

## H4 – Odour management

# Consultation DRAFT

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# 1. INTRODUCTION

This guidance is part of a suite of our technical guidance notes designed to help both potential holders and holders of Environmental Permits make their applications for a permit or variation and then understand how to comply with their permit.

The top level in this suite is [Getting the Basics Right](#) which covers a large proportion of the what an operator needs to know. There are then notes that cover issues specific to a particular business sector, and “horizontal” notes that go into more detail on a particular topic such as risk assessment, noise or odour. Click [here](#)<sup>1</sup> to see a list of the available sector and “horizontal” notes. H4 is one of these “horizontal” topic notes. All of these are available from our website.

The Environmental Permitting Regulations require the control of pollution including odour. This guidance covers our regulatory requirements with regard to odour, advice on the management of odour and, in particular the aspects, that should be dealt with in an odour management plan.

If you are making a new application you should start with the Environmental Permitting application form which will lead you through the necessary steps. Click [here](#)<sup>2</sup> for the application form and guidance.

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<sup>1</sup> Link to EPR guidance - <http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx>

<sup>2</sup> Link to application form - <http://www.environment-agency.gov.uk/business/topics/permitting/32318.aspx>

## 2. YOUR PERMIT CONDITIONS AND THEIR ENFORCEMENT

For an explanation of how our approach delivers the legislation see [RGN4 - Setting Standards in Environmental Permits](#).

Depending on its age, your permit may express an odour condition using different terms. For example, it may say that the operator must not cause nuisance, annoyance, offensive odours, offence to man's senses, interference with amenities, pollution etc. It may require the use of Best Available Techniques (BAT), appropriate measures, due diligence, all reasonable precautions, odour management or working plans etc to minimise odour.

The law behind these also differs in its terminology. For example, the Landfill Directive says "*Measures shall be taken to minimise nuisances and hazards arising from the landfill through emissions of odours*", whereas the IPPC Directive includes odour in the definition of pollution and says "*.....all the appropriate preventive measures are taken against pollution .....*".

We consider the standards described in [Section 3](#) meet the legislative requirements (standards) in the relevant directives and domestic legislation. If problems do occur, or are likely to, you must take the appropriate actions to prevent them or minimise them when prevention is not practicable. The measures that are appropriate will depend on your industry sector/regime and your individual circumstances.

### The Conditions

The most recent form of our odour condition is shown below and is usually in two parts:

- There is the outcome (sometimes known as "odour boundary") condition, which specifies the outcome (e.g. no odour pollution) with which the operator must comply (1)
- There is a condition requiring compliance with an odour management plan (OMP) (2).

(On occasions there may also be specific operational conditions relating to odour control.)

### The Odour Boundary Condition

1. *Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in an approved odour management plan, to prevent or where that is not practicable to minimise the odour.*<sup>3</sup>

### The Odour Management Plan Conditions

For activities that are likely to give rise to odour problems (i.e. as listed in [Appendix 2](#) of this document and Annex 2 of [Getting the Basics Right](#)), an odour management plan will be submitted for approval as part of the permitting process and the permit will require the operator to comply with this plan and to submit revisions of the plan in the future, should this prove necessary (condition 2A)

- 2A (a) *The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in Schedule 1, Table 1.2, unless otherwise agreed in writing by the Agency.*  
  
(b) *If notified by the Agency that the activities are giving rise to pollution, the operator shall submit to the Agency for approval within the period specified, a revision of any plan specified in Schedule 1, Table 1.2 or otherwise required under this permit, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by the Agency.*

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<sup>3</sup> Where any existing permits contains an odour boundary condition without the underlined provision it is our policy that we will act as though it were present. An operator may have a free variation to include this provision, although this is not necessary to provide protection. The provision will be added when a permit comes up for review or variation for any other reason.

Low odour risk sites will get condition 2B below which allows us to require an OMP at the compliance stage should there prove to be an unexpected odour problem post permitting, at a site where we would not have anticipated it

**2B.** *The operator shall:*

- (a) *if notified by the Agency that the activities are giving rise to pollution outside the site due to odour, submit to the Agency for approval within the period specified, a new or revised odour management plan;*
- (b) *implement the approved odour management plan, from the date of approval, unless otherwise agreed in writing by the Agency.*

These conditions allow us to agree changes to a plan proposed by you, specify changes to it ourselves or require revision to an existing plan.

