

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

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CPANS Edmonton Lunch Presentation  
April 10, 2015



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# Topics

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



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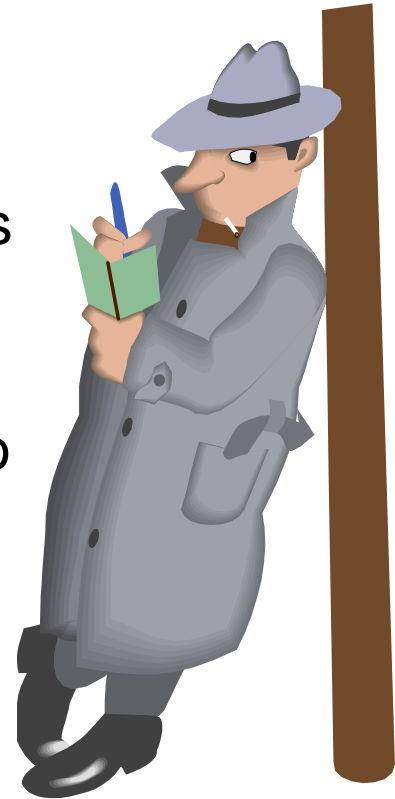
# Background

- 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.
- January 2014 – AER convenes public inquiry in Peace River.
- March 2014 – Panel issues report and recommendations.
- April 2014 – AER issues response to recommendations
- June 2014 – AER issues Hydrocarbon Odour Management Protocol

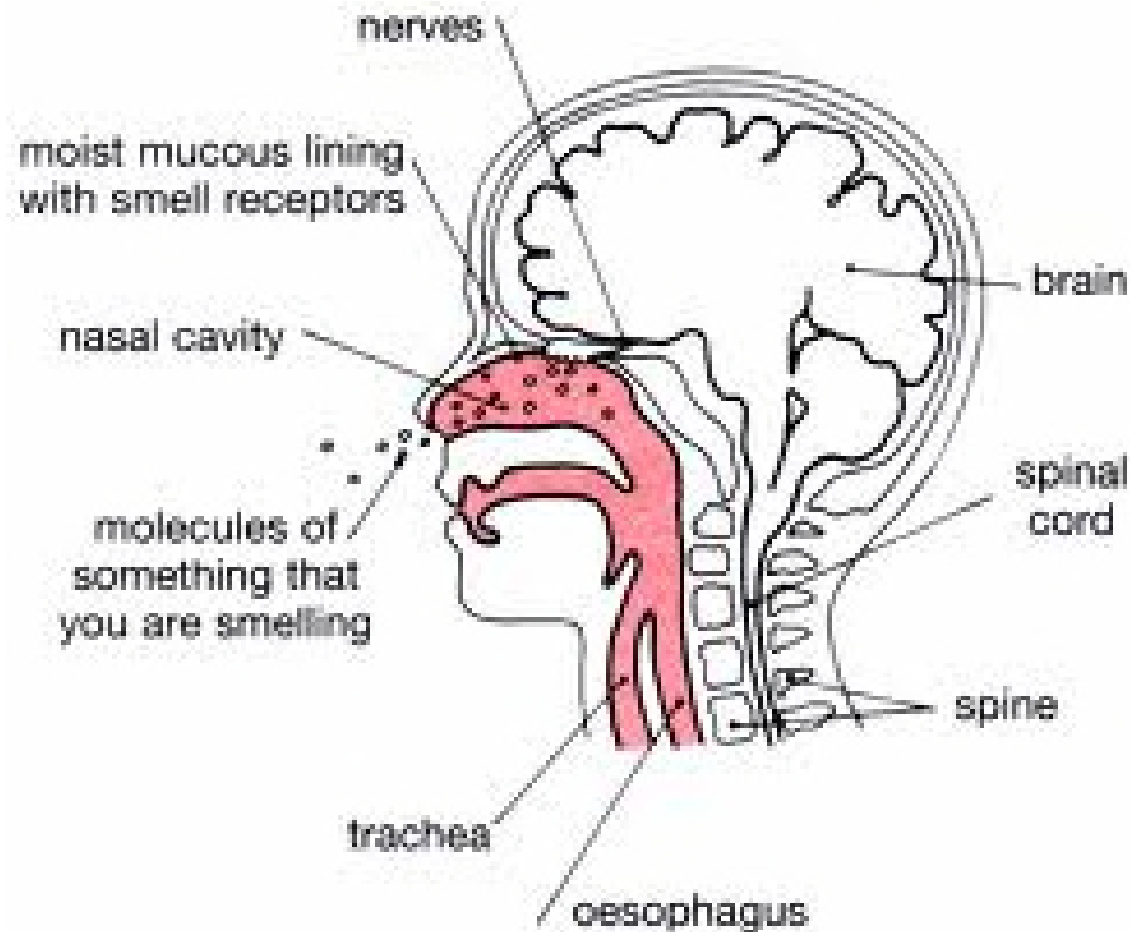
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# Background

