

Odour Measurement

Understanding Odour and Olfactometry

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Objectives

- Explain how odour is measured
- Explain why it is measured this way
- Describe the complete measurement method
- Discuss what the numbers mean and some of the limitations of this approach



Why do we want to measure odour?

To provide objective answers to a variety of questions:

- Will this emission source cause a nuisance in the community?
- Which emission source is contributing most to a problem in the community?
- Where can I get the most value from expenditures to reduce emissions?
- How efficient is my odour abatement system?



What do we want from this measurement?

- Must be objective – not based on opinions
- Quantifiable – a number; something that can be used in calculations
- Verifiable, repeatable, consistent



How do we measure odour?

Need to answer another question first:

What is odour?



What is odour?

*Odour is an organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances.
(ISO 5492)*

Odour is the perceived response of human sensory systems to chemical compounds in the air.

What is odour?

Odour is the perceived response of human sensory systems to chemical compounds in the air.

Key ideas:

1. Odour is an effect, not a substance – we must distinguish between **odour** and **odorant**.
2. Odour is a perception – more than just a signal produced in response to a compound



Steps Producing Sensation of Odour

- sniff – moving air with odorants into nasal cavity
- absorption into aqueous mucus layer at olfactory epithelium
- transfer of odorants to receptors in olfactory cilia
- interaction of odorant and receptor cells
- production of an electrical signal
- processing signal – amplification
- signal decoding
- interpretation



Why not measure odorant
concentrations instead?

Sensory vs. Chemical Analytical Methods

Sensory Methods

- address odour
- concerned with the whole air mixture
- relate to the concern of odour impact

Chemical Methods

- address odorants
- concerned with the components of the air mixture
- relationship to odour impact must be inferred from some established sensory chemical data (chemical data alone has no value)



Chemical Analysis

- What is actually being measured?
- What is missed in that measurement?
- How do you relate the chemical composition to odour sensation?



So, we want to measure odour – a human sensation:

- Objectively (“effects of personal opinions are minimized”)
- Quantitatively – as a “concentration”

What parameter can we use?



Odour Perception Parameters

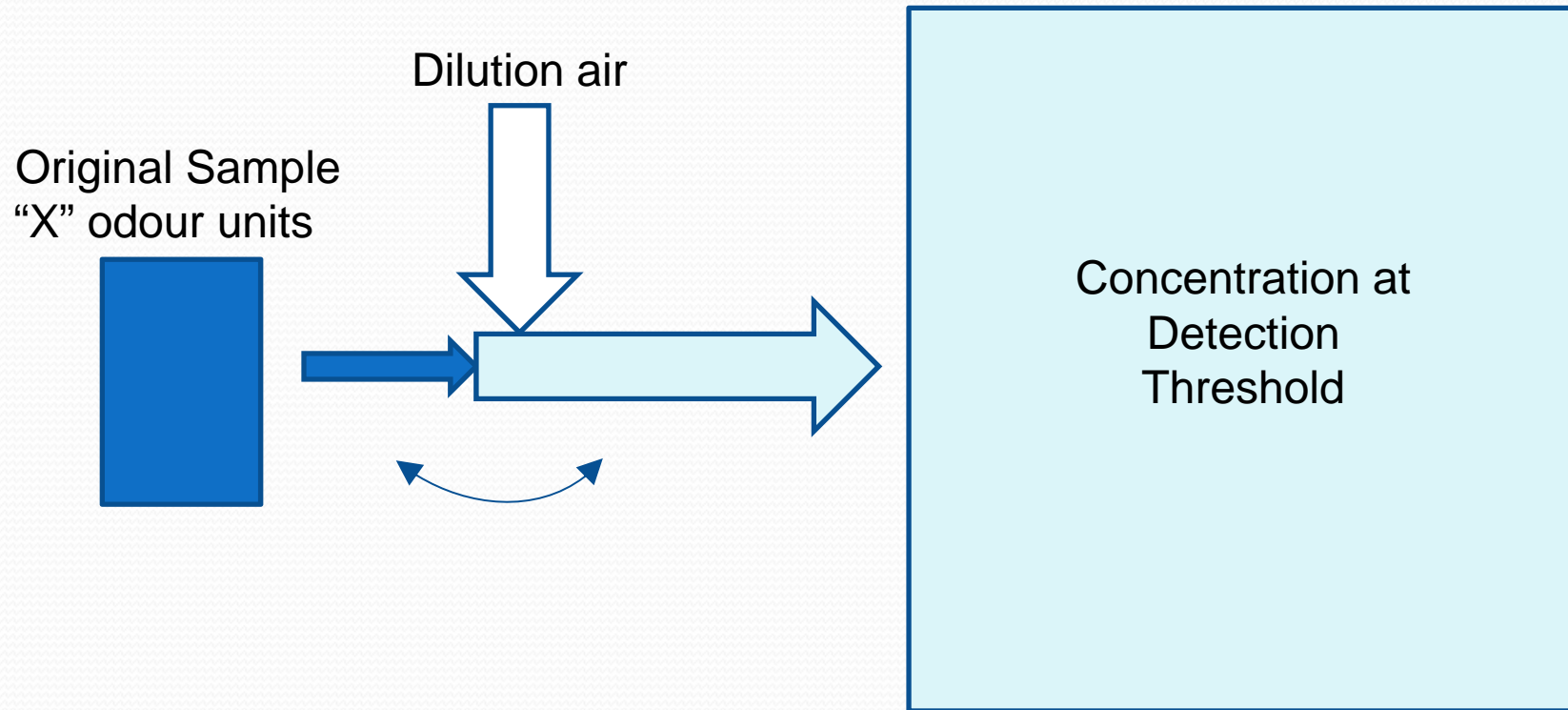
- detectability
- recognition?
- intensity
- hedonic tone
- character