While there may be no problem at the moment, if circumstances change, for example development occurs around your site such that your activities then affect people outside the site, you will have to take action to prevent or where that is not practicable to minimise those problems.

### **Our regulatory approach to compliance and enforcement**

Enforcement action will not normally be the first response and we always seek to work with you to establish solutions. The exception to this is where serious pollution is occurring, or very likely to do so, immediate action may be necessary, as described under Enforcement Action below.

#### ***Establishing a solution***

The first step to a solution will normally be a discussion on what physical or procedural improvements are necessary. We will challenge you to come up with the solution that is most likely to succeed. When improvements are agreed, we will agree a realistic timetable for the work to be completed.

We will make the improvements binding, for example by requiring an amended or new odour management plan. If you do not submit an acceptable plan in the specified timescale we may:

- if you have submitted a plan of some sort, approve it subject to any requirements we consider are necessary
- vary the permit to add site specific improvement conditions or a prescriptive condition

What is a reasonable timescale to find a solution and amend the plan will depend on how bad the problem is and how technically difficult the solutions. If it is serious, then 48 hours may be appropriate, if minor a number of weeks. Major modifications may take months or more than a year to complete but the initial proposals and subsequent detailed plans should be presented in a timely manner in weeks /months respectively as appropriate. We will set out the requirements in writing and failure to supply or amend an odour management plan within the requested time scale is a breach of the condition.

#### ***Enforcement action***

In addition to securing solutions, as described above, a variety of forms of enforcement action are available. Of particular relevance to odour issues are:

- (a) where there is a breach of a permit condition - a warning letter, formal caution or prosecution and/or an enforcement notice.
- (b) where a breach of permit condition is likely – a warning letter or enforcement notice.
- (c) whether or not there is breach of permit condition, where there is a risk of serious pollution – a suspension of the permit
- (d) where we and you have exhaustively explored all appropriate measures that could be taken but there is still ongoing pollution that is unacceptable- we will consider revocation/partial revocation of the permit
- (e) where there is no breach of a condition, but pollution is being caused – vary the permit.

We will follow our [Enforcement and Prosecution Policy and associated guidance](#) on the use of the various options.

## Solutions and enforcement with regard to odour management plans

If the permit contains conditions as described above, and we are satisfied that the standards described in [Section 3](#) are exceeded, it will almost always be the case that you are not using whatever appropriate measures are **now** needed to control odours. However, if you have an approved OMP, we will take into account that we agreed certain proposals with you at the time of approval. So while any approval is subject to the permit conditions with which you must comply:

- If you are carrying out the measures we originally approved and they are operating as designed, but still not completely solving the problem then we will give you reasonable time to make proposals and implement improvements that will solve the problem. What might be a reasonable timescale is described above.
- However, no OMP covers every eventuality so we may consider immediate enforcement action if:
  - a. the odour is caused by you not doing something you said you would do in the OMP
  - b. the odour is caused by you not having specified, designed, operated, maintained and otherwise managed a measure in the OMP
  - c. there is a serious impact on the environment caused by something not in the OMP that you could and should have reasonably foreseen – for example the wrong liquids are mixed causing a major release, but nothing was said about this in the OMP.

In other words, we will agree the scope and suitability of key measures included in the plan or application, for example the proposed control measures, but it would not be feasible for the Agency to be able to confirm that all of the details of equipment specification design, operation and maintenance are suitable and sufficient for a particular site. That must remain your responsibility.

If you need to carry out rapid action to solve an odour problem, it is theoretically feasible that the action may contravene something you had previously written in your OMP. Clearly we would prefer that you took the action to solve the problem and, in these circumstances too, we would give you time to bring the OMP up to date after the event.

Examples of how this might work in practice are given in Box 1 below.

If you do not have an approved OMP and you cause a significant incident, then we will form an opinion as to whether you have used appropriate measures and, if a prosecution results, the courts will decide whether our opinion is correct.