- 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



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# 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



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# 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,  $H_2S$ , mercaptans, RSCs, VOCs, aldehydes, ketones, aromatic hydrocarbons.



# Odour detection thresholds

Chemical	Odour Detection Threshold (ppm)	
	Average	Range
Ethyl mercaptan	0.001	0.00000000051 – 0.56
Methyl mercaptan	0.002	0.0000087 – 18
Hydrogen sulphide	0.01	0.00040 – 1.4
Naphthalene (mothballs)	0.1	0.0013 – 0.086
Dimethyl disulphide	0.2	0.00029 – 1.5
Acetic acid (vinegar)	0.5	0.0004 – 200
1,3-Butadiene (rubber)	1.6	0.10 – 2.6
Toluene (model airplane glue)	2.9	0.021 – 270
Ethylene glycol (automotive coolant)	5.1	0.046 – 0.39
Ammonia	5.2	0.043 – 60
Acetone (nail polish remover)	13	0.40 – 4,200
Methanol (windshield washer fluid)	100	3.1 – 200,000



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# 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

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

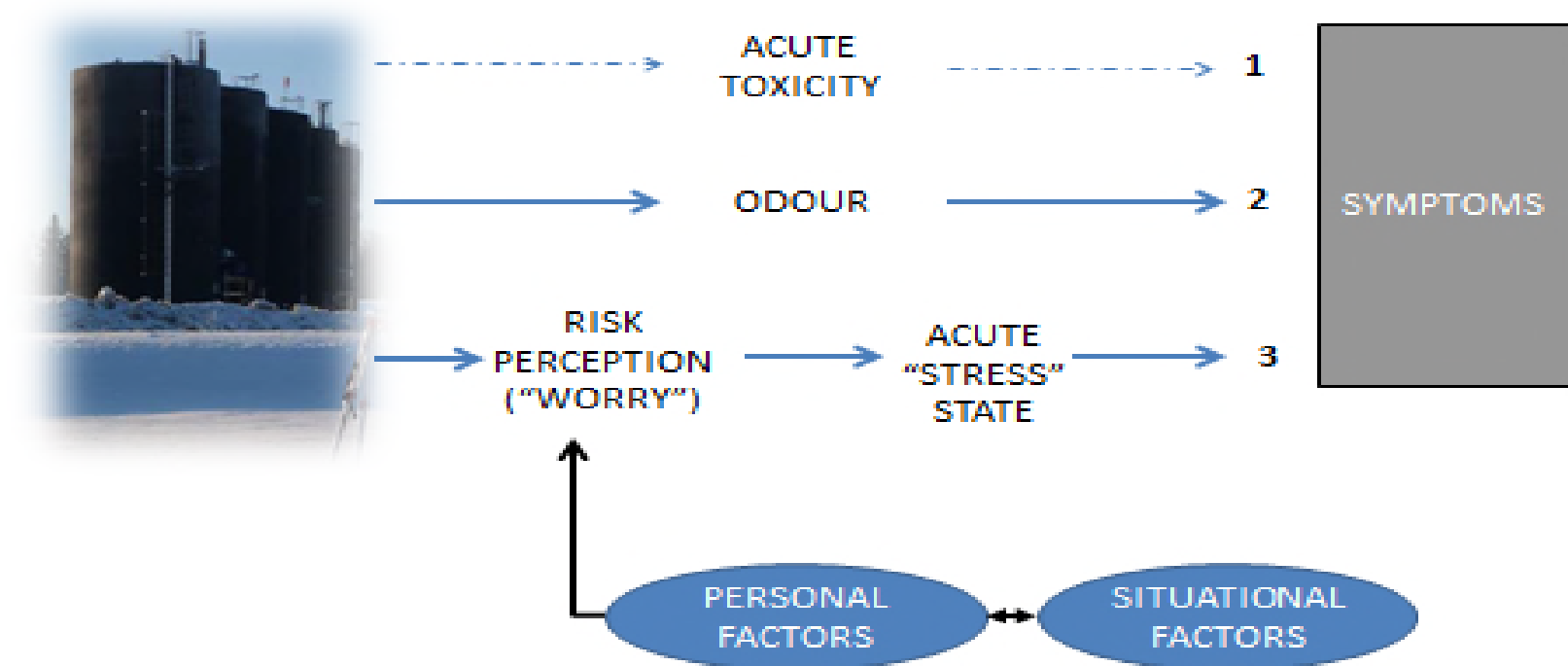
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# Mechanisms

