ABOUT THIS SECTION

The information in this section was summarized from this report, which includes more detailed information and all references cited:

* [***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.

Odour management involves the application of the appropriate tools to understand and effectively manage odour. There are many approaches for managing odours, and there are challenges in determining the best option for controlling odour impacts that arise from the wide range of odour sources and the varied and qualitative nature of odour perception and response. Odour sensitivity varies among people, as does the level of annoyance associated with an odour. Consequently, most jurisdictions use multiple approaches when considering and addressing odour, and no one odour management approach is capable of covering all situations.

* [**Regulatory-related Odour Management**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Regulatory)
* [**Avoidance of Nuisance Laws**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Avoidance)
* [**Ambient Concentration Criteria for Individual Chemicals**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#AmbientChemicals)
* [**Ambient Concentration Criteria for Odour**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#AmbientOdour)
* [**Episode Duration-Frequency**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Episode)
* [**Minimum Separation Distances**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Minimum)
* [**Odour Intensity Scales**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Intensity)
* [**Odour Index**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Index)
* [**Complaint Criteria**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Criteria)
* [**Quantitative Emission Criteria**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Emission)
* [**Technology Criteria**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Technology)

Odour-related regulation and associated enforcement of these regulations is one of many odour management tools. For enforcement to effectively resolve or prevent odour issues, it must be based on a set of comprehensive and appropriate regulations and is generally the least preferred/desirable option for managing and addressing odour issues. Regulation in the context of this guide refers to any law, bylaw, rule, code, standard, objective or other order prescribed by a government authority (federal, provincial or municipal) that regulates or guides conduct and provides oversight with respect to odours.

While CASA reviewed odour regulation, no specific recommendations regarding regulatory approaches or regulatory requirements related to odour were made as this was beyond its mandate. The approach was, therefore, to assess possible regulatory options for odour management in Alberta, and to provide the results of this work to the Government of Alberta without any specific comments or recommendations. The following information is, therefore, a summary of regulatory considerations and possible options for formally managing odours in Alberta.

REGULATORY-RELATED ODOUR MANAGEMENT

There are many regulatory approaches for managing odours. This is partially the result of difficulties in finding a single best option for controlling or managing odour issues, which are often site specific and unique in nature due to the varied and qualitative nature of perception of odour. Odour detection, along with the annoyance level associated with an odour, also varies among people. For these reasons, almost all jurisdictions have multiple approaches when considering and managing odour. Not any one approach will cover all aspects of odour management that are likely to be encountered.

There are a number of general considerations for any potential regulatory-based odour management framework:

* Clarity is essential to the selection of a suitable odour management approach. If the approach is not clear and well-defined, it will be difficult to implement and will not work once put to a legal test.
* Good relationships between facilities and surrounding residents are a significant benefit, and should be promoted where possible, regardless of the odour management approach selected.
* The development of best practices guides are highly recommended for various categories of facilities to avoid potential odour issues, or to help identify solutions if/or when issues do arise.
* Cumulative effects from neighbouring facilities, as well as location-specific geography and meteorological conditions, can be an issue and must be recognized.
* Certain combinations of geography and meteorological conditions may also exacerbate odour issues, and should be considered in the siting process for new facilities or developments near existing facilities.
* No one approach will apply to all situations or industries and, therefore, some flexibility is critical. Implementing more than one approach is likely beneficial, as it can help deal with a wider variety of situations, giving both facilities and the regulator additional options.

Regulatory approaches for managing odours can be classified as being related to specifying ambient odour levels, acceptable odour emission levels, or possibly a combination of the two. Fundamentally, the components of any of these approaches break down into a series of eight ambient-based and two emission-based regulatory systems.