Information as to the appropriate measures we would normally expect an operator to have taken is provided in [Section 6](#) and [Appendix 3](#). For some sectors we have also prepared example OMPs containing many measures. While these sources of information cover most situations it is possible that some other measure may become evident in particular circumstances.

### **Box 1 - Examples of when we will and will not consider enforcement with regard to an OMP**

Every situation differs and the following examples should be taken as a guide to our approach.

- For a process plant, your odour management plan proposes a thermal oxidiser, probably stating its capacity. If the oxidiser turns out in practice to be insufficient we will work towards a solution with you as described below. If, however, you failed to design the control system properly so that a power or instrument failure caused the oxidiser to be ineffective and caused a significant incident then you would be liable to enforcement action.
- For a landfill, your odour management plan proposes gas scavenger lines of given diameters and extraction fans of a given capacity for the extraction of landfill gas. If these parameters prove in practice to be insufficient we will work towards a solution with you as described below. If, however, the fans fail because of a design flaw, poor maintenance, inadequate training of your staff or because you just decide to turn them down to save costs resulting in an odour incident then you would be liable to enforcement action. The sort of design flaw that could attract enforcement action would be something that should have been picked up as a matter of reasonable due diligence, that is, something that would be normal good practice. As with anything if the courts are likely to consider that it could not reasonably have been foreseen then we would be equally unlikely to take any enforcement action.
- For a farm your odour management plan proposes weekly removal of bedding and this turns out to be insufficient we will work towards a solution with you as described below. If, however, you rely only on one contractor who does not turn up leading to a significant odour incident then you would be liable to enforcement action for having failed to arrange adequate contingency.
- Further examples of the level of detail that are assumed to be within the competence of you or your contractors include:
  - how alarms and notification of failure should be achieved
  - resistance to corrosion, power failure or component failure
  - what its reliability should be (although you may agree levels of reliability in your OMP to overcome this).

### 3. HOW MUCH ODOUR IS UNACCEPTABLE?

As stated in [Section 2](#), whichever terms are used in your permit or the legislation we will interpret the required standard as follows.

You must ensure that odour is controlled so as not to materially affect your neighbours' enjoyment of their property, cause them harm or offence or reduce their legitimate use of the environment, and if problems do occur, or are likely to occur, you must take the appropriate actions to prevent or minimise them.

While for some activities it may not be practicable to avoid all odour, your neighbours have a right to expect that your activities will not detract from their quality of life. We are, however, unlikely to take action over occasional, slight odours.

By "neighbour" we mean anyone living, working, visiting or making use of public space outside your site. It means any sensitive receptor.

Whether or not odour emissions will cause problems for your neighbours depends on a number of factors.

The **FIDOL** acronym is a useful reminder of some of the odour factors that will determine how serious the problem is and what you will need to do as a result.

- **F**requency of detection;
- **I**ntensity as perceived<sup>4</sup>;
- **D**uration of exposure;
- **O**ffensiveness<sup>5</sup>;
- **L**ocation<sup>6</sup> – in particular, the sensitivity of an individual as influenced by their context. .

At different levels of odour exposure different responses can be expected:

- where no odour is detectable, or likely to be detectable, beyond the boundary of your site then no action is required;
- similarly, odour may be detectable outside the site but, because of a mix of the above factors, there may not be a problem. For example, the smell of a local baker's shop can be detected but it only happens in the morning, is usually not considered offensive and, in context, the shop adds amenity to the town. Similarly, the detectable smell of a manure heap from a small, non-intensive farm is usually accepted in the rural context. In such cases no action would be necessary. However, odours from larger commercial operations that are subject to the Environmental Permitting Regulations are generally less well tolerated.
- At some levels of odour exposure, the appropriate response will be a professional judgement of how serious the above (FIDOL) factors are when weighed together and in considering the cost of reducing odour exposure. The Environment Agency will base its professional judgement of the action that should be taken on:
  - the Agency's own monitoring, which is likely to include sniff testing. We may also use other monitoring methods described above, or modelling. Our officers may carry out the monitoring, or we may appoint experts to do so;

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<sup>4</sup> The **intensity** of an odour is a logarithmic function of its concentration. So increasing the concentration of an odorous chemical or mixture by a factor of 10 might increase its perceived intensity by a factor of about 2. Conversely, if a site causes odour pollution, abatement equipment might need to remove ~90 per cent of the odour-causing substances in order to halve the intensity of odour as perceived in the community. Adaptation means that the perceived intensity of an odour diminishes rapidly with constant exposure.

