APPLYING THE RESEARCH – WHAT REMAINS TO BE TACKLED

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What do we have?

- C4SL research report + appendices:
  - Detailed consideration of uncertainties involved in derivation and use of screening criteria
  - Development and justification of a methodology to derive C4SL
  - Provisional C4SLs for 6 substances + 6 land-uses
- Companion policy document from Defra
  - Gives policy steer on the choices/options given in research document
  - Gives C4SL for 6 substances + 6 land-uses
    - 2 new land-uses (POS)
    - C4SL for 3 substances with no SGV (BaP, CrVI, lead)

What remains to be tackled?

- C4SL use
  - How/where should they be used?
- C4SL for other substances
- Considerations for DQRA
- Further research on key areas to refine knowledge based on robust data

C4SL use

- Can help classify a site as Category 4 for human health
- Subject to same use limitations as SGV/GAC, e.g.
  - Do not assess all possible s-p-r linkages involving humans
  - Do not assess acute risks
  - LLTC (and HCV) based on potential for significant harm occurring to humans and not on other effects (such as odour/phytotoxicity)
- Represent a risk that is higher than “minimal”
  - Risk of adverse effects occurring to site users/occupants is still low

C4SL for other substances

- Published SGV/GAC exist for ≈ 120 substances
- SGV/GAC can still work effectively as conservative screening criteria as part of a GQRA
  - Note that all generic screening values should be subject to periodic check for up-to-date chemical specific data
- C4SL are beneficial for substances where SGV/GAC are frequently exceeded
  - Not many remaining substances (without C4SL) where this is the case, which are they?
- GAC for POS could easily be derived using C4SL POS assumptions

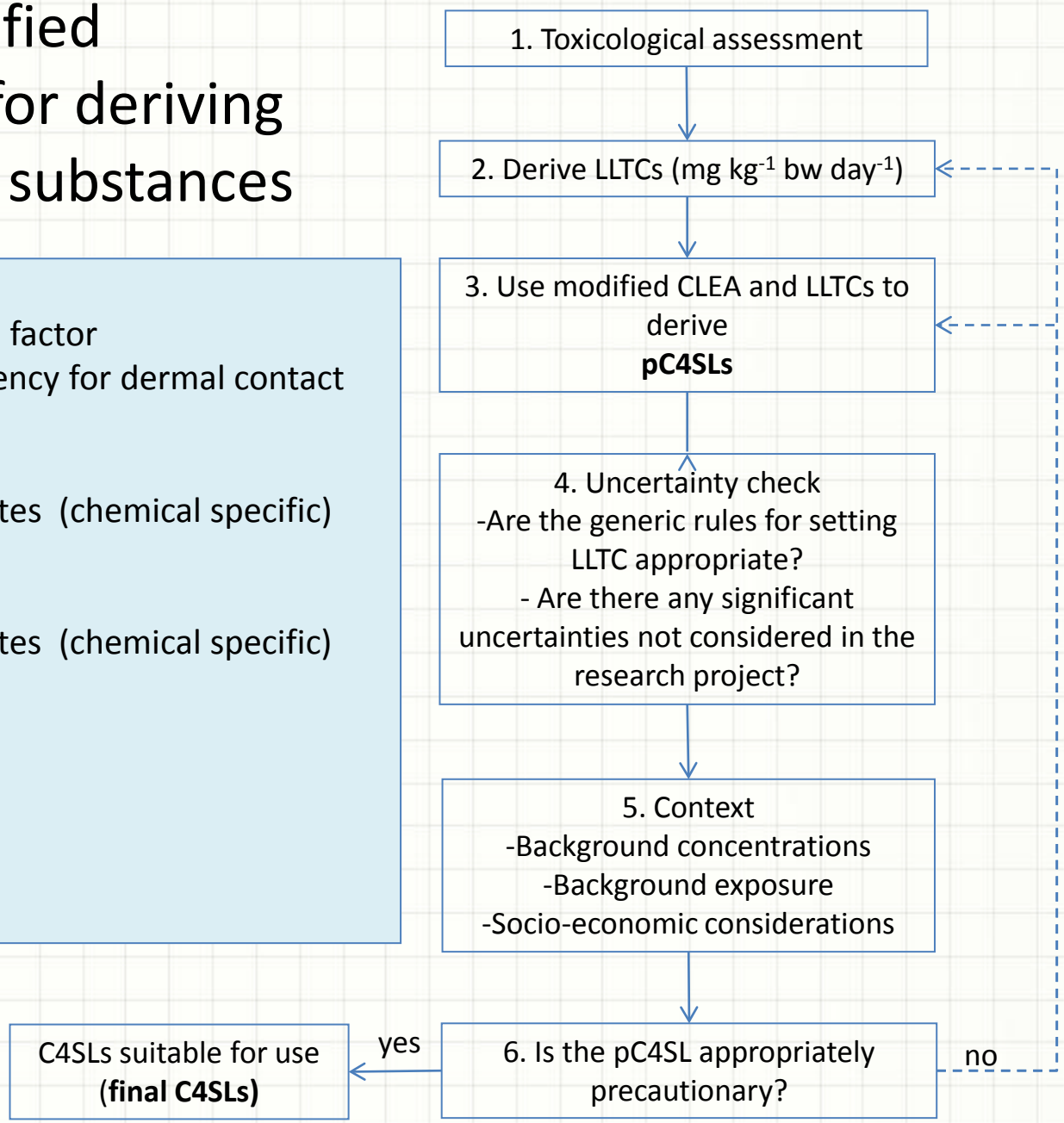
Possible simplified methodology for deriving C4SL for other substances

