

Acute Risks

Health Risks from Short-term Exposure to Soil Contamination

UPDATE

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Acute GAC sub-group

- Objectives:
 - Develop methodology to derive generic assessment criteria protective of acute health effects from short-term exposure (AGAC) for various acute exposure scenarios
 - Test methodology on example contaminants
- Participants:
 - Barry Mitcheson (Wood) – subgroup manager
 - Simon Firth (Firth Consultants)
 - Tim Rolfe (AECOM)
 - Gareth Wills (WSP)
 - Sarah Bull (WRC)
 - Steven McMullen (WSP)
 - Lauren Boydell (Wood)
 - Geoff Hood (Jacobs)
 - Sarah Dack (Public Health England)
 - David Schofield (Ramboll) – Executive Committee champion

Contents

- Acute vs chronic risks
- Proposed methodologies for deriving GAC for short-term exposure
- Acute risk scenarios considered

Why consider acute?

- Most human health risk assessments focus on chronic risks arising from long-term exposure to specific substances
 - E.g. CLEA model compares average daily exposure, averaged over long duration (one or more years), with health based guidance value for chronic health effects
- In some cases averaging infrequent exposure over a long period or using average exposure to apply to a large area make acute risks more significant than chronic risks
 - Or assessment of “hotspots” or localised areas?
 - E.g.. risks to Construction workers?

C4SL Limitations

- “...risks arising from acute exposure may be of particular concern for C4SLs derived for the commercial and park-type public open space (POSpark) land-uses, as these C4SLs can be relatively high for some contaminants and they could pose an acute risk to young children who are assumed to be the critical receptors. “
- This may also be a specific issue for contaminants whose screening criteria for residential land-use are driven by the inhalation exposure pathway, since this pathway 100 has little relevance to POSpark and C4SLs are consequently much higher for this land-use than residential or indeed, POSresi, as illustrated by the pC4SLs derived for POSpark for chromium (VI) and benzene, which are 10 and >200 times higher, respectively, than the pC4SLs for residential land-use.

Quick Reminder

Outputs

- Subgroup has developed methodology to derive Acute Generic Assessment Criteria (AGAC) for contaminants in soil
- AGAC intended to be used as part of Generic Quantitative Risk Assessment (GQRA) and represent the soil concentrations below which acute risks to human health are acceptable
- Algorithms have been developed to calculate AGAC for various short-term exposure scenarios

Overview of methodology

- Overall approach to derivation of AGAC:
 - Step 1: Toxicity screening - which exposure scenarios could be of potential concern for the contaminant
 - Step 2: Collation and selection of relevant acute toxicity reference values
 - Step 3: Use of relevant algorithms to calculate AGAC
 - Step 4: Sense check AGAC

Screening of substances

Consider using hazards codes

Ingestion

- H300: Fatal if swallowed
- H301: Toxic if swallowed
- H302: Harmful if swallowed
- H303: May be harmful if swallowed
- H304: May be fatal if swallowed and enters airways
- H305: May be harmful if swallowed and enters airways

Dermal contact

- H310: Fatal in contact with skin
- H311: Toxic in contact with skin
- H312: Harmful in contact with skin
- H313: May be harmful in contact with skin
- H314: Causes severe skin burns and eye damage
- H315: Causes skin irritation
- H316: Causes mild skin irritation
- H317: May cause an allergic skin reaction

Inhalation

- H330: Fatal if inhaled
- H331: Toxic if inhaled
- H332: Harmful if inhaled
- H333: May be harmful if inhaled
- H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled
- H335: May cause respiratory irritation
- H336: May cause drowsiness or dizziness

This is complex particularly for metals (e.g. what form is arsenic in?)

Currently considering a reasonable worst case substance approach (as used for waste)

Definitions and discussion

Lots of one-off assessment have been made but currently there is no agreed methodology or standardisation of parameters.

- **What timescale is acute?**

We have chosen one-off dose, a single day or a half hour period trial pitting

- **What level of harm should be considered?**

Based on hazard statements

- harmful and toxic?
- what about odours?