<sup>5</sup> The **offensiveness** of an odour is referred to as its hedonic tone. The measurement scale for hedonic tones typically ranges from +4 for very pleasant odours (bakeries, say) to -4 for foul ones (rotting flesh, for example). Neutral odours score 0. The hedonic tones for common odours are in [Appendix 3 Table A3.1](#).

<sup>6</sup> **Location / context:** Places where people eat (e.g. houses, restaurants, picnic areas), sleep (e.g. houses, hotels), relax (e.g. houses, parks) or cannot leave or are concerned with health (e.g. nursing homes, prisons, hospitals clinics) will be more sensitive.

- the results of our investigations of complaints, and consideration of any other information from the community;
- the size of exposed population;
- the cost or feasibility of reducing the odour and the need to manage public expectation that some activities will not be entirely free of odour
- If you need to make changes, we will give you a reasonable time in which to make them. This will depend on how serious the pollution is.
- In some instances, the level of odour impacts may simply be unacceptable. Here, if you cannot find a rapid solution, you will normally have to cease operations until a solution can be found. The Agency has statutory powers to suspend or revoke a permit if necessary.
- This might include, for example, situations where what you are doing repeatedly stops your neighbours from enjoying or using their properties (for example by preventing them using their gardens, having to keep windows closed in warm weather, affecting their businesses or making them feel ill).

Theoretical harm, and therefore appropriate expenditure on controls, increases with the size of **the exposed population**. However odour is a very local issue and even if only a very small number of individuals are affected, further control measures might well be necessary. Even if the odour affects only one person or property, the problems caused may be sufficiently significant to require you to take action to address them.

Your activities should not breach the standards described at the beginning of this section for anyone within the normal distribution of odour sensitivity shown in [Appendix 3 Figure A3.1](#). This includes people with a highly developed sense of smell. There are a very small number of people, who have conditions which put them well outside this range and make them hypersensitive. Designing systems to protect them is not normally considered appropriate. We find, though, that this is rarely an issue. See also [Section 7.3 Monitoring – Complaints Data](#). [Appendix 4](#) explains the benchmarks in terms of what is acceptable when you assess modelled results for new proposals, set emission limit values or calculate chimney height or abatement efficiency. You cannot use any of these values in day-to-day compliance activities, because you will not be able to measure the levels in ambient air.

## 4. ODOUR MANAGEMENT PLANS

If it is likely that odour from your activities may cause pollution /annoyance beyond your site boundary, you will be required to have a written odour management plan (OMP) which will have to be submitted to and approved by the Agency. If the version submitted is not considered satisfactory, the Agency will ask you to revise it to address any identified concerns before approving a revised draft. Once the OMP is in a form acceptable to the Agency it will be approved and you will then be required to comply with it. Activities for which odour is a key issue and which should always have an odour management plan, are listed in [Appendix 2](#) and are also in Annex 2 of [Getting the Basics Right](#).

Even if you are not on that list, if odour problems have arisen at your site, you may also need an OMP.

If you have an OMP which isn't adequately controlling the odour you will need a revised OMP which addresses the problems more effectively, or addresses new or unanticipated problems.

Sites that both the Agency and you consider to have a low odour impact potential (inert waste landfills, for example) will not need an OMP. However, if problems arise this initial assessment may have to change and an OMP may then be required.

All OMPs should, as a minimum, contain the following elements:

- an assessment of the [risks of odour problems](#), from normal and abnormal situations, including worst case scenarios, for example of weather, temperature, or breakdowns, as well as accident scenarios;
- the [appropriate controls \(both physical and management\)](#) needed to manage those risks;
- suitable [monitoring](#);
- actions, contingencies and responsibilities when problems arise;
- regular review of the effectiveness of your odour control measures;
- emission limits where appropriate.