Ambient-based

1. [**Avoidance of nuisance law**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Avoidance)

2. [**Ambient concentration criteria for individual chemicals (units of μg/m3 or ppm)**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#AmbientChemicals)

3. [**Ambient concentration criteria for odour (units of OU, OU/m3, OUE/m3 or D/T)**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#AmbientOdour)

4. [**Episode duration-frequency (units of odour-hours)**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Episode)

5. [**Minimum separation distances (units of distance)**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Minimum)

6. [**Odour intensity scales**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Intensity)

7. [**Odour index**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Index)

8. [**Complaint criteria**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Criteria)

Emission-based

1. [**Quantitative emission criteria (units of concentration or flow rate)**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Emission)

2. [**Technology criteria**](http://casahome.org/CurrentInitiatives/GoodPracticesGuideforOdourManagementinAlberta/OdourManagement.aspx#Technology)

These approaches are not mutually exclusive and are often used in combination within a single odour management program.

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AVOIDANCE OF NUISANCE LAWS

This type of law is based on either “nuisance” or “quality of life” narrative standards and essentially requires that odour from a facility not result in a nuisance. In many jurisdictions, the only regulation related to odour is a nuisance law while all other aspects of the odour management program are simply guidelines that are not enforceable.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Applicable to Pre-existing Sources:* Can be applied to already existing facilities.

Acknowledges Receptors(a):* Odour issues are a problem only where there are human receptors.
* Focus is on sources of concern only (i.e., if a source has not raised concern with receptors, no time or money is invested into an investigation).
* Can focus investment (both financial and time) in areas where odour concerns are predominant.

 Not Specific to Individual Source:* Can be applied to all sources.

 Well-established Practices:* Odour regulations in 42 of the 50 states in the United States are of this type (Epstein and Freeman, 2004).
* Nuisance laws in Europe date back to late 19th century (Van Harreveld, 2005).
 | Contradicting Legislation:* May conflict with existing legislation.

 Quantification:* Different smells affect different people in different ways.
* Each facility would need to be considered as unique.
* Legal hearings may increase since “nuisance” and “quality of life” may be interpreted differently by the parties in conflict.

 Public Relations:* Once relied on for enforcement, public relations may break down.
* Quantifying impacts may take time, leading to receptors being exposed to additional effects on quality of life.

 Future Projects:* Hard to determine what is perceived as “quality of life” when in planning stage.
* Land use (and thus receptors) may change over time affecting what is considered a nuisance.
 | Sources:* Could be applied to all sources (with the exception of perhaps agricultural).

Combined Application:* Quite often combined with Complaint Criteria Method.

 Sample Jurisdictions:* Ontario; New South Wales, Australia.

 Enforceability:* A legal test must be established to determine what constitutes a “nuisance.”
* The steps to enforce with policy and law must be clear.
* The time-frame for solving issues must be clear for all parties.

 Clarity:* Requires definition of “nuisance” and “quality of life.”
* Legislation should be clear with respect to odour.
* This would include factors such as frequency, intensity and annoyance potential.
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 (a) Receptors are locations where general public would notice a smell

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AMBIENT CONCENTRATION CRITERIA FOR INDIVIDUAL CHEMICALS

Many jurisdictions in North America and elsewhere in the world have quantitative ambient concentration criteria for individual odorous chemicals. The regulatory status of these criteria ranges from guidelines or objectives to enforceable standards.

Dispersion modelling used to predict concentrations of a compound usually considers hourly averaging times. A human nose, though, can pick up an odour in seconds. Averaging time for measurements of many odorants usually fall between these two extremes. This leads to a unique issue when comparing odorous substance measurements with ambient background criteria.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Quantifiable:* Out of all methods arguably the most quantifiable.
* Odour thresholds are known for many compounds.
* Ambient concentrations can be measured and quantified.
* Concentrations can be predicted with dispersion modelling.

 Proactive Management:* Dispersion modelling can be used to predict concentrations and measures can be taken before a facility is built.
* Monitoring of multiple compounds can be conducted. As odour thresholds are approached, facilities can take proactive measures to mitigate problems.
* Can be used for urban planning, and planning for future facilities.