- **Occupational exposure versus exposure by general public?**

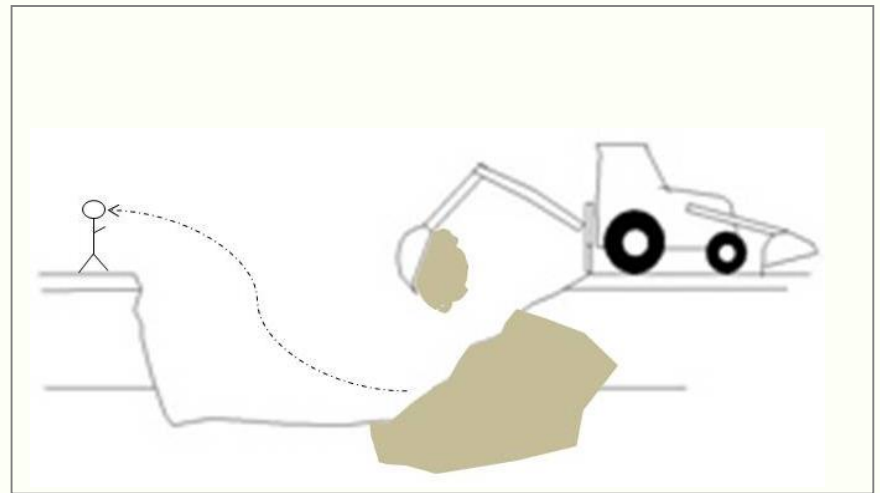
Acute risk scenarios considered

- Oral exposure
 - Child resident/trespasser - ingests single bolus of soil (soil pica)
 - Adult worker (e.g. ground worker) – incidental ingestion of soil (via hand to mouth contact, smoking, eating, biting nails etc.) over an 8hr shift
- Dermal exposure
 - Child resident/trespasser – soil on skin for up to a few hours
 - Adult worker (e.g. ground worker) – soil on skin for up to a few hours



Acute risk scenarios considered

- Inhalation exposure
 - Member of public – inhalation of dust/vapours released during excavation from near-by site
 - Adult worker (e.g. ground worker) – inhalation of dust/vapours released during excavation



Reference Concentrations in Air for Acute Exposure

- Worker scenario
 - Workplace exposure limits (WELs) – EH40/2005
 - Use short-term limit (15 minute exposure) where available
 - If not, EH40 recommends use of 3 x long-term exposure limit
- Child scenario (member of public)
 - Acute exposure guideline levels (AEGs)
 - AEG1 – Receptor could experience notable discomfort, irritation – reversible effects
 - AEG2 – Irreversible or other serious long-lasting adverse health effects
 - AEG3 – Risk of death

Caveats

- **Fire and explosion** - The methodology is based on health risks not the acute effects arising from explosive or fire risks.
- **Odour effects** - In some cases odours themselves can lead to effects such as headaches and nausea etc. These are not specifically assessed in the current methodology.
- **Complex pathways** – e.g.. Migration of vapours into building following a storm event (similar to methane)
- **Free product** - The assessment is focussed on soil bound substances not free product which can behave quite differently (and for instance can lead to skin damage due to defatting the skin)
- **Legal duties** - Irrespective of the results of the acute risk assessment users should remain aware of their duties to ensure that the compliance (e.g. Control of lead and Works act or asbestos regs.) and the need to minimise risk under the health and safety legislation.
- **Verification** – The use of the AGAC should not replace monitoring to confirm the risks.

Progress

Lead

- The AGAC approach does not address the prediction of short term blood lead concentrations from soil
- Sub Acute exposure may be important
- Some non-soil examples cited for reference

AGACs Child

		Child			Comparison with Chronic GACs	
		Oral	Dermal	Inhalation	Residential without plant uptake	Public open space
Benzene	mg/kg	47	>Csat	232	0.89-3.3	140-230
Arsenic	mg/kg	Under review	Not estimated	Under review	40	79-170
Cadmium	mg/kg	Under review	Not estimated	Under review	150	220-880
Hexavalent Chromium	mg/kg	Under review	Under review	Under review	21	21-250
Phenol	mg/kg	Under review	*Not estimated	Under review	440-1200	440-3200
Vinyl chloride	mg/kg	Not estimated	Not estimated	Under review	.00077-0.0015	3.5-5.4
Cyanide	mg/kg	Under review	Under review	Under review	-	-

AGACs Adult Construction Worker

		Adult AGAC			Comparison with Chronic GACs
		Oral	Dermal	Inhalation	Commercial
Benzene	mg/kg	4113	>Csat	463	27
Arsenic	mg/kg	Under review	Not estimated	Under review	7350
Cadmium	mg/kg	Under review	Not estimated	Under review	410
Hexavalent Chromium	mg/kg	Under review	Under review	Under review	49
Phenol	mg/kg	Under review	*reference to SGV Report and 3200mg/kg (based on a solution)	Under review	440 -1300
Vinyl chloride	mg/kg	Not estimated	Not estimated	Under review	0.059 -0.12
Free Cyanide	mg/kg	Under review	Not derived	Under review	-

Initial Observations

1. Oral exposure is often the risk driver for children.
2. For POS GACs values potentially of similar order to acute risk values for a 10kg child ingesting a bolus dose of 5g. Should this be considered? (See Caveat from C4SLs)

Why?

- ~200x Difference in ingestion for POS Park
 - Chronic Child ~0.05 g/day for 170days – average ~0.023g/day
 - Acute bolus dose ~5g
- For substances where oral route is the driver, if Acute RFD in mg/kgbw is less than ~ 200 x LLTC/TDI in mg/kgbw/day acute may be a driver for POS park

Chronic doses RFD are generally lower than acute but are they more than 200 times lower?

3. Under review

Current Status and Next steps

- Toxicity review and sense check in process
- Report undergoing review
- Finalise report
- Publish SoBRA report

Thanks for listening