Residential
-Reduced soil adherence factor
-Reduce exposure frequency for dermal contact outdoors
-Update inhalation rates
-Update consumption rates (chemical specific)

Allotments
-Update consumption rates (chemical specific)

Commercial
-Update inhalation rates

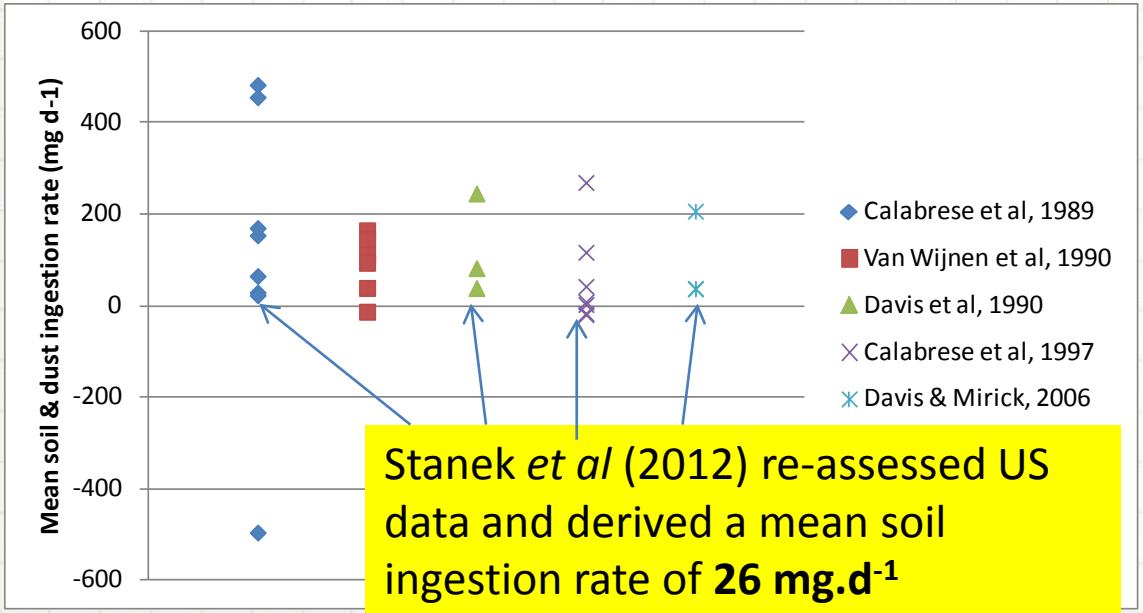
POS parameters
- POS_{resi} + POS_{park}