 Temporal Resolution:* Many compounds can be measured continuously, leading to multiple measurements over time.
* Can study times of day, meteorological conditions, etc. that can lead to odour and proactively manage emissions.

 Familiarity to Alberta:* Alberta Ambient Air Quality Objectives currently includes three substances because of odour, (including carbon disulphide, ammonia and hydrogen sulphide).
 | Capturing Odour:* Odour compounds are not necessarily additive. They can react with each other giving higher or lower odour thresholds than individual chemicals.
* Although individual compounds may be below their respective odour threshold, odour may still be present.
* Would be hard to quantify (without direct monitoring) for sources that are variable due to organic matter (e.g., landfills, composting, agricultural).
* Hard to quantify with monitoring in areas with large number of sources producing similar compounds.

 Measurements:* Some chemicals may pose an odour concern even when concentrations are below detection limit of instrumentation.
* There are hundreds of compounds that are considered to be odorous (AIHA, 2012), and not all can measured (e.g., cost prohibitive).

 Consideration of Receptors:* Even if no human receptors are present or receptors report no odours, facilities would still be required to uphold legislation.

  | Sources:* Works well for sources with known emission rates, especially those already reporting to the government, such as oil and gas facilities, pulp and paper mills, chemical plants and power plants.

 Jurisdictions:* Ontario; Quebec; New South Wales, Australia.

 Sampling Methods:* There are costs associated with measurements.
* Frequency of sampling period and averaging period must be considered.
* Minimum monitoring requirements must be defined.
* Preventative monitoring may provide a good community relations tool, while reactive monitoring may come under more scrutiny.

 Odour Thresholds:* Definition of odour threshold would need to be considered. Reported odour thresholds can range by several orders of magnitude (AISA, 2012).
* There are hundreds of odour causing compounds; how would legislation work when it would be impossible to measure/consider all?

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AMBIENT CONCENTRATION CRITERIA FOR ODOUR

Odour is commonly measured using an odour panel, which consists of a number of specially trained personnel. The European, Australian and American standards are the most commonly used for odour panel measurements. The general concept behind these methods is to dilute air samples with known amounts of odour-free air using an olfactometer or scentometer. The most diluted samples are presented to the odour panel first. Less dilute samples are gradually presented to the panel until 50% of the panel can detect an odour. This is defined as the odour detection threshold.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Well Established Methods:* Two primary standards have been developed for measurements of odour:

1) ASTM International E679-04: Standard Practice for Determination of Odor and Taste Thresholds by a Forced-Chose Ascending Concentrations Series Method of limits.2) European Union Standard EN13725:2003: Air Quality Determination of Odour Concentration by Dynamic Olfactometry. Proactive Measures:* If odour emission rates can be estimated, odour units can be modelled using dispersion modelling.
* Can aid in urban planning around new or expanded facilities.

 Quantifiable:* With use of odour panels, a well-established quantifiable odour can be determined.
* Can be used as a tool for reactive responses (e.g., from complaints).

 Classifies Odour:* Is applicable to a large range of odorants.
* Can be used for complex odours (i.e., more than one odorant).
* Related to odour intensity as perceived by human sense of smell.
 | Future Planning:* Many times more difficult to determine odour emissions before a facility is built and thus, to proactively model OU concentrations.

 Uniqueness of Samples:* Samples are not always continuous.
* Coordination between time of day, meteorological conditions, location, etc., can influence if odours are detected or not.
* Odours from different facilities with different character of odours may result in odours even though an individual facility may not.

 Costs:* Suitable odour testing facilities (e.g., odour panels) may not exist locally, and must either be established and trained with standardized programs, or the samples must be sent to other jurisdictions for testing.
* Cost to send samples to an odour panel can be high, as the panel usually consists of at least six people.

 Sample Degradation:* Sample can degrade with respect to time, temperature, humidity, etc., and are time sensitive.
* Window of optimal testing may factor into cost.
 | Sources:* Can be useful for existing and new facilities (in some cases).
* Reactive measurements could be used with all types of facilities.