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



# Mechanisms



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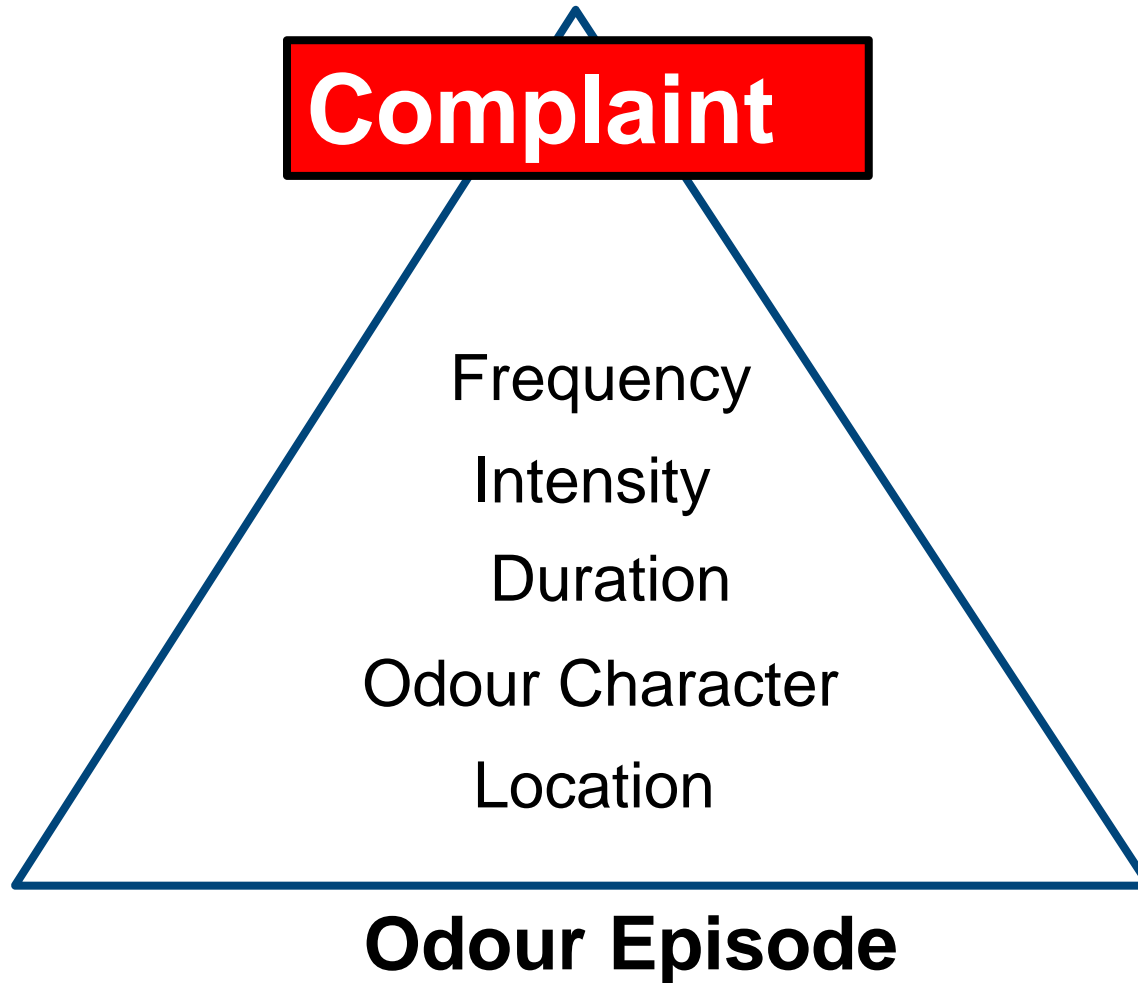
# Odour annoyance