Considerations for DQRA

- Research unpicks key aspects of modelling that could prove useful to DQRA

E.g. soil ingestion rates

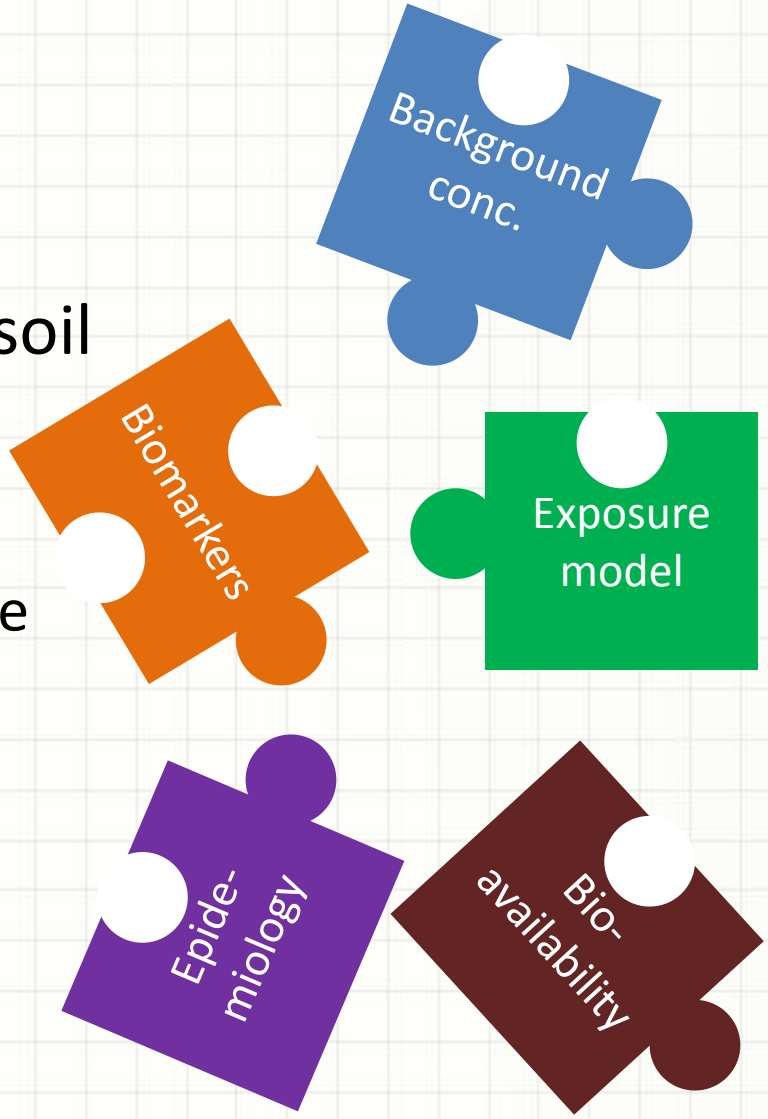


Stanek *et al* (2012) re-assessed US data and derived a mean soil ingestion rate of **26 mg.d^{-1}**

- Probabilistic modelling highlights the range/distribution in exposures that might occur
  - helpful to think of likelihood of model underestimating exposure

Further research

- Further research to better understand relationship between concentrations in soil and risk to health
  - Exposure modelling
  - Use of biomarkers to estimate exposure
  - Health impacts from land contamination
- Prioritise research on key areas of concern
  - Where can we achieve greatest benefit?