Odour Perception Parameters

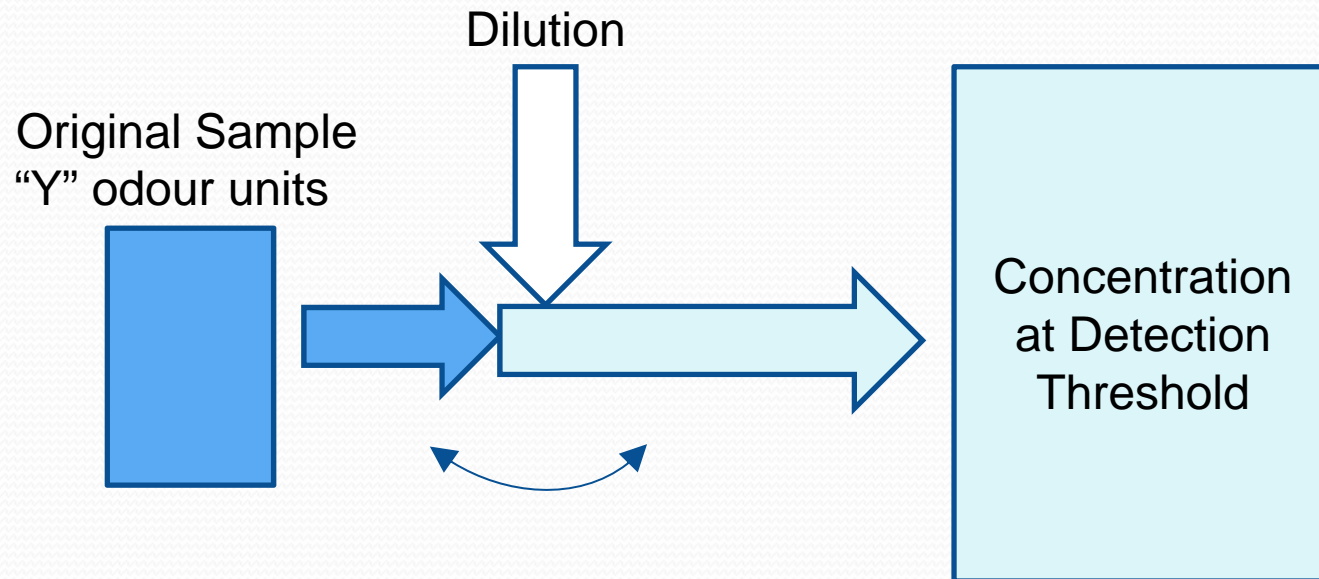
- detectability
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-
- Only one of these – **detectability** – can be measured objectively, and expressed as a “concentration” useful for other calculations

Visualizing calculation of “odour concentration”



Ratio of flows = odour concentration (odour units)

Visualizing calculation of “odour concentration”



Ratio of flows = odour concentration (odour units)



What do we have?