- 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



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# The Odour Complaint Pyramid

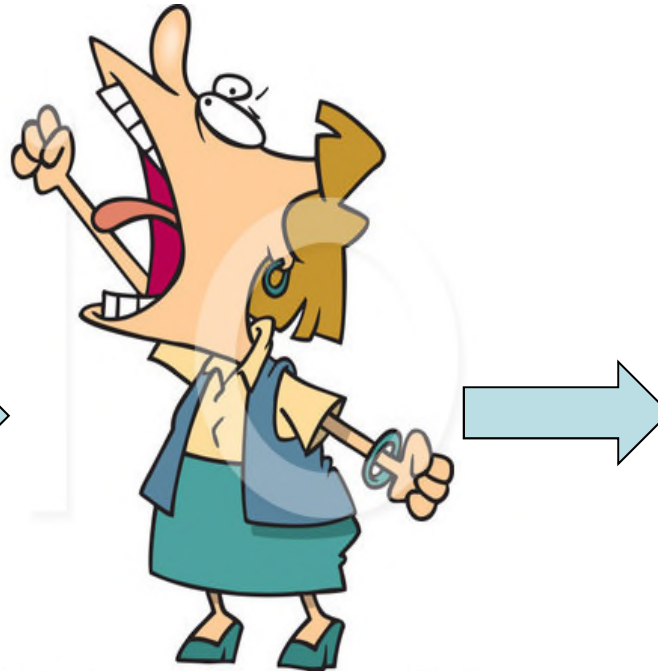


# Things can escalate ...

**Annoyance**



**Anger**



**Illness**



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# Confounders

- Subject bias
- Reporting bias
- Subjective nature of symptoms
- Lack of differential diagnoses
- Many determinants other than odour
- Personalities





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# So, what are the facts?

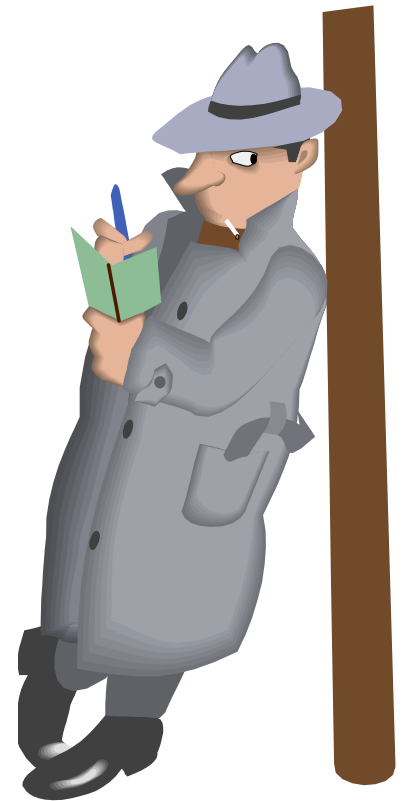
- Mounting evidence of a possible connection between odours and health effects.
- Reported symptoms represents a combination of physical and psychological effects.
- Frequency of symptom reporting dependent on a number of factors, including personal circumstances and attitudes.



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# 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.



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# 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”.

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Questions?