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| [**Good Practice Guide Introduction**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/GoodPracticesGuideIntroduction.aspx) | [**Understanding Odour**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx) | [**Odour Prevention and Mitigation**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourPreventionandMitigation.aspx) | [**Odour Assessment**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourAssessments.aspx) | [**Odour Management**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx) | [**Odour Complaints**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourComplaints.aspx) |

**ABOUT THIS SECTION**

THE BASICS ABOUT ODOUR, HOW IT IS PERCEIVED AND THE EFFECTS IT CAN HAVE

 An important step in managing odour is developing an understanding of its properties, frequency and duration of occurrence, sources, and impact on health and well-being.

* [**Understanding Odour**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#about)
* [**Characterizing Odour – FIDOL Factors**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#characterizing)
* [**Properties of Odour**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#properties)
* [**Odour Thresholds**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#thresholds)
* [**Characteristics of Odour Episodes**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#episodes)
* [**Types of Odour Sources**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#sources)
* [**Factors Affecting Odour Dispersion**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#dispersion)
* [**Odour Impacts**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#impacts)
* [**Odour and Health**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/UnderstandingOdour.aspx#health)

The information in this section was summarized from these reports, which include more detailed information and all references cited:

* [***Odour and Health Backgrounder***](http://casahome.org/Portals/0/documents/Odour%20Management/Consultant%20Reports/Odour%20and%20Health%20Backgrounder_FINAL%2030JAN2015.pdf?timestamp=1436886776432)which was prepared by the CASA OMT Odour and Heath Task Group for the Clean Air Strategic Alliance.
* [***Report to the Clean Air Strategic Alliance Odour Management Team Enforcement/Role of Regulation Task Group***](http://casahome.org/Portals/0/documents/Odour%20Management/Consultant%20Reports/ERoRTG%20RWDI%20Review%20Final%20Report%20150311%20CASA.pdf?timestamp=1436886730219) which was prepared for the Clean Air Strategic Alliance by RWDI AIR Inc.
* [***Review of Odour Assessment Tools and Practices for Alberta***](http://casahome.org/LinkClick.aspx?fileticket=P-9teU5NWU4%3d&portalid=0&timestamp=1436887677750)which was prepared for the Clean Air Strategic Alliance by Millennium EMS Solutions Ltd., and Environmental Odour Consulting.
* [***Review of Odour Prevention and Mitigation Tools for Alberta***](http://casahome.org/Portals/0/documents/Odour%20Management/Consultant%20Reports/PMTG%20Pinchin%20Final%20Report%20w%20Appendices%202015-01-27.pdf?timestamp=1436886856110) which was prepared for the Clean Air Strategic Alliance by Pinchin Ltd.

UNDERSTANDING ODOUR

Odour can be a significant contributor to air quality and pollution concerns. Offensive odours may have adverse effects on peoples’ lives and well-being, and can result in conflicts between the public and the facilities or activities generating the odours.

Managing odour is complicated by the fact that the sensation caused by mixtures of odorants is subjective and technically difficult to measure and quantify. The adverse effects of odour can vary significantly based on the sensitivity of the people experiencing the odour. Personal sensitivity to and acceptability of odours depends on the environment where the odour is detected and may change over time.

Odour is recognized during the process of breathing. It is the sensation that results when olfactory receptors in the nose are stimulated by particular chemical compounds in gaseous form (called odorants). (McGinley et al., 2000a; St. Croix Sensory, 2003). A single odorant stimulus (e.g., hydrogen sulphide or chlorine) may be readily recognizable and easy to describe. However, a person’s olfactory system may not recognize the individual odorants in a mixture of multiple odorants (e.g., odour from a landfill).

Odour sensation depends on the nature and concentration of the substances that interact with the olfactory receptors. Odours generated by the food and cosmetic industries, which are generally pleasant, are often referred to as aromas or fragrances, respectively. Terms such as malodour, stench or stink refer to unpleasant odours.