 Jurisdictions:* Saskatchewan, Europe (majority of countries), Australia (all provinces), Korea, Colorado, Connecticut.

 Sampling Methods:* Frequency of sampling period and averaging period must be considered.
* Minimum monitoring requirements must be defined.
* Preventative monitoring may provide a good community relations tool, while reactive monitoring may come under more scrutiny.
* Coordination of sampling time vs. introducing it to the panel.

 Choosing Limits:* 1 OU/m³ is the point of the detection of an odour, while at approximately 3 OU/m3 recognition threshold is reached. This differs within the general population.
* An acceptable limit must be established, with an appropriate averaging period.
* Multiple criteria can be established for different averaging periods as well.
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EPISODE DURATION-FREQUENCY

Germany has a unique system for assessing whether a nuisance odour is significant. This system considers not only the intensity of an odour, but also its duration and frequency. The existing odour impact in the field is assessed, using a systematic process, and is added to the predicted odour impact of a new or modified facility. The total odour impact is compared with imission limit values, which are relative frequencies of odour-hours. It is permissible for odours to occur more frequently in industrial or commercial areas.

The word “imission” is used in the sense of influence of air pollutants, in this case odour, on humans. This establishes an active view of air pollutants influencing receptors, in contrast to the passive view of receptors being exposed to air pollutants. If this semantic difference is ignored, imission can be interpreted as exposure (Germany, 2003).

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Considers Type of Sources:* Takes into consideration other issues besides intensity that may trigger complaints (e.g., a bakery, although it may emit odours, would likely not raise as many complaints as other industries).
* Considers intensity, duration, location and frequency.

 Proactive Management:* A systematic process for predicting odour impacts on new and/or modified facilities is in place in Germany.
* Can be used for future planning of the facility and/or urban planning.
 | Quantification:* Some subjective analysis including what is considered.

 Labour-intensive:* It can take up to six months to take all variables into consideration.
* Would not work for short-term complaints.
* Costs associated with the method can be high.

 Uniqueness of Protocol:* Only used in Germany, therefore, not as well tested in other environments.

 Reference material would be only from one country (i.e., harder to determine what works/does not work elsewhere). | Sources:* Could be applied to all sources including oil and gas facilities, pulp and paper mills, chemical plants, refineries and power plants.
* Good at distinguishing impact from different types of facilities.

 Jurisdictions:* Germany.

 Choosing Limits* Duration and frequency would have to be defined along with what would be termed acceptable.
* Length of an investigation with monitoring would need to be determined, weighing in such factors as cost and exposure, and taking enough time to obtain all necessary measurements.
* Germany distinguishes limits for different zones. Zoning may need to be considered (industrial vs. residential).
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MINIMUM SEPARATION DISTANCES

Many jurisdictions manage nuisance, including odours, using minimum separation distances or buffer zones, especially for the agricultural sector. Minimum separation distances tend to be either fixed or variable, depending on a number of factors. In general, minimum separation distances are applied to agricultural sources, sewage treatment plants and composting.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Future Planning:* Once source is established, urban planning would be straightforward as to where and where not to build.
* Facilities would be able to quickly decide if expansions could/could not occur.
 | Pre-existing Sources:* Would be hard, if not impossible, to implement for sources and facilities that are already established and minimum separation distances are not currently met.

 Influence of Surrounding Environment:* Does not take into consideration meteorological conditions that may cause odour issues downwind, while a receptor upwind may not notice an odour.
* Complex terrain (such as in the foothills and mountains) may affect the dispersion of odours that would not be considered in the minimum separation distance method.

 Source Upgrades:* Would not take into consideration technology investments that a source may implement to reduce odours.

