

Assessing exposure to contaminants to air - How does exposure produce health effects?



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Aim of brief presentation

- Briefly offer a medical diagnostic type commentary to complement the exposure material circulated beforehand
- Add to the workshop some medical insights about why exposure is a risk to health



Acute and chronic effects

- Acute

- Rapid or immediate
- Occasionally symptom onset delayed by days
- Single exposure poss
- Usually higher conc
- Need short exposure measurement periods

- Chronic

- Develop over time or delayed onset
- Repeated or ongoing exposure
- Effects at conc lower than acute effects
- Longer averaging period for exposure measurement



How to identify medically relevant exposure?

- What? physical, chemical, biological nature?
- Where? which human social environment?
- How much? amounts present over a time period?
- How often? repeatability and chronicity?
- For whom? Community and personal characteristics, including prior and other exposures?



What is medically relevant exposure?

- Contact and absorption
 - Skin
 - Respiratory
 - Gastrointestinal
- Once absorbed, fate in body
 - Organ for effects



What is medically relevant exposure?

- Contact and absorption
 - Skin
 - Respiratory
 - Eyes, mucous membranes
 - Nasal passage
 - Bronchial airways
 - Alveoli (lungs)
 - Gastrointestinal
 - Mouth, throat
 - Stomach
 - Intestine
 - Liver



What is medically relevant exposure?

- Contact and absorption
- Once absorbed,
 - Circulatory or lymphatic transport
 - Metabolism
 - Excretion
 - Retention
- Organ for effects



What is medically relevant exposure?

- Organ for effects
 - Direct contact eg skin, respiratory
 - Indirect through transport eg brain
 - Indirect through contact with excretion including metabolites eg kidney and bladder
- Onset of effects can be delayed, even from brief exposure



Individual susceptibility

- Fixed characteristics eg gender, genetic type
- Age related - not actually often this
- Existing disease that modifies organ reaction
- Interaction of susceptibilities eg allergy and irritant substance
- Prevent effects through changed reaction to contaminant - nutrition or medication
- Prior exposure
- Physiology at time - eg exercise, hydration



Individual susceptibility

- Children with asthma
- Elderly
- Pregnant
- Chronic respiratory condition
- Undernourished
- Etc
- etc



A case example for data pattern & health effects

Table 3: Statistics for 24-hour avg. equivalent H₂SO₄ concentration at various discrete receptors around the site. ⁺

Statistic	Receptor Number [#]					
	1	2	3	4	5	6
mean	0.04	0.17	0.11	0.39	0.11	0.25
median	0.00	0.01	0.01	0.11	0.01	0.01
maximum	1.2	2.1	1.4	3.5	1.1	5.2



Comparison information for interpretation

Table 1: Relevant ambient guidelines for H₂SO₄

Organisations that recommended the guidelines	Year the guideline was published	Recommended guideline values for H ₂ SO ₄
Ontario Ministry of the Environment (Ontario MOE)	2006	1-hour average: 1 µg/m ³ 24-hour average: 150 µg/m ³
World Health Organisation (WHO)	1987	10 µg/m ³ *

* The WHO 1987 AAQG value is not limited to a set time period (i.e. 1-hour or 24-hour). The subsequent WHO guideline (2000) did not include an update of the section for H₂SO₄.



Exposure time periods

- Measurement issue
- Comparison issue
- Type of effects and relevance issue
- Statistical issue



Health effects

- Develop over varying periods of time
- Develop in some people
- Develop sometimes but not others in same person
- Care with exposure measurement can assist understanding and reduction of risk