Due to olfactory adaptation, some of the odours that individuals are familiar with, such as their own body odour or typical household odours, are less noticeable to them than external or infrequently encountered odours (Wolfe et al., 2014). Sensitivity to odour and the ability to distinguish odours weaken quickly during continuous exposure or adaptation, but recover rapidly after the stimulus is removed. However, conditions such as prolonged or frequent exposure to an odour may increase an individual’s sensitivity to that odour, and even pleasant odours, such as those from baking or coffee, may become offensive.

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CHARACTERIZING ODOURS

FIDOL Factors

To completely describe the nuisance characteristics of an odour, five factors (commonly referred to as “FIDOL”) are generally considered:

* Frequency (the number of times an odour is detected during a specific time period)
* Intensity (a person’s perception of the concentration or strength of the odour)
* Duration (the period of time in which the odour remains detectable)
* Offensiveness or hedonic tone of the odour (pleasantness or unpleasantness)
* Location of the odour

**Frequency**

Generally, the more frequently an odour is detected, the greater the potential to lead to an odour complaint. The time an odour occurs can also be important. An odour that occurs when there is a greater likelihood of people being exposed to it is more likely to lead to a nuisance complaint. The same odour that occurs while people are not present is less likely to lead to a nuisance complaint.

**Intensity**

The intensity of an odour is related to the odorant concentration or the concentration of the compounds involved. It is also related to a person’s perception of the odour’s strength. Intensity is the relationship that exists between perception and concentration, but it is not proportional. A large increase in concentration may lead to only a small increase in a person’s perception of intensity, or vice versa. The intensity of an odour is not a measure of its character, quality, offensiveness or hedonic tone.

**Duration**

The duration of odour impact refers to how long an odour event lasts and, along with frequency, provides an overall odour exposure time metric. Duration depends on factors such as the variation over time of the odorous emissions from the source(s) and meteorological conditions, which can have a strong influence on the duration of an odour event. For example, stable meteorological conditions, which can be more common at night, may lead to events of longer duration. Long periods of continuous odour exposure can have two widely different effects—adaptation or sensitization. Adaptation is where the perceived odour intensity decreases with repeated or continuous exposure. Sensitization is where perceived intensity increases with repeated or continuous exposure.

**Offensiveness**

The offensiveness, or hedonic tone, of an odorant is related to its perceived pleasantness or unpleasantness. This is the most subjective of the FIDOL factors, as it depends on the individual and their response to a specific odour. A person living and working in an agricultural area may be more tolerant and less sensitive to agricultural odorants than a person living in an urban environment. Of note, offensiveness is not directly related to odour intensity or concentration.

**Location**

The location of an odour may affect the perceived offensiveness of an odour, especially when an odour would not normally be expected in a given location. In addition, ensuring good odour control and adequate separation between odour-generating activities and odour-sensitive receptors is important.

Of these FIDOL factors, offensiveness is primarily subjective in nature and difficult to measure—it is also one of the key drivers for complaints. A “non-offensive” odour can be acceptable to a community despite relatively high frequency, intensity and duration. However, a pleasant odour might become offensive after frequent or long exposure.

Frequency and duration, both of which depend on wind direction and the nature of the odour source, need to be considered together when assessing an existing or potential odour issue. Odour sources may be continuous, (e.g., from agricultural, municipal and industrial facilities), intermittent (e.g., spreading of waste on land), or a single event (e.g., due to an accident, a process upset or a disruption in normal operations; bacterial growth in water bodies; or animal decomposition on land).

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PROPERTIES OF ODOUR

The following properties are generally considered when assessing odours:

* Concentration of the odour (based on the dilution with odour-free air required to reach a certain response point)
* Odour intensity (strength of the odour sensation)
* Odour persistence (another measure of odour intensity)
* Hedonic tone (general classification, such as pleasant or unpleasant)
* Character (descriptors such as “fishy” or “chemical”)

Odour Concentration

Odour concentration refers to the number of dilutions required for an odorant sample to reach the odour detection threshold value (ODTV) or the odour recognition threshold value (ORTV) (St. Croix Sensory, 2003). Odour concentration is the most common parameter for quantifying odours and is usually expressed based on the ODTV in preference to the ORTV.

