & Tromp, 2008

Effect of ACM matrix and fibre type

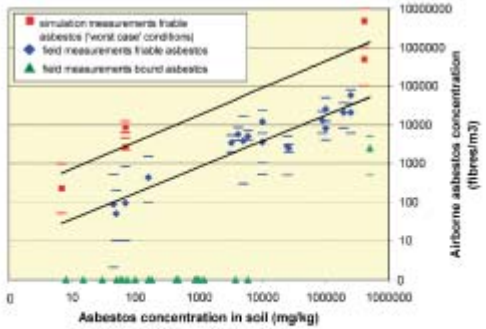

Figure 2. Average airborne asbestos concentrations from several comparable measurements (*symbols*) in fibers/m$^3_{air}$ and 95% confidence intervals (*hyphens*), from *worst case* simulation experiments (*squares*) and from field measurements with friable (*diamonds*) and bound (*triangles*) asbestos, as a function of asbestos concentration in soil. Straight lines represents the 95% confidence intervals of all data.

Figure 2 from Swartjes & Tromp, 2008

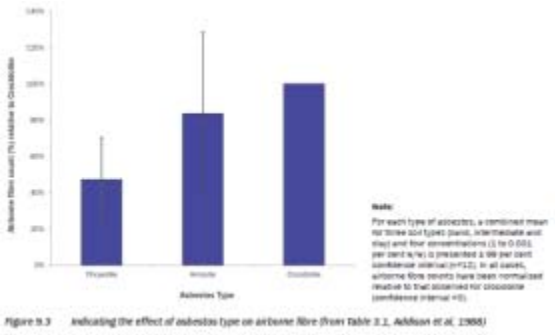

Figure 9.3 *Indicating the effect of asbestos type on airborne fibre (from Table 3.1, Addison et al, 1988)*

Figure 9.3 from CIRIA C733

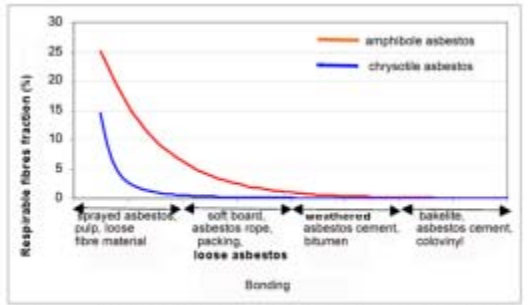

Figure 2.1 Respirable asbestos fibres fraction for amphibole and chrysotile asbestos according to bonding. [Estimates are based on soil analyses carried out by TNO over the last ten years.]

Figure 2.1 from RIVM, 2003

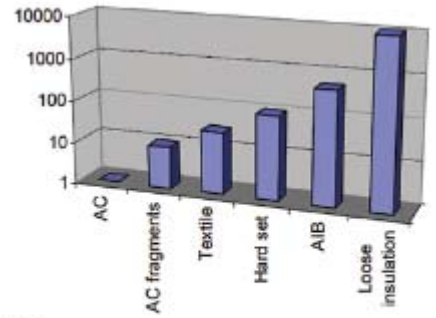

Figure 9.5 *Relative release of PCM fibres in dustiness tests for different types of asbestos-containing materials*

Figure 9.5 from CIRIA C733

What's next…

- Examples of exposure estimates and risk estimation for common scenarios
- Better understand QRA options
- Provide material for debate on what generic numbers might look like