These are described in following sections. Each of these elements may be necessary to manage your site effectively in practice, even if there is no requirement for a formal OMP.

Your odour management plan should also include clear statements that show that you understand and accept your responsibilities. In particular, it should show:

- that you, either directly or through your contractors or subcontractors, will ensure that any odour control equipment is designed, operated and maintained such that it operates effectively to control odour at all times;
- that you are familiar with the characteristics of the processes and equipment on site and have identified the areas of risk of emissions from odour;
- how you will reduce or cease operations if necessary to avoid serious odour pollution;
- how you will engage with your neighbours to minimise their concerns and complaints. See [Section 6.6 - Engaging your neighbours](#);
- how you will respond to complaints.

The OMP is your document although it must first be approved by the Agency. If the OMP is not considered sufficient for its purpose, the Agency will make suggestions as to amendments required before it will approve it. Once approved, it explains the key things you will do to prevent odour. The Agency's approval of it means that the provisions contained in the OMP are considered appropriate in the light of the information available at the time. The OMP must be implemented and complied with in full, subject to the caveats described in Section 2; i.e. that approval of the OMP cannot be taken to mean that the Agency considers that the measures it contains represent all appropriate measures.

You should review your OMP at least every year, or sooner if there have been complaints or if there are significant or relevant changes to your site's operations or infrastructure. If it fails to solve the problems

or new odour problems arise that were not planned for or if you know that the risk of a significant odour incident is high, you should reassess your approach as often as necessary.

You should do what you need to in order to make sure that you control the odour so that it does not cause problems (as defined in [Section 3](#)) for people outside your site.

More information on what we are expecting to see in your OMP is given in [Appendix 5](#).

## 5. RISK ASSESSMENTS FOR ODOUR

As a first step in your OMP, if you haven't already done so, you should carry out a risk assessment. This is described in our guidance [H1 Part 1 – Environmental Risk Assessment](#).

A risk assessment considers what might go wrong and what you will do to minimise those risks. Risks include accidents (e.g. human error, something fails or breaks), abnormal situations (e.g. extreme weather) or normal operations (e.g. deliveries, compost turning, waste tipping).

The risk assessment method in H1 is flexible enough to handle both simple and complex situations. It uses the normal source–pathway–receptor approach. For each situation, it requires you to propose measures that will make sure that odours from your activities are effectively controlled..

You can use the systematic approach described in the [Section 6 - Control Measures](#) below to help you decide which are the most appropriate measures to use to minimise the risk of odour problems.

When we assess your proposal we will be looking particularly at the probability of unplanned releases caused by poor process control or management. You should address what resilience you have when things go wrong and not simply cover normal operation.

In some cases modelling may help in assessing a new proposal. [Appendix 4](#) gives further information on modelling. However, for most new proposals better evidence is likely to come by providing evidence of other sites that are carrying out the operation you propose without problems. In doing so you should take into account the degree of comparability of the comparison sites. In particular:

- the comparison site may have different weather and dispersion conditions (including topography);
- odorous emissions can differ in frequency, intensity, duration or offensiveness. This can be due to different feedstock materials, operating conditions or engineering differences;
- the quality of monitoring data at the reference site may be poor or not available;
- the community near the new site may be more, or may be less sensitive than at the reference site.

## 6. CONTROL MEASURES

Your OMP will need to consider the necessary control measures. This guidance can only explain how you should approach tackling odour issues. It describes types of control measures and plant that should be considered to prevent or abate pollution, but cannot go into every detail of, for example, how plant and equipment is designed, operated and maintained.

You should take a systematic approach considering all measures under each heading and giving priority to controls that can be used at the earliest possible stage in the process.

The most effective strategies may or may not involve large capital investment. But nearly any method you implement will need careful management. The ultimate action for you to take is likely to be reducing or stopping odour-causing activities altogether, at least until circumstances change, or you have resolved the problem.

Technology and best practice are constantly changing. You should use the latest and most effective control measures available for your industry sector. You should base your decisions on industry best practice, taking costs and benefits into account – not on how profitable your site is.