Odour unit (OU) is another unit of measurement for the concentration of odour in an air sample and is similar to ODTV. An OU is defined as the number of times that an odour sample must be diluted with odour‐free air so that 50% of a trained odour panel can just detect the presence of the odour (ASTM, 2002; CEN, 2003). For example, if it is determined that an odorous air sample needs to be diluted 620 times to be just detected, the odour concentration is 620 OU.

Very low concentrations of odorants in air can be challenging to measure using chemical methods. Mixtures of chemicals can have an odour threshold that cannot be predicted based on the thresholds of the individual odorants in the mixture. Therefore, the use of human noses—olfactometry—is the most reliable way to measure odour concentrations. In olfactometry, the sample is diluted to the level where it is just detectable or recognizable by odour panelists. Typical odour panels are composed of six to twelve panel members and are intended to be representative of the population in general. A diluted odorous sample and odour‐free air (as a reference) are presented separately from sniffing ports to a group of panelists, who perform the evaluations in an odour‐free room. The responses of the panelists over a range of dilution settings are used to calculate the concentration of the odour (OU or ODTV). Portable olfactometers are available for field measurement of odour concentrations but these have some limitations in terms of sensitivity and reproducibility.

Odour Intensity

Odour intensityis the perceived strength of an odour at a given concentration. Some odours and odorants, even at low concentrations or when they are just detectable (i.e., at threshold concentration), are perceived as being strong (i.e., have a high intensity). Odorants with this property are commonly associated with naturallyunpleasant odours (DEFRA, 2010), such as hydrogen sulphide (rotten eggs) and skatole (feces). When odorants are mixed, the resulting odour intensity is generally not simply the sum of the intensities of the individual odorants. Therefore, the overall odour intensity of mixtures of odorants cannot be calculated with high certainty. However, in some cases (e.g.,for modelling assessments), summing of components may be the only feasible way to estimate total odour effects.

Odour Persistence

Odour persistence is used to characterize the decrease in intensity of an odour as it is increasingly diluted with nitrogen or filtered air (Ouellette et al., 2006). Therefore, odour persistence is a function of odour intensity. The result is that some odorants and odours linger even after being diluted with large volumes of fresh air, while others dissipate very quickly. For example, hydrogen sulphide and pig manure odour are more persistent than ammonia and dairy manure odour, respectively (Ouellete et al., 2010).

Hedonic Tone

Hedonic tone is a subjective measure of the pleasantness or unpleasantness of an odour. The hedonic tone is independent of the odour character and is often ranked on a nine‐point scale ranging from extremely unpleasant to neutral to extremely pleasant (Pullen, 2007; VDI, 1994).

The hedonic tone of an odorant can be evaluated by panelists who are exposed to it for a controlled intensity and duration. The degree of pleasantness or unpleasantness is then determined by the panelists’ experience and emotional associations to the odorants.

Odour Character

Odour character uses common descriptors such as “fruity,” “chemical,” “moldy,” “soapy,” ”floral” and “sweet” to describe odour. Examples of descriptors for specific odorants that have distinctive odours include ammonia (cleaning fluid), trimethylamine (fishy), phenol (medicinal), skatole (fecal), toluene (solvent/hydrocarbon) and hydrogen sulphide (rotten eggs). Odour panelists describe character using a descriptor from a standard list or in their own words.

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ODOUR THRESHOLDS

Several threshold metrics may be used to characterize the concentration of odours. For odorant mixtures, the odour threshold values are expressed as OUs; however, odour thresholds for single chemicals may be expressed as micrograms per cubic metre (μg/m3) or parts per million by volume/parts per billion by volume (ppmv/ppbv). In mixtures, if one odorant is dominating an odour effect and there are no synergistic effects with other chemical odorants, the odour threshold for that odorant may be used to assess and mitigate the overall effects of odour.