 Capturing Odour:* Separation distances would not necessarily alleviate all odour issues.
* Over-conservative distances would impede future projects and developments around the sources that may not be necessary.
 | Sources:* Can be applied to new sources.
* Used in many jurisdictions for agricultural sources, sewage treatment and composting.
* Would not be able to implement for existing sources that do not meet separation distancesince source is established.
* If separation distance had previously been established, expansion of an existing facility may be limited.

 Jurisdictions:* Alberta (for agricultural sector), Ontario (for agricultural sector), South Australia (most if not all sectors).

 Standardizing All Sources:* In a number of jurisdictions, odour issues related to agriculture are handled by a different department or ministry than other industrial or municipal sources of odour.
* Modification to include all sources would have to be taken into account.
* Determination ofhow to adjust legislation for all sources would be needed.
* Consideration of all types of sources would have to be determined.
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ODOUR INTENSITY SCALES

A number of jurisdictions have developed semi-quantitative odour intensity scales to assist field personnel when they are investigating an odour complaint. This allows field staff to make a determination about the intensity of an odour without having special training on the use and calibration of certain equipment (such as portable digital olfactometer training) or sending an odour sample to a laboratory for olfactometric testing. Training focuses on being able to implement a scale for odour intensity. The main advantage of this approach is its simplicity.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Simplicity:* Semi-quantitative intensity scale.
* Used to assist field personal when investigating an odour complaint.
* Allows field staff to make immediate determination regarding intensity of odour.

 Cost:* Cost efficient compared to other measuring techniques.
* Multiple points can be assessed with little time and effort.
* Little to no special training.

Does not require taking a sample for further analysis and does not incur associated laboratory costs. Source Appointment:* In an area of multiple sources, this method may be able to pinpoint odorous source.
 | Subjective:* Smell is unique to an individual (i.e., something strong to one may be moderate or below odour threshold to another).
* Dependent on time of day and location.
* If exposed to higher odour intensities earlier, may reduce odour detection of field personnel later in the day.
* May be hard to hold up in a court of law.

 Distances:* Supporting large areas may be difficult.
* Deploying field personnel out in the field as soon as a complaint is issued may be difficult, especially in remote areas.

 Uniqueness of Samples:* Determinations are not always continuous.
* Coordination between time of day, meteorological conditions, location, etc., can influence if odours are detected or not.
 | Sources:* Can be applied to all sources.
* Good for existing facilities.

 Combined application:* Often used jointly with complaint criteria.

 Jurisdictions:* Western Australia; New Jersey; Japan; Korea; Wellington, New Zealand; Texas.

 Sampling Methods:* Preventative monitoring may provide good community relations tool, while reactive monitoring may come under more scrutiny.
* Required frequency of measurements would need to be established and/or possible follow up measurements after a complaint is filed.

 Streamlining for All Sources:* Would have to consider how to merge existing procedures/methods or have procedures differ between source types.
* There may be situations where one department would oversee odour measurements and pass it to other departments, depending on the nature of theodour.

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ODOUR INDEX

The “Odour Index” is used in Japan to quantify the intensity of odours. The odour index is equal to ten times the log of the odour concentration (i.e., Odour Index = 10 x log [Odour Concentration]). The odour concentration is measured using the Triangular Odour Bag Method in which a panel of six or more people are given a set of three bags, one with a sample in it and two with odour-free air. Panel members are asked to choose the odorous bag. The odorant is gradually diluted and tested until it becomes impossible to identify the bag with odour. The odour index is calculated based on the dilution rate at which the panel can no longer correctly identify the odorous bag. In the case of liquid samples, flasks are used instead of bags. The method also identifies how members of the panel should be selected, how samples should be gathered and how test results should be calculated.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Quantifiable:* With use of odour panels, a well-established quantifiable odour can be determined.
* Can be used as a tool for reactive responses (e.g., from complaints).

 Locations:* Could be used to quantify odours in locations such as inside buildings.