This section considers general approaches to control measures. Measures that are specific to particular sectors are given in [Appendix 2](#).

### 6.1 Receipt and management of odorous materials

Many feedstock materials, particularly putrescible wastes or animal by-products, can become very smelly before they arrive at your site. You should liaise with your waste suppliers about this. For example, where feasible, your contracts with them may need to specify:

- which types of waste the processing plant or local authority collection teams will receive, and which they will reject;
- how long the waste can be held before it is delivered;
- storage and treatment conditions;
- any appropriate pre-treatment before the waste is dispatched;
- transport conditions (refrigeration, for example);
- the need to divert wastes if you've got operational difficulties or you've exceeded your capacity.

If this is not enough, then you should have procedures in place so that you can identify and reject highly odorous wastes.

You should:

- treat odorous materials promptly;
- keep odorous materials on site to a minimum;
- generate as little extra odorous chemicals as possible, by for example minimising temperatures or conditions that cause materials to decay.

### 6.2 Transfer of odorous chemicals to air

You can contain many odorous chemicals (at least partly) by reducing their rate of evaporation. The methods to do so can be either chemical or physical. You can, for example:

- lower the temperature by avoiding direct sunlight or otherwise reducing the water evaporation rate and the release of dissolved odorous chemicals;
- increase humidity in the immediate environment to reduce evaporation, as above;
- reduce airflow over the surface of odour-releasing materials. This also reduces the rate of evaporation;

- control the acidity/alkalinity of a material to make specific smelly chemicals much more soluble in water. This makes them less likely to evaporate. For example, acidic conditions can suppress the evaporation of alkaline chemicals such as ammonia. Alkaline conditions can suppress odorous acidic chemicals such as propionic acid or acetic acid;
- introduce temporary surface treatments to lower the surface temperature or create a chemical barrier. The simplest is simply clean water. These treatments can also contain pH buffers (acidity or alkalinity regulators) or other chemicals to make odorous chemicals more soluble. You should carefully assess any commercial treatments that claim to suppress or break down odorous chemicals. One study found no relationship between the cost of commercial surface treatment products and how well they work;
- reduce the surface area of an odorous material. This will cut the rate of evaporation;
- avoid disruptive activities such as shredding or screening, which dramatically increase exposed surface area and emissions, unless adequate containment is provided.

### 6.3 Containment of contaminated air

If you cannot avoid significant levels of odorous air, you will need to contain the emissions before treating them.

- Choose containment and treatment methods at the same time. This is so that you can coordinate the most appropriate treatment and management of ventilation rates;
- Localised containment involves lower air flows. It will normally be much more cost effective than if you rely entirely on a large building for primary containment;
- Where you are relying on containment to control continuous odour you should maintain effective airflow by pressure control within the process plant or within process buildings. Air-lock entry and exit doors will enable the integrity to be maintained;
- Keep windows and doors on the process buildings shut. Pedestrian doors should be self-closing;
- Avoid putting doors on opposite ends of a building, because this can create a through-draft and carry odours out;
- Consider all of the normal techniques for minimising VOC emissions from tanks and pipework (see the section on fugitive emissions in [Getting the Basics Right](#));
- Check pipes, valves and tanks regularly for leaks.

### 6.4 End of pipe treatment

There are many ways to treat air from contained sources. They are, in general, the techniques used for chemical abatement:

- **adsorption** using activated carbon, zeolite, alumina;
- **dry chemical scrubbing** - solid phase impregnated with chlorine dioxide or permanganate;
- **biological treatment** - soil bed biofilters, non-soil biofilters – peat/heather, woodbark, compost – bioscrubbers;
- **absorption (scrubbing)** - spray and packed towers, plate absorbers;
- **incineration** - existing boiler plant, thermal, catalytic;
- **other techniques** - odour-modifying agents, condensation, plasma technology, catalytic iron filters and ozone and UV.

Environment Agency guidance note on abatement techniques A3 (*currently under revision*) compares these options. It looks at which are the most appropriate for different circumstances.