Soil ingestion

- Key exposure pathway for Resi, Commercial and POS land-uses for non volatile compounds

Data gaps

- Soil ingestion rates based on limited datasets from USA and Netherlands, conducted in summer months
- Some evidence that ingestion of soil derived dust indoors << ingestion of soil outdoors

Ongoing/Potential research

- Not aware of any soil ingestion studies being conducted in the UK, or studies that represent seasonal changes in behaviour

Consumption of homegrown produce

- Key pathway for allotments land-use

Data gaps

- High degree of uncertainty in the amount of homegrown produce consumed and soil to plant concentration factors

Ongoing/Potential research

- Homegrown fraction based on 2004/5 expenditure survey (fraction of household fruit/veg obtained for free). Still valid? Is HF set to increase?
- FSA study on soil to plant concentration factors for metals in Devon/Cornwall – required for other areas?

Surveillance/Biomarkers

- Would be useful to know 'normal' levels of human exposure i.e. lead, arsenic

Previous research

- Millennium cohort study (Child of the new century)
  - Centre for longitudinal studies Institute of Child Health
  - ~ 18800 children
  - Investigated child development, cognitive ability, demographic info
- Every tooth tells a story project (~ 3013 children)
  - Investigated lead build-up in children's teeth and environmental lead concentrations in different regions
    - 13 % of families live in lower than average areas (19-37 mg/kg)
    - 70 % live in average areas (38-47 mg/kg)
    - 17 % live in higher than average areas (>48 mg/kg)

Surveillance/Biomarkers

- Surveillance of lead in children study (SLIC)
  - BPSU, HPA (PHE)
  - To investigate the incidence of elevated blood lead concentrations ≥10µg/dl in children
  - To report the proportion of cases where a lead source was identified and to describe these sources

Surveillance/Biomarkers

- Arsenic in Leicester
  - As in hair, urine and toenails
  - Effect of ethnicity and diet
  - Toenails appear to be a sensitive biomarker of exposure
- Devon Great Consols, Cornwall
  - As in soil
  - Bioaccessible fraction
  - As in hair, urine and toenails
  - As in toenails much higher in participants living near DGC
- Arsenic in private drinking water supplies
  - As in private water supplies (5.5 % exceeded 10 µg/L)
  - As in soil, household dust, and foodstuffs
  - As in hair, urine and toenails

Biomarkers

Potential research

- Compare tooth lead levels in children from regions of high and low lead?
- Correlate tooth levels to blood levels?
- Investigate As in toenails in regions of high arsenic and compare with data from Leicester?
- Investigate soil As levels in DGC and correlate with toenail levels?

Epidemiology

- Used as a ‘reality check’ i.e. compare C4SL against data from regions with associated epidemiology data

Previous research

- Shipham, Avonmouth and Worcestershire for cadmium
- Glasgow for chromium VI
- Weston for HCBD
- FERA report SP1002, 2009. Potential health effects of contaminants in soil
  - *Overall, there is no evidence for widespread impacts of contaminated land on human health. Equally, the potential for health impacts has not been dismissed.*

Epidemiology

- Bambra et al (2014). Healthy land? An examination of the area-level association between brownfield land and morbidity and mortality in England
  - *A significant and strong, adjusted, area-level association was found between brownfield land and morbidity*
  - *Brownfield land could potentially be an important and previously overlooked independent environmental determinant of population health in England*
- Morrison et al (2014). An initial assessment of spatial relationships between respiratory cases, soil metal content, air quality and deprivation indicators in Glasgow, Uk: relevance to the environmental justice agenda
  - *Relationship between soil nickel and respiratory cases*
  - *Significant correlation between soil metal concentration and deprivation*
  - *Causal links between soil quality and population health/well being??*

Epidemiology

Potential research

- Population epidemiology study of health effects in areas with known contaminants
  - BGS NBC data
  - Biomarker data
  - SAHSU health data
  - Office for National Statistics data
  - Hospital episodes statistics

Thank you

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