 Classifies Odour:* Applicable to large range of odorants.
* Can be used for complex odours (i.e., more than one odorant).
* Related to odour intensity as perceived by human sense of smell.
 | Future Planning:* May not be able to predict odours for future projects and planning.

 Uniqueness of Samples:* Samples are not always continuous.
* Coordination between time of day, meteorological conditions, location, etc., can influence if odours are detected.

 Costs:* Suitable odour testing facilities (e.g., odour panels) may not exist locally, and must either be established with standardized training programs, or the samples must be sent to other jurisdictions for testing.
* Costs to send samples to an odour panel can be high, as the panel usually consists of at least six personnel.

 Sample Degradation:* Sample can degrade due to time, temperature, humidity, etc., and are time sensitive.
* Window of optimal testing and may factor into cost.

 Uniqueness of Method:* Only used in Japan, therefore, not as well tested as other methods in different environments.
* Reference material would be only from one country (i.e., harder to determine what works/does not work elsewhere).
 | Sources:* Can be used for all sources.
* Can be used for future planning of different types of sources.

 Jurisdictions:* Japan.

 Sampling Methods:* Frequency of sampling period and averaging period must be considered.
* Preventative monitoring may provide a good community relations tool, while reactive monitoring may come under more scrutiny.
* Coordination of sampling time vs. introducing it to the panel.

 Choosing Limits:* What would be considered acceptable vs. threshold detection of the panel?

 Training:* Limited globally trained individuals.
* Training for odour panel required to use this method.
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COMPLAINT CRITERIA

Most jurisdictions have a system in place for responding to odour complaints. In many cases, there is a policy to respond to all complaints. In some jurisdictions, complaint criteria are expressed in terms of a minimum threshold number of complaints required before an investigation is launched or an odour is considered a nuisance. Other jurisdictions also have complaint hotlines that are staffed by the regulatory agencies or an answering service with staff trained to ask the complainants certain questions used in complaint documentation and reporting. Some jurisdictions have regulations or guidelines for how the regulator will respond to complaints. Other jurisdictions also clearly set out how they will determine whether a complaint is justified or verified. Typically, once a complaint is deemed to be credible, organizations follow their investigation procedures.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Applicable to Existing Sources:* Can be applied to already existing facilities.

 Acknowledges Receptors:* Gives power to public.
* Focuses on areas where receptors are located.
* Focus on sources of concern only (i.e., if a source has not raised concern with receptors, no time or money is invested into an investigation).
* Can focus investment in areas (both financial and time) where odour concerns are predominant.

 Not Specific to Individual Source:* Can be applied to all sources.

 Well Established Practice:* Most jurisdictions have a system in place for responding to odour complaints.
 | Quantifiable:* Different people react to odours at different thresholds.
* Hard to distinguish what is acceptable/not acceptable for different people.

 Public Relations:* Once relied on for enforcement, receptors may become hostile towards source owner.
* Verifying impacts may lead to receptors being exposed to even longer effects.
* Lawsuits may result if disagreements arise between complainant and source owner on what constitutes an odour.

 Preventative Legislation:* This method is reactive.
* May be seen as “band-aid” solution which doesn’t solve the problem.
 | Sources:* Applied to all sources, quite often industry based.
* Usually combined with other methods to quantify.

 Jurisdictions:* Many cities have bylaws associated with odour complaints. (e.g., Metro Vancouver).
* Alberta for agricultural sources (NRCB).

 Involvement and Method of Reporting:* Some jurisdictions use an odour diary for public receptors to record details over a certain amount of time. Others use online reporting forms and/or toll-free numbers.
* Once a complaint is issued, the next step must be identified.
* Some jurisdictions respond to each complaint, others require all complaints to be logged, but not necessarily acted upon.
* Some require a minimum threshold of complaints before an investigation is launched.