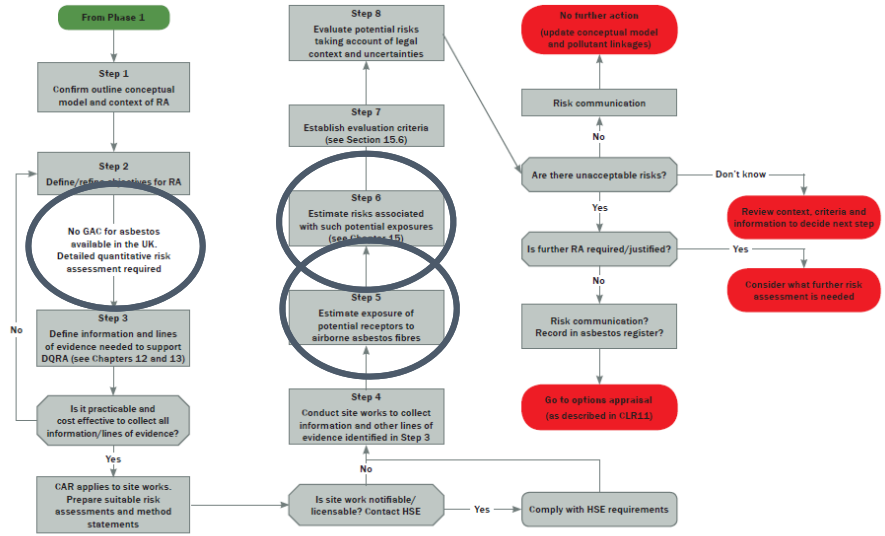

Figure 2.2 Flowchart of a risk estimation and risk evaluation process

Figure 2.2 from CIRIA C733

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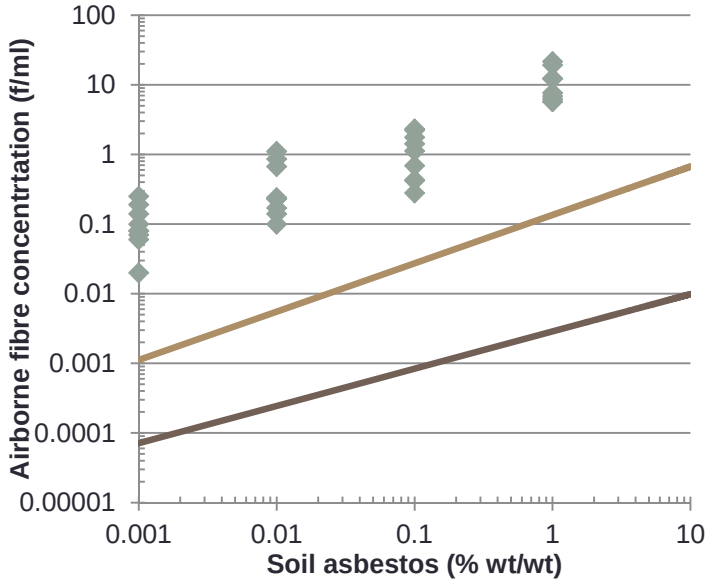
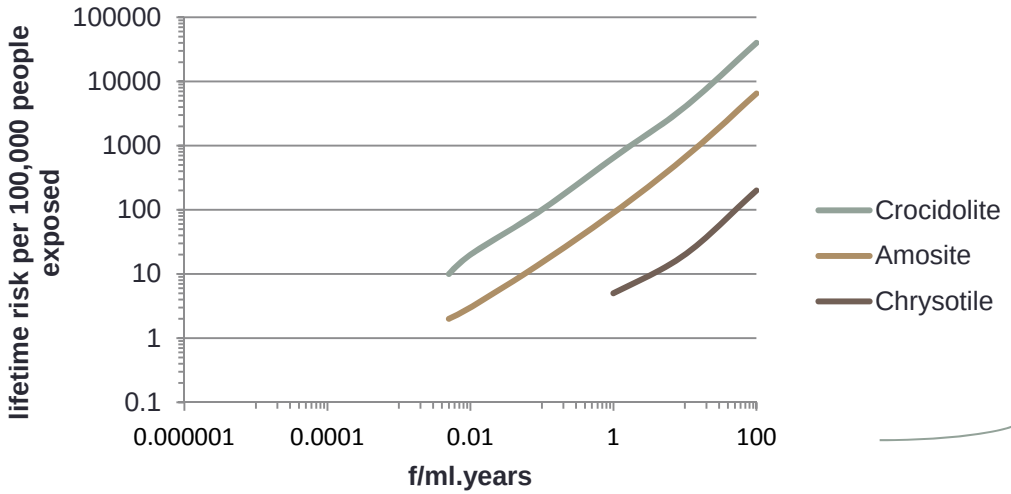
Examples of using empirical relationships





e.g. CIRIA C733 Box 13.3

Exposure calcs:

0.1%wt/wt amosite in soil

0.1f/ml per mg/m^3 dust

0.1mg/m^3 dust

=0.01f/ml exposure concentration

6yr childhood exposure:

=0.0027f/ml.years

Risk estimate:

2 in 100,000

Age adjustment 6.6

=13 in 100,000

If exposure extended for entire childhood at property:

=38 in 100,000

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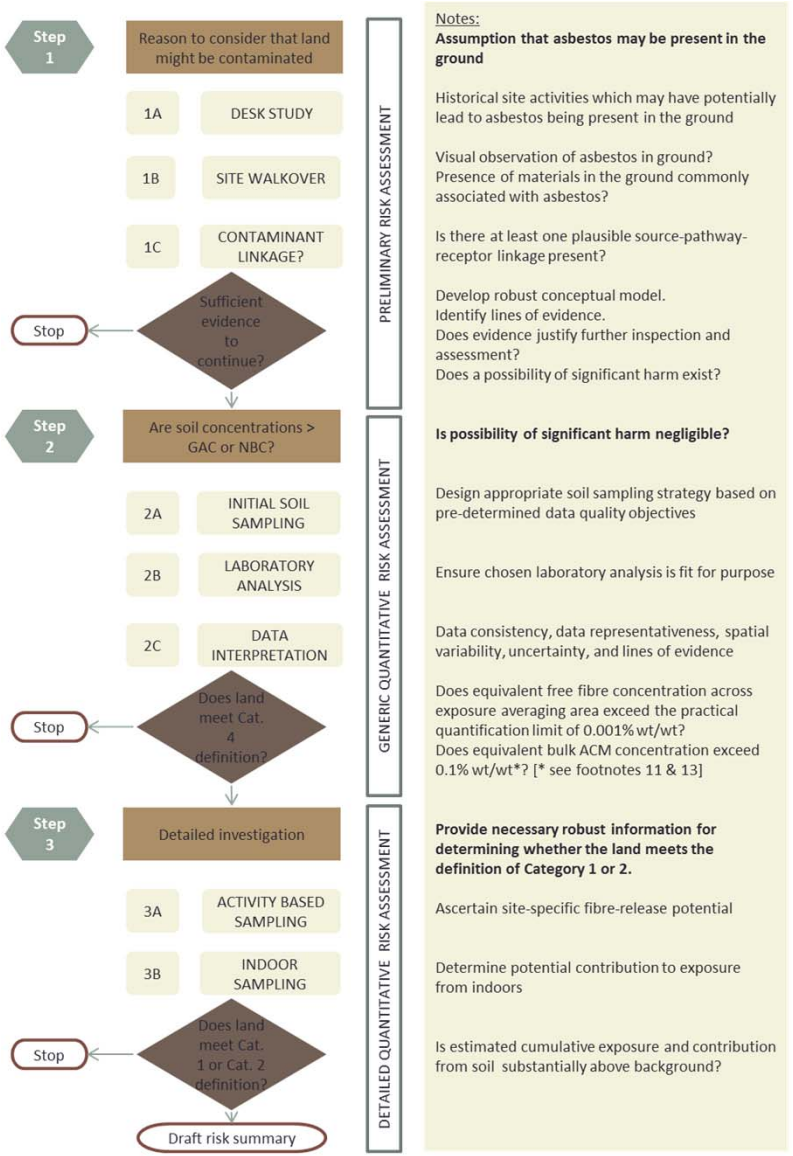
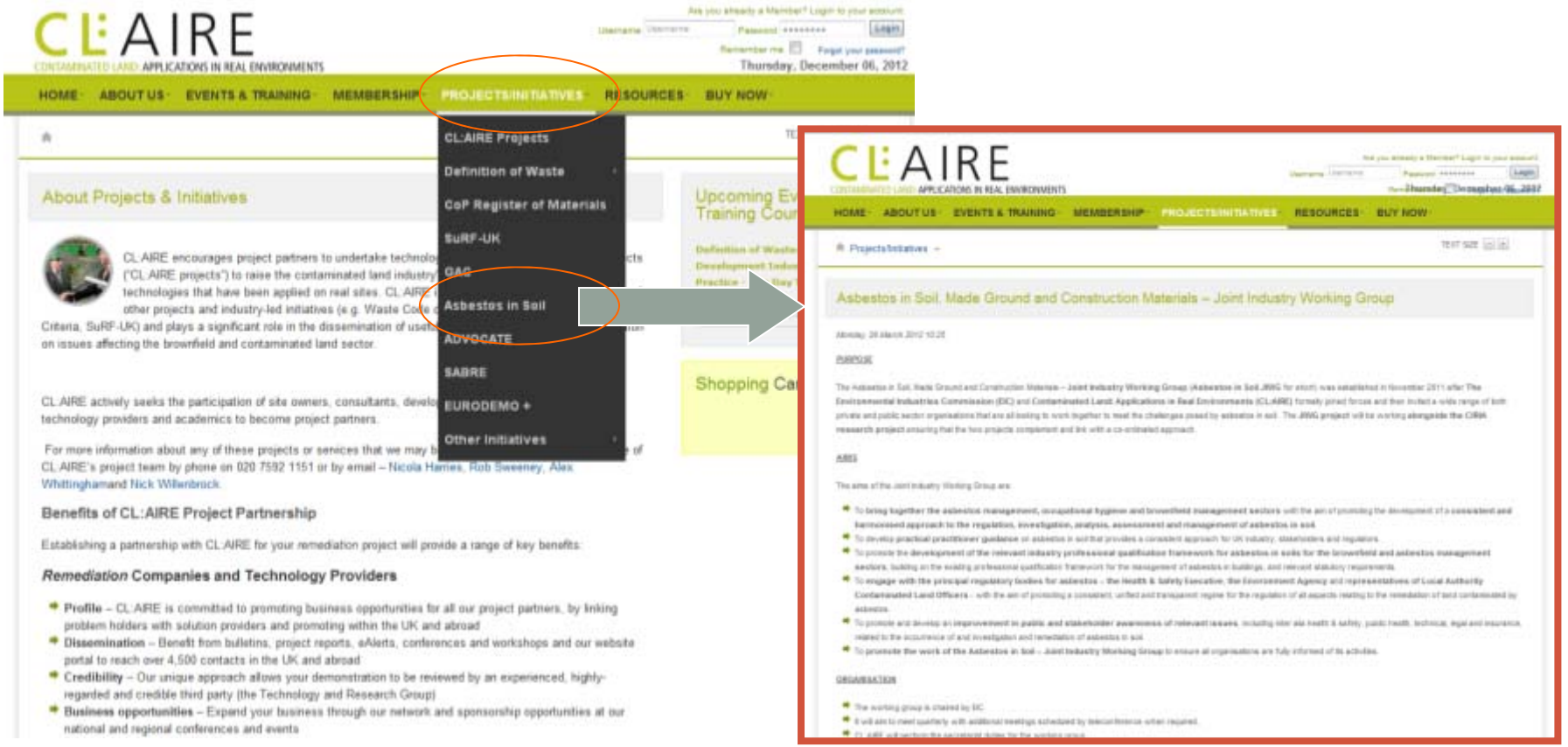
Example for chrysotile cement

Key assumptions:

- 0.001%wt/wt free fibre in soil LOD acceptable for 24/7 CLEA household dust exposure
- RIVM data suggests that at 1% AC in soil, airborne fibre <LOD
- Maximum respirable fibre content in AC is 0.1% (RIVM)
- Adopt 0.1% wt/wt threshold on precautionary basis
- Equates to ~ 100 4cm^2 fragments per m^3 of soil



Access to information



www.claire.co.uk/asbestos

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Access to information

http://www.sobra.org.uk/resources/

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Thank you

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