Assessing exposure to contaminants to air - How does exposure produce health effects?
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 possible
  ▪ 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. *

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Receptor Number#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>mean</td>
<td>0.04</td>
</tr>
<tr>
<td>median</td>
<td>0.00</td>
</tr>
<tr>
<td>maximum</td>
<td>1.2</td>
</tr>
</tbody>
</table>
## Table 1: Relevant ambient guidelines for H₂SO₄

<table>
<thead>
<tr>
<th>Organisations that recommended the guidelines</th>
<th>Year the guideline was published</th>
<th>Recommended guideline values for H₂SO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario Ministry of the Environment (Ontario MOE)</td>
<td>2006</td>
<td>1-hour average: 1 µg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24-hour average: 150 µg/m³</td>
</tr>
<tr>
<td>World Health Organisation (WHO)</td>
<td>1987</td>
<td>10 µg/m³*</td>
</tr>
</tbody>
</table>

* 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