 Streamlining for All Industries:* Since there are already procedures for some agencies with respect to odour complaints, it is important to decide how to implement for all sources.
* There may be situations where one department would oversee odour measurements and pass it to other departments, depending on the nature of theodour.
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QUANTITATIVE EMISSION CRITERIA

Some jurisdictions have quantitative emission criteria for either odour or for specific chemicals. Unlike ambient criteria, which were in two distinct formats, the format of the emission criteria appears to be different for each jurisdiction. In general, these criteria limit the emissions of odorants or specific chemicals at the source, and are essentially in-stack emission limits.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Measurements:* Stack testing is common for a number of contaminants and adding additional testing for odour standards could be included.

Future Planning:* Facilities would know what standards they would need to meet before building and would be able to design to or implement so that the facilities follow guidelines.
* Dispersion modelling based on measurements could be used to determine possible odour issues surrounding the facility before they occur.
 | Capturing Odour:* Emission rates do not necessarily equal odour issues.
* Although high emissions may be recorded, meteorological conditions, temperatures, surrounding terrain, etc., can influence the dispersion of the emissions.
* Does not take into account where receptors are located or if an odour issue would occur in public places.

Inclusion of All Sources:* Would be hard to do for an individual complaint or for an agricultural operation where emissions may be more spread out in both area and time.
* Emission rates may be difficult to measure from non-point sources (e.g., agricultural sources).
* Would be hard to quantify for sources that are variable due to organic matter content (e.g., landfills, composting, agricultural).
* Hard to quantify with monitoring in areas with large number of sources producing similar compounds.
 | Sources:* Would be limited to facilities that have point source emissions. For example, electricity generation, pulp and paper mills, chemical industry, transportation.
* Would be more beneficial in new facilities.

Jurisdictions:* Japan, Korea, Switzerland, Bay Area Air Quality Management District (California, USA).

Sampling Methods:* Frequency of sampling period and averaging period must be considered.
* Preventative monitoring may provide good a community relations tool, while reactive monitoring may come under more scrutiny.
* Averaging time would need to be considered.

Odour Thresholds:* Some jurisdictions measure directly OU or D/T; others measure compound concentration.
* There are hundreds of odour causing compounds. Would need to know how legislation would prioritize them when it is impossible to measure/consider all of them.
* Measurements must relate back to odour detection at the public receptors.
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TECHNOLOGY CRITERIA

Many jurisdictions have requirements for new or existing facilities to implement state-of-the-science control technology or similar approaches that specify required levels of odour treatment controls or best management practices. These requirements are mostly qualitative in nature. Although most jurisdictions do not stipulate which technologies or management practices must be used, some jurisdictions do specify control technologies or management practices for different types of facilities.

Examples of odour control technologies that could be considered as best management practices include vent gas collection and treatment, vent gas condensation, chemical treatment, biological treatment, adsorption, incineration and dispersion (the last step in an odour control process). A typical control system for heated heavy oil tanks would include a vapour recovery unit and destruction unit such as flare, incinerator or thermal oxidizer.

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| STRENGTHS | WEAKNESSES | CONSIDERATIONS |
| Proactive:* Allows for best practices to occur on site.
* Minimizes potential for odour complaints by addressing emissions on site and at the source.

Clear Direction:* Industry would know minimum standards before the planning stages.
 | Capturing Odour:* Even with precautions, odour may still be an issue.
* Additional technology may not affect potential for odour issues, but will likely have financial impact to companies.
* Meteorological conditions, temperatures, surrounding terrain, etc., can influence the dispersion of the emissions.
* Does not take into account where receptors are located or if an odour issue would occur in public places.
 | Sources:* May be more applicable to large facilities (due to cost to individual facilities).
* Easier to implement for common facilities where multiple technology control measures already exist.
* Easier to implement for new facilities

Jurisdictions:* Netherlands; Colorado; Wellington, New Zealand.

Definitions:* What is considered best control technology?
* How would this change over time?

Defining Limits:* Criteria for technology would need to be defined.
* Cost/benefit analysis required.
* Some form of change management required as odour criteria evolve or new technology becomes available.
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