The following four thresholds are common odour recognition and response metrics:

* **Odour Detection Threshold Value (ODTV)** – The concentration at which 50% of a population, based on the results from an olfactory experiment using an odour panel, would be expected to detect the odorant (VDI, 1994).
* **Odour Recognition Threshold Value (ORTV)** – The concentration at which 50% of a population, based on the results from an experimental odour panel, would be expected to recognize the odour (VDI, 1994). People might describe the odour, for example, as rotten eggs or cabbage (for sulphur compounds), or fishy (for amines).
* **Odour Offensiveness Threshold Value (OFTV)** – The concentration at which 50% of a population, based on the results from an experimental odour panel, would be expected to indicate that the odour is offensive over a short period of exposure (Bokowa, 2008b).
* **Odour Complaint Threshold Value (OCTV)** – The concentration at which 50% of a population, based on the results from an experimental odour panel, would be expected to complain about an odour if exposed to the odour for a short time period (Bokowa, 2008a).

Another odour threshold is the “nuisance threshold level,” which the World Health Organization (WHO, 2000) defines as the concentration at which not more than a small proportion of the population (less than 5%) experiences annoyance for a small part of the exposure time (less than 2%) to an odour.

Odour issues resulting from nuisance effects may arise when:

* Odour sources change with limited warning or planning.
* Best management practices related to odour control are not used.
* Urban areas encroach on existing odour sources or odour sources encroach on existing urban areas.

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CHARACTERISTICS OF ODOUR EPISODES

Factors that affect odour episodes include odorant emission rates, odour character, meteorological conditions, terrain near the source, and the odour sensitivity of the people involved. In addition, more subjective factors, such as the frequency of odour detection, air quality expectations, and the hedonic tone of the odour, determine whether a person may be concerned about an odour after it has been detected.

Typically, an odour episode is annoying before concern is expressed in the form of a complaint. Annoyance resulting from odour episodes is most likely to occur in residential areas where annoying odours are not expected. While the reason for an odour complaint may simply be annoyance at the unpleasantness of the odour, other issues may also contribute, such as physical response to the odour (e.g., nausea) and/or aversion to and/or interruption of normal activities (e.g., avoidance of certain areas).

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TYPES OF ODOUR SOURCES

The type of the odour source influences how odours are formed, transferred and/or released into, and behave in the environment. Facilities should have a good understanding of their odour sources and how different mitigation and prevention tools may be used to reduce or eliminate odour releases and impacts.

Point sources

Point sources are single entity, easily identifiable sources that generally have well defined exhaust parameters (velocity, temperature, odour rate). They can be elevated or located at ground level. A stack is the most common and familiar type of point source. Common examples of point sources include:

* Electricity generation sources, such as stacks associated with coal-fired power plants, biomass generation, gas‐fired generation and co‐generation
* Major stack and vent sources at refineries, oil sands processing and upgrading facilities, steam-assisted gravity drainage (SAGD) facilities and gas plants. These sources include steam generators, flares and furnaces
* Major stack sources at forest products facilities including oriented strand board (OSB) plants, sawmills, and pulp and paper mills
* Incinerator stacks at municipal waste management facilities
* Major stack sources at chemical and manufacturing plants

Fugitive emissions

Fugitive emissions are unintended or peripheral emissions from a variety of sources. Fugitive emissions can be associated with:

* Small oil and gas facilities, well site and trans-loading facilities
* Rail car or truck loading and unloading activities
* Doors and windows in enclosed operations
* Recycling or composting facilities
* Storage or treatment piles, ponds and lagoons
* Piping flanges, valves, pumps and other equipment at various heights within industrial facilities such as oil refineries, gas plants and petrochemical plants

Area sources

Area sources are two dimensional sources without a physical height. The surface dimensions are known; however, the odour emission is diffusive and may not be uniform or well understood. Sewage lagoons and tailings ponds are examples of area sources.