“Dynamic Dilution Olfactometry”

Olfactometry

- Olfactometry is the measurement of odour
- Usually refers to determination of detection threshold, expressed as “odour concentration”
- Dilution-to-threshold technique most common – usually with dynamic dilution, hence “dynamic dilution olfactometry”
- European Standard EN13725:2003 “Air Quality – Determination of odour concentration by dynamic olfactometry”

Olfactometry

Basic Principles

- Accurately dilute the sample in a continuous flow of air
- Present it to a number of subjects (panelists)
- Comparison to a control blank – clean air (more than one “sniff port”)

Olfactometry

Components of the Process

- Panelists – the “sensors” in the analytical system
 - Selection, training, “calibration”
 - Butanol reference
- Presentation system
- Criteria for assessment – detection of what, at what confidence level?
- Data assessment/calculation





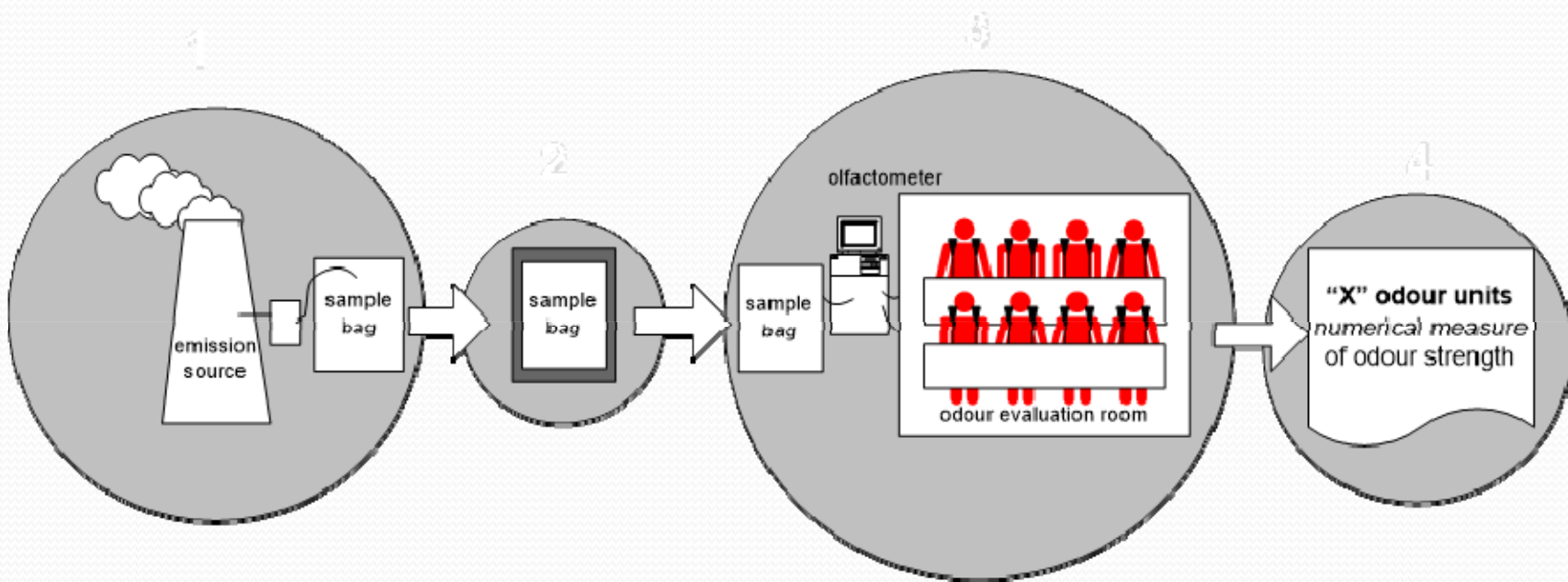




Overview of the whole procedure:

Method ON-6: Determination of Odour Emissions from Stationary Sources

- Collect samples at the emission source
- Evaluate them in a laboratory using a panel of observers



Sampling

- Not really sampling odours – we are sampling odorants
- Representative sampling – as for any chemical component we might test for; where, how many, how often
- Unknown chemical composition – sampling needs to ensure even very fragile compounds are not lost
- Variety of source types – stacks, area sources (lagoons, compost piles), volume sources (processing equipment in open air)

Sampling

- Collection in gas sample bags (usually Tedlar)
- Dilution sampling as often as possible – minimize condensation effects etc.

Results

- Reported in “odour units”
- How is the data used?
 - calculate emission rates
 - odour emission inventories
 - dispersion modelling
 - calculate destruction efficiencies of emission controls



Putting the Results in Context

- What do the results mean?
- What are the limitations?



Questions?