

The Superfund Basic Research Program: Consulting Community Perspective on Research Needs

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SBRP External Advisory Committee Meeting
Durham, NC

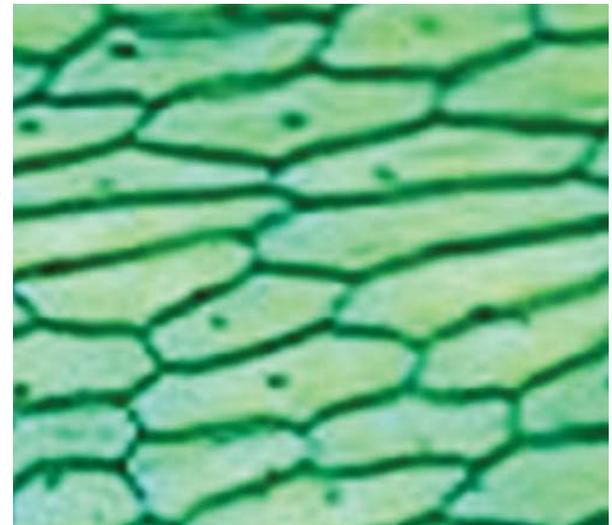
January 19, 2009

Overview

- Improve precision of dermal exposure assessment
- Refine bioavailability of chemicals in soil and sediment
- Refine methods to model/measure concentrations of chemicals in indoor air
- Conduct research on practicality of increased use of epidemiologic (human) data in toxicity assessment
- Conduct research concerning pharmaceuticals and personal care products in the water supply
- Refine statistical and sampling methods for determining exposure point concentrations

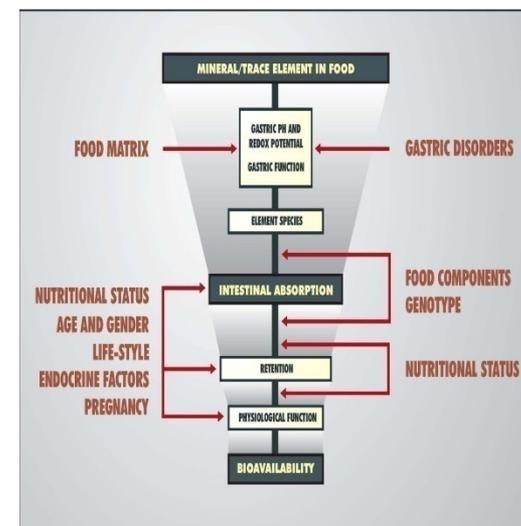
Improve the precision of dermal exposure assessment

- Problems with current procedures
 - Complex pathway
 - Different EPA programs assess exposure differently (see EPA (2007))
 - Limited understanding of dermal penetration, transfer efficiency, skin loading, time/location/activity info
- Research needs
 - For chemicals in water: K_p estimates for lipophilic compounds (e.g., PCBs, dioxins); re-examine Flynn data base
 - For chemicals in soil: effect of soil composition (e.g., carbon, moisture, particle size) on skin loading
 - Dermal exposure assessment for contaminated surfaces: types of contaminants, transfer rates, time-activity patterns
 - Effects of clothing



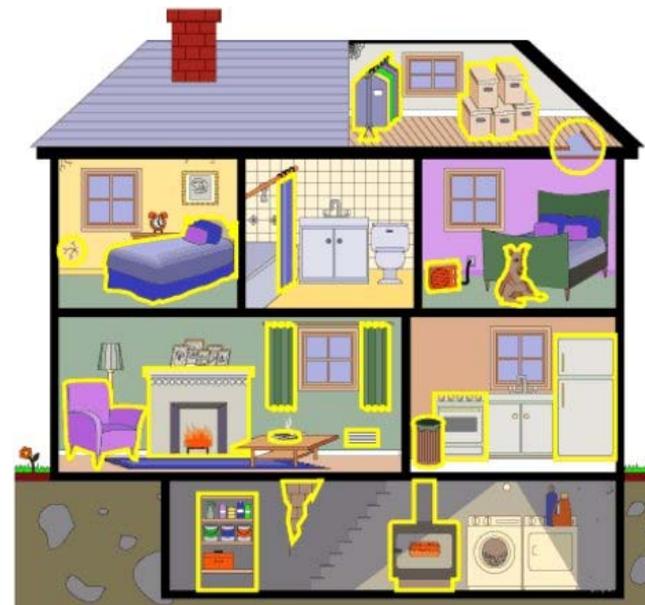
Refine bioavailability of chemicals in soil and sediment

