

## Assessing Acute Exposure

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## Introduction

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- SR3 (CLEA Technical Background document) Disclaimer (EA, 2009a):  
*"The CLEA Guidance does not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures."*
- Other references to acute exposure (and it not being addressed in the CLEA model) are within the sections on soil ingestion and dust inhalation.
- This talk focuses on assessing risks from acute soil ingestion only.
- Basis for discussion only!

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## Soil Ingestion – Background Concepts

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- SR3 distinguishes between "normal" inadvertent soil ingestion, occasional deliberate soil ingestion (also considered "normal") and "pica", which is defined as follows:
  - *"A psychopathological condition that refers to the persistent and purposeful consumption of soil, often in relatively large quantities (World Health Organisation, 1990)"*
- Earlier CLEA document (CLR 10) also referred to "geophagia"

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## Soil Ingestion – Background Concepts (cont)

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- Many risk assessment methodologies (including CLEA) use assumed soil ingestion rates which may exclude, or not account for, pica.
- SR3 page 94:
  - *"There are many types of psychopathological behaviour that can affect adults and children, and where it is considered that protective measures are necessary they are best decided and implemented on an individual basis. Soil pica has therefore not been included in the soil and dust ingestion rates for children and adults."*
- CLEA default rates for chronic combined soil and dust ingestion exposure are 100 mg/day for children and 50 mg/day for adults

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## Acute Soil Ingestion

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- US EPA (cited in SR3) has suggested that:
  - Pica is characterised by recurring ingestion of at least 1-5 g/day
  - Relatively rare, approx 1 child in >600
  - One child in a case study showed a mean ingestion rate of 5-6 g/day and range of 0.074-13.6 g/day
- Calabrese (1997) mentions that 25-60 g/episode has been observed

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## Acute Soil Ingestion (cont)

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- SR3 page 94:
  - "However, where separate short-term effects from exposure to contamination are known, it is advisable for the risk assessor to consider a one-off high soil ingestion rate, when deriving site-specific assessment criteria (Calabrese et al., 1997a). USEPA (2006) concluded that an ingestion rate of 10 g day<sup>-1</sup> may not be unreasonable in assessing risks to children with pica behaviour."

## Possible Approach to Risk Assessment

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- Incorporate a higher soil ingestion rate in exposure algorithm or model. Examples (in addition to previous slide) include:
  - SNIFFER Framework, 1<sup>st</sup> Edition – Annex 7 (not in 2<sup>nd</sup> edition):
    - 2 g/episode
  - Calabrese, 1997:
    - 5, 25 and 50 g/episode
  - US EPA, 2008:
    - Pica = 1 g/day
    - Geophagy = 50 g/day
- Use appropriate body weight (eg. 10kg for a toddler)
- Use appropriate toxicity value (needs to be based on an acute study – human data if possible), with appropriate uncertainty factors
- Incorporate bioaccessibility considerations, as appropriate
- "Acute Generic Assessment Criteria" (AGACs)?

## Possible Approach to Risk Assessment (cont)

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$$AGAC = ATV \times BW / AIR$$

Where:

AGAC =	acute generic assessment criterion (mg/kg)
ATV =	acute toxicity value (mg/kg-day)
BW =	body weight
AIR =	acute soil ingestion rate

## Illustrative Example - Cadmium

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- Acute (single oral intake) human data:
  - No Observed Effect Level (NOEL) estimated at 3 mg (EFSA, 2009)
  - Lethal dose reported to range from 350 mg to 8900 mg (EFSA, 2009)
- Could use NOEL and convert to an acute toxicity value of 0.043 mg, by assuming an adult (70 kg) body weight and no uncertainty factor?

## Illustrative Example – Cadmium (cont)

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Current SGVs (EA, 2009b):

Land use	Soil Guideline Value (mg kg <sup>-1</sup> DW) <sup>1,2,3,4</sup>
	Cadmium
Residential	10
Allotment	1.8
Commercial	230

## Summary and Conclusions

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- Acute exposure not included in current version of CLEA model.
- Abnormally high deliberate soil ingestion (pica) thought to occur in approximately 1 in >600 children
- Estimates of potential pica soil ingestion rate range from 1 to 5 g/day (with some evidence that higher rates can occur due to geophagy)
- One possible risk assessment approach is relatively straightforward and could be used to derive "acute generic assessment criteria" (AGACs)
- Consider possible acute soil ingestion exposure where "high" SSACs derived?
- Consider possible acute soil ingestion exposure when interpreting site data using statistics?
- Relevance to Planning and Part 2A?
- Basis for discussion only!

## References

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## Thanks for listening!

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