Volume sources

Volume sources are similar to area sources, but they have a known height dimension. Odour emanating from a volume source can be diffusive, non-uniform and hard to determine. A building with windows, vents or other openings housing an odorous process, can be a volume source. An industrial complex, such as a refinery or chemical processing plant, can be considered and assessed as a volume source. Common examples of volume sources include:

* Refineries and chemical processing plants
* Small businesses such as retail outlets, dry cleaning facilities and garages
* Agricultural production and secondary agricultural processing facilities

Line sources

Line sources are long and narrow sources and this type of source is not common. Vehicle exhaust from roadways can be classified as a line source.

Multi-sources

Multi-sources are a collection of different sources within a group, facility or study area. A complex facility or collection of industries with many individual sources can be composed of roadways, tanks, piping and stacks. This source relates to places where there are multiple sources operating and the cumulative effect needs to be considered.

Most facilities will have a combination of source types. The use of a multi-source emission and dispersion model may prove beneficial when managing odours on a larger scale. Generating an inventory of odorous sources is a key component of odour assessment and management.

SOURCE OF ODOURS: EXAMPLES

Odorous emissions can be associated with a variety of sources. The following sections provide some examples.

**Municipal Solid Waste Management**

The collection, transfer and long-term storage of municipal solid waste (MSW) are among of the most common sources of odorants and go back throughout human history. Today, the management of MSW typically starts with the collection of household waste by trucks, which take it to transfer stations or to long-term storage facilities (e.g., landfills). In some areas, typically rural, residents drop off waste at transfer stations; whereas, urban waste is collected and taken to larger facilities. Once MSW is concentrated at a transfer station or landfill, odour management typically becomes a key concern. While fairly common, the key odour-causing components of the MSW management system are also fairly localized, most often at the working face of the landfill and leachate collection systems.

**Municipal Wastewater Treatment**

Municipal wastewater treatment includes the collection and treatment of wastewater from homes, businesses and potentially the treated wastewater from some industrial operations. While odour may potentially be generated from all components of the wastewater collection system, it is odours at the wastewater treatment facilities that tend to result in complaints. Wastewater treatment systems include mechanical treatment plants and sewage lagoons. Odour management at wastewater facilities is a significant concern in many municipalities, often exacerbated by the location of these facilities in low lying areas to take advantage of the gravity-drainage in the sewer networks. While common, since almost every community above a certain size has a municipal wastewater system, the key odour-causing components of the wastewater management system are also typically localized.

**Composting**

Composting of residential organic waste, sewage sludge and agricultural waste has become a growing trend in recent years. It encompasses everything from residential composting bins to large-scale composting operations at MSW facilities. Odours tend to be similar in character to traditional MSW facilities, but can be more concentrated due to the increased concentration of organic matter in the waste relative to traditionally mixed MSW streams. Depending on the method used, composting can represent large area sources.

**Agricultural Operations**

Similar to MSW management, odorants from agricultural operations have been a part of human society since the beginning of civilization. The primary odour issue with agricultural operations revolves around the generation, collection, storage and/or eventual application/use of animal waste. Facilities that have no animal husbandry component may still rely on the application of animal waste-based nutrients for crop production, which is often associated with odour complaints. Facilities that have an animal husbandry operation (e.g., hog farms) will generate waste that must be stored for some period of time and which has odour generation potential. Where there are large areas dedicated to agriculture, odorants from these operations can best be described as both sporadic and relatively de-centralized.

**Food Production**

Food production facilities encompass a large variety of operations, such as abattoirs, meat packing plants, grain and feed mills, large industrial-scale bakeries and dairy processing plants. Given the widely varied nature of this category, it is difficult to generalize about odour sources other than to note that the presence of these facilities both in the urban and rural landscape often results in odour issues, even from seemingly non-offensive operations such as bakeries and coffee roasting.

**Oil and Gas Operations**

Odorants from the oil and gas industry vary widely in character, depending on the nature of the operation. Sour gas production generates odorants related to total reduced sulphur compounds, while heavy oil operations may generate odorants related to aromatic hydrocarbon compounds. Although the sources of odour associated with this industry may be located throughout a geographic region, the major sources of odorants tend to be very localized, centred on sources at central processing or product storage facilities (e.g., tank vents and process exhausts) and open storage or holding ponds (e.g., tailings ponds).

