Heavy Oil, Odours, and Your Health
… Just the facts, please!
… One year later

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Topics

- Background
- The sense of smell
- Odours, annoyance and symptoms
- The “Odour Complaint Pyramid”
- Mechanisms
- Closing remarks
Background

• July 2013 – AER announces plans for a public inquiry into odours and emissions from heavy oil operations in the Peace River area.

• October 2013 – AER hosts organizational meeting to define scope of the proceeding.


• March 2014 – Panel issues report and recommendations.

• April 2014 – AER issues response to recommendations.

Background

• Panel concluded that …
  • there is no obvious prospect for the health of residents to be adversely affected from the direct toxic effects of chemicals in the emissions when exposed on a short-term basis.
  • heavy oil operations are causing odours in the area and that these odours have the potential to cause some of the symptoms of area residents. Therefore, the Panel finds that odours need to be eliminated to the extent possible.
How we smell things
Factors affecting the sense of smell …

- Genetics
- Age
- Gender
- Health status
- Level of awareness
- Experience with particular odour(s)
- Sensitivity
- Regularity of odour
- Personal circumstances and living conditions
Odours, annoyance and health effects

• Mounting evidence of a link between odours and health effects.

• Sources of odour complaints include: municipal landfills, waste treatment lagoons, sewage treatment plants, tanneries, pulp & paper mills, refineries, land-spreading operations, hog farms, sour gas operations …and heavy oil operations.

• Chemical “culprits” include: ammonia, H₂S, mercaptans, RSCs, VOCs, aldehydes, ketones, aromatic hydrocarbons.
## Odour detection thresholds

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Odour Detection Threshold (ppm)</th>
<th>Average</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethyl mercaptan</td>
<td>0.001</td>
<td></td>
<td>0.0000000000051 – 0.56</td>
</tr>
<tr>
<td>Methyl mercaptan</td>
<td>0.002</td>
<td></td>
<td>0.0000087 – 18</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>0.01</td>
<td></td>
<td>0.00040 – 1.4</td>
</tr>
<tr>
<td>Naphthalene (mothballs)</td>
<td>0.1</td>
<td></td>
<td>0.0013 – 0.086</td>
</tr>
<tr>
<td>Dimethyl disulphide</td>
<td>0.2</td>
<td></td>
<td>0.00029 – 1.5</td>
</tr>
<tr>
<td>Acetic acid (vinegar)</td>
<td>0.5</td>
<td></td>
<td>0.0004 – 200</td>
</tr>
<tr>
<td>1,3-Butadiene (rubber)</td>
<td>1.6</td>
<td></td>
<td>0.10 – 2.6</td>
</tr>
<tr>
<td>Toluene (model airplane glue)</td>
<td>2.9</td>
<td></td>
<td>0.021 – 270</td>
</tr>
<tr>
<td>Ethylene glycol (automotive coolant)</td>
<td>5.1</td>
<td></td>
<td>0.046 – 0.39</td>
</tr>
<tr>
<td>Ammonia</td>
<td>5.2</td>
<td></td>
<td>0.043 – 60</td>
</tr>
<tr>
<td>Acetone (nail polish remover)</td>
<td>13</td>
<td></td>
<td>0.40 – 4,200</td>
</tr>
<tr>
<td>Methanol (windshield washer fluid)</td>
<td>100</td>
<td></td>
<td>3.1 – 200,000</td>
</tr>
</tbody>
</table>
Odours, annoyance and health effects

- Combination of physical, psychological and sensory symptoms.
- Many subjective in nature.
- Commonality of effects across different studies.
- Likelihood of symptom reporting subject to many influences …
  - Personal attitudes
  - Personal circumstances
  - Socio-economic status
  - Level of education
  - Coping behavior
  - Concern over the environment
- Odours may trigger fear of chronic illnesses
# Summary of Odour-Induced Symptoms

<table>
<thead>
<tr>
<th>Physical/Neurological</th>
<th>Psychological</th>
<th>Sensory Irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Irritability</td>
<td>Sinus congestion</td>
</tr>
<tr>
<td>Nausea</td>
<td>Feeling angry</td>
<td>Runny nose</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Feeling depressed</td>
<td>Nose irritation</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Feeling anxious</td>
<td>Scratchy throat</td>
</tr>
<tr>
<td>Muscle aches</td>
<td>Worried feeling</td>
<td>Dry throat</td>
</tr>
<tr>
<td>Joint pain</td>
<td>Feeling panicky</td>
<td>Sore throat</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>Loss of energy</td>
<td>Throat irritation</td>
</tr>
<tr>
<td>Sweating</td>
<td>Crying</td>
<td>Phlegm production</td>
</tr>
<tr>
<td>Constipation</td>
<td>Negative mood</td>
<td>Watery eyes</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Tension</td>
<td>Tearing of the eyes</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Confusion</td>
<td>Stinging of the eyes</td>
</tr>
<tr>
<td>Stomach ache</td>
<td>Feeling of embarrassment</td>
<td>Dryness of the eyes</td>
</tr>
<tr>
<td>Heartburn</td>
<td></td>
<td>Eye irritation</td>
</tr>
<tr>
<td>Loss of appetite</td>
<td></td>
<td>Cough</td>
</tr>
<tr>
<td>Abdominal bloating</td>
<td></td>
<td>Redness of the skin</td>
</tr>
<tr>
<td>Memory problems</td>
<td></td>
<td>Itchiness of the skin</td>
</tr>
<tr>
<td>Disorientation</td>
<td></td>
<td>Earaches</td>
</tr>
</tbody>
</table>
Mechanisms

- Conventional toxicological reaction
- Multiple Chemical Sensitivity
- Behavioral sensitization
- Psychosomatic reactions to stress
- Mass psychogenic illness
- Odour annoyance
Mechanisms
Odour annoyance

• The higher the level of annoyance … the higher the number of complaints … the higher the likelihood of reports of health effects.
• The “Odour Complaint Pyramid” … or FIDOL
The Odour Complaint Pyramid

Complaint

- Frequency
- Intensity
- Duration
- Odour Character
- Location

Odour Episode
Things can escalate ...
Confounders

• Subject bias
• Reporting bias
• Subjective nature of symptoms
• Lack of differential diagnoses
• Many determinants other than odour
• Personalities
So, what are the facts?

• Mounting evidence of a possible connection between odours and health effects.
• Reported symptoms represents a combination of physical and psychological effects.
• Frequency of symptom reporting dependent on a number of factors, including personal circumstances and attitudes.
So, what are the facts?

- Symptoms more common when odours are foul, intense, occur regularly, and linger.
- Several mechanisms have been proposed to explain the connection.
- Odour annoyance-mediated mechanism is gaining favour.
- Sensory irritation is plausible and explainable.
What about heavy oil emissions and odours?

“Heavy oil operations are causing odours in the area and that these odours have the potential to cause some of the symptoms of area residents. Therefore, the Panel finds that odours need to be eliminated to the extent possible”.
Questions?