- Problems with current procedures
 - Use of “neat” or aqueous solutions rather than environmentally relevant matrices (e.g., soil or sediment)
 - Physiologically relevant animal models?
- Research needs
 - Pulmonary bioavailability
 - Estimates from sediment – assume same as soil?
 - Estimates of mixtures
 - Primate studies
 - Use of radiolabels (e.g., Maibach et al. studies with benzene)
 - *In vitro* methods development/refinement



Refine methods to model/measure concentrations of chemicals in indoor air

- Problems with current procedures
 - Conservatism of J & E model
 - Lack of baseline studies
 - Lack of unobtrusive/ multipurpose personal air sampling gear
 - Lack of health effects data for chemicals at indoor air concentrations
- Research needs (EPA 2005)
 - Baseline studies – more chemicals, additional indoor environments
 - Personal air sampling equipment
 - Dose-response studies
 - Health effects studies for mixtures



Conduct research on practicality of increased use of epidemiologic (human) data in toxicity assessment

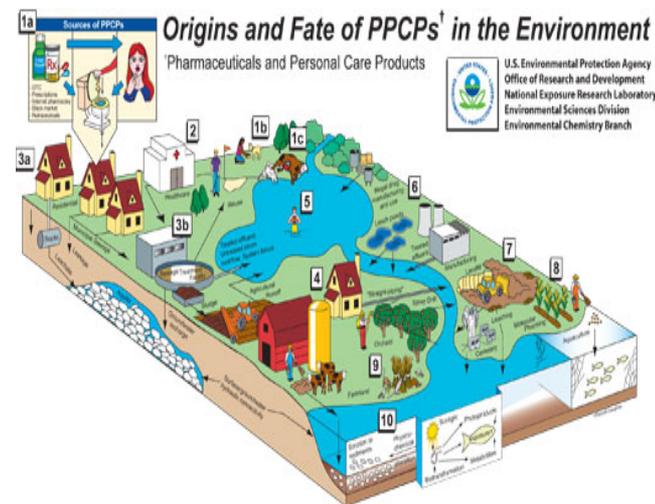
- Problems with current procedures
 - Preponderance of use of animal data as the basis for RfDs and CSFs
 - Species/low-dose extrapolation
 - Metabolism/toxicokinetics
 - Anatomy/physiology
- Research needs
 - Focus on common Superfund site chemicals: dioxins, PAHs, PCBs
 - Literature review/analysis to assess adequacy of epi data for modified toxicity factor development
 - Meta analysis
 - Epi studies of facilities with robust IH data (e.g., refineries)
 - Simulation studies



Conduct research concerning pharmaceuticals and personal care products in the water supply

- Problems with current procedures
 - Many sources: prescription and OTC meds, hospital waste, veterinary/agribusiness waste
 - Environmental persistence of PPCPs
 - Ability to detect extremely low concentrations
 - Perception of effects

- Research needs
 - Analytical methods for detection
 - Fate and transport
 - Health effects at environmentally relevant concentrations
 - Ecological exposure and effects



Refine statistical and sampling methods for determining exposure point concentrations

- Problems with current procedures
 - Lots of methods – which is appropriate for Superfund sites?
 - Many methods require extensive (costly) sampling
 - Are the bounds of uncertainty too large with current methods?
- Research needs
 - Advanced statistical methods – e.g., advanced robust kriging
 - Gy sampling methods/theory (Gerlach et al. 2002)
 - Software development to support new/advanced methods – “Scout”



References

- Gerlach, R.W., D.E. Dobb, and G.A. Raab. 2002. Gy sampling theory in environmental studies 1: Assessing soil splitting protocols. *Journal of Chemometrics* 16(7):321-328.
- Modjtahedi, B.S and H.I. Maibach. 2008. In vivo percutaneous absorption of benzene in man: Forearm and palm. *Food Chem Toxicol.* 46(3):1171-1174.
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