**Forestry and Pulp and Paper Industries**

Odorants from forest products and pulp and paper mills are, for the most part, due to hydrogen sulphide and reduced sulphur compounds released as by-products of the pulping process. Additional, but relatively minor, odorants from the lumber industry can include the cutting of wood at sawmills.

**Chemical Industries**

The chemical industry is composed of companies that produce industrial chemicals and convert raw chemical feedstock into multiple products. Because of the large variation in chemicals and processes involved, odorant emissions from these facilities can vary greatly. Volatile organic compounds (VOCs) can be the source of odour for many of these industries, although reduced sulphur compounds can also be associated with chemical manufacturing, storage and handling.

**Transportation**

Where there are large transportation networks, transportation-related activities can be a potential source of odorants. Stationary facilities such as railway stations, airports or gas stations can also be an odour source. Transportation-related loading and unloading facilities, depending on the materials being handled, are another potential odour source.

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FACTORS AFFECTING ODOUR DISPERSION

Terrain and meteorological conditions affect the way odour disperses. Hills, valleys and trees, for example, all have an impact on odour emissions. Likewise, weather conditions such as temperature, humidity and wind play a role in the movement of odour. The interaction between the terrain and meteorological conditions further affects the dispersion of odour.

Terrain

Landscape characteristics influence the dispersion of odour emissions and the concentration of odours received by potential receptors (i.e., people). Dispersion of odour emissions is inhibited if the emission source is located in a valley or a depression, but enhanced if the emission source is located on high ground or the emission point is located well above the ground. Due to the physical barriers they create, valleys can channel winds and, therefore, emissions. This may result in high concentrations of an odour emission being channeled for a long linear distance, rather than dispersing. Obstacles can either positively or negatively influence odorant dispersion. For example, tree cover can reduce odour concentration by enhancing dispersion (reducing odour concentration) and providing surfaces for deposition of odorants or by restricting dispersion in the canopy (due to reduced wind speeds).

Meteorology

Meteorology influences odour episodes in two ways—by altering odorant emission rates or releases and by determining the atmospheric transport, dilution/dispersion of odour emissions.

**Temperature and Humidity**

Factors such as ambient temperature and humidity affect the perception of odour. Higher temperatures and humidity increase the likelihood of detection. During precipitation, the concentration of odour is generally reduced. The volatility of odorants increases during warm weather, and odour emissions from open tanks, ponds and storage piles will increase during summer months, leading to increased odour potential during this season. Odour emissions from other sources such as industrial processes may also increase if the process is affected by warm weather. Other reasons for increased odour detection in summer include the opening of windows and doors at facilities and an increase in the number of people outdoors.

**Wind Speed and Direction**

To detect odour, the odour source must be located upwind; therefore, wind direction is a key factor in odour potential. Odour emissions from open tanks and storage piles may be increased by higher wind speeds but this effect is somewhat balanced by increased dilution and, in some cases, improved atmospheric dispersion.

**Mixing Height**

Mixing height (mixing depth), inversions and atmospheric stability can affect dispersion of odorous emissions.

Mixing heights vary by season and depend on wind speed, temperature and cloud cover. Mixing heights are generally lower in winter. Shallow mixing heights mean that ground‐level emissions, such as those from area sources, cannot easily penetrate to the more unstable (better mixed) layers above the ground-level mixing height. The most intense odours typically occur in stable conditions with light winds that inhibit the mixing of odour plumes. Usually higher wind speed causes an increase of the mixing height due to mechanical turbulence. However, mixing height is often dominated by surface heat flux and in cold temperatures the mixing height may be relatively low or zero. Tall stacks emitting odorants above the mixing height result in reduced ground level odour.

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ODOUR IMPACTS

Managing odours can be complex. This is because odour is a sensation that can be caused by asingle odorant or by a complex mixture of odorants. It is subjective in nature, and therefore, difficult to measure and characterize. Various techniques have been developed to measure odorants; however, such instruments measure only the concentrations of different odorants. Measured concentrations are then compared to odour threshold values for the individual odorants which are developed using human odour panels.

For complex mixtures of odorants, it is very difficult to predict the resultant odour concentration, intensity, hedonic tone and characteristics. Therefore, the best instrument for measuring odour is still the human nose. Some individuals have far more sensitive senses of smell and will detect an odorant at much lower concentrations than others. In addition, one person may find an odour objectionable while another may not (e.g., roasting coffee or malt from a brewery).

The possible impacts of odours range from simply detecting an odour to a public nuisance or, at elevated concentrations, a health concern or hazard. Most odours are believed to constitute a public nuisance rather than a health hazard (Bates and Caton, 2002). However, a number of physiological manifestations from offensive odours have been reported in published literature, including nausea, vomiting, headache, loss of appetite, sleeplessness, upset stomach and throat irritation (see Odour and Health).

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ODOUR AND HEALTH

The sense of smell is one of the most primal human senses, with a powerful and direct connection to the brain, and it is no surprise that odour can impact a person’s actual or perceived sense of well-being.

Olfaction, the mechanism that allows people to smell, relies on two essential processes. Volatile chemicals in the air (odorants) bind to olfactory receptors that extend into the nasal passage from special olfactory neurons in the nasal lining (epithelium). Those olfactory receptors signal the brain, which then makes associations with a person’s surroundings and between the odour and their past experiences. Our noses contain roughly 400 different types of receptor neurons, each sensitive to specific types of odorants.

The nasal lining also contains trigeminal neurons, which transmit information on temperature, pressure and pain, and also respond to noxious stimuli. Individual volatile chemicals can trigger olfactory neurons or trigeminal neurons, but odours often trigger both simultaneously.

Stimulation of trigeminal neurons by odorants can cause irritant effects, while stimulation of olfactory neurons by odorants can cause nuisance effects. Some odorants can stimulate both types of neurons, causing both effects.

* Irritant effects (e.g., watery eyes) are a bodily reaction to trigeminal nerve stimulation
* Nuisance effects (e.g., insomnia) are tied to the perception of odour, with no mechanistically understood cause. While the reason why certain odours cause nuisance effects is not fully understood, the resulting symptoms are nevertheless real

Odours can also affect a person’s health physically (e.g., nausea), psychologically (e.g., stress) and socially (e.g., embarrassment).

That said, there are challenges in studying the relationship between odour and health. Different people experience odours in different ways—a nuisance smell to one may be undetectable or pleasant to another. It is also difficult to measure odours in an objective way. These two factors make it challenging to assess the health effects caused by odours.

Most people are not able to identify or quantify the chemicals in something that they smell. Likewise, different people experience and describe symptoms in different ways—symptoms that do not always point to specific medical conditions.

Current knowledge of chemical toxicity is based on chemical-by-chemical assessment. The usefulness of chemical-by-chemical assessment is limited in the case of odours because it is possible that the chemical mixtures in an odour may interact in unexpected ways. Until the ways that volatile chemical mixtures affect human health are better understood, it is important to respond to odour complaints by assessing the presence of chemicals in the environment to identify potential health effects.

Tracking responses to odours

Keeping records is an important tool in helping people understand how odours may be affecting their health. Memory can be unreliable over the long term, so it is important to write down a description of the odour, the conditions in which it was experienced and any health effects/symptoms (which may or may not be related to the odour). The symptoms provide good information for health professionals and descriptions of the odour help odour investigators.

The Symptom and Odour Tracking Tool is available in two formats:

* A [**downloadable PDF**](http://casahome.org/Portals/0/DMX/OMT%20GPG/CASA_GPG_webversion_SymptomTracker.pdf?timestamp=1444748437083) that can be printed off for handwritten entries
* An online form that can also be printed and/or stored electronically



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