For example, biofilters can usually cope with relatively high loading rates, have a high overall capacity, and can be very cost-effective. But they require available space, regular maintenance by competent

staff, and they can't cope with widely variable loading rates. Activated carbon, on the other hand, can deal with highly variable loading rates. Its limited capacity will, though, be quickly used up at high loading rates.

As with containment, it is typically cheaper and more effective to treat small quantities of highly odorous air than it is to treat large volumes of less-odorous air.

If a site has two odorous exhaust streams with very different chemical characteristics, it is often cheaper and more effective to treat them separately.

You may find opportunities for abatement in existing plant and materials. Combustion plants such as boilers, or compost heaps, for example, can often treat low-volume high-odour streams. They can do this either on their own, as a primary treatment before a polishing step, or before enhanced dispersion through an elevated stack.

Some processes are very dusty, and much of the odour will be associated with the dust. Examples include some pharmaceutical processes, poultry farms and animal feed compounders. You might be able to reduce odour significantly by filtering out the dust or droplets from the exhaust, or using mist eliminators. Some forms of abatement equipment will need preliminary particulate control. Packed bed scrubbers, for example, will need protection. You may be able to recycle the collected particulate matter, particularly if it has some value.

Odour neutralising chemicals can be very effective within a process or abatement chamber where effective mixing can take place. They can work also within a building such as an incinerator reception hall or on a farm where there is sufficient time for mixing to occur. In ambient air they are rarely effective. Masking agents and perfumes should not be used, they are merely adding another pollutant to the atmosphere.

## **6.5 Transport and dispersion**

One obvious strategy is to use high stacks and carry out your activities away from sensitive receptors.

You may be able to avoid peak impacts by not carrying out known odour-releasing activities when the smells will be carried to the receptors. For example, suspending operations when there are inversion conditions, adverse wind direction, cold drainage flow conditions. Where this is part of your control strategy you should be monitoring weather forecasts so that you are ready to take swift action to avoid problems.

Dispersion can only be part of a control strategy if you know what you are releasing and in what quantity. That is, in modelling terms, if the source term is known with a known degree of confidence. If it is, then modelling may provide useful information on whether further controls are needed. See [Appendix 4](#).

## **6.6 Engaging your neighbours**

Engaging your neighbours is an important component of your OMP.

It is really important for you to engage with the people who may be affected by your activities. Many operators do this as a matter of course and have well-established procedures for interfacing with the general public. However, some operators overlook this essential step to managing odour.

Odour is only a problem if it causes problems, or is likely to cause problems, for your neighbours. It is up to you to stop that from happening.

You must appreciate that your neighbours are likely to perceive odour differently from you or your employees. For you, the activity is your livelihood, and you do not want it interrupted. You only have to put up with the smell when you are working. You will become used to the smell, so it no longer seems to be a problem.

For your neighbours, bad smells mean that they enjoy their homes and gardens less. They may worry that your activities will devalue their properties. The smell will reach them less often, and so they will be more conscious of it than you are. They may fear that the substances they smell will cause them more long-term harm.

Your neighbours, in short, may feel threatened by your activities. They may also be concerned about other aspects such as lorry traffic, noise, dust or other pollution. Many of the complaints we receive are for multiple problems, including odour. It may be more than just odour that you need to address.

Whatever the particular local issues, the perception of threat can be compounded if your company is disconnected from and unaccountable to the local community.

If you engage your neighbours at an early stage, they may be more accepting of the situation. Even if they do not accept it, they can still help you identify the problem and that will help you find the solution. That itself will make it less likely that they will initiate action against you.

It is far better for you to engage with your neighbours, to solve the problems and avoid annoying them, than waiting until our officers get called in.

Good engagement can include newsletters explaining what you plan to do, a website with similar information, meeting with community leaders, open days and organised visits to your plant and public meetings.

You should:

- make sure that your neighbours know how to contact you if they think that odour from your activities is a problem;
- take action to solve the problem promptly;
- work with your neighbours to pinpoint an odour if its source is uncertain, for example by getting them to complete residents' diaries. An example of a resident's diary is given in [Appendix 1](#).

## 6.7 Responding to complaints

Your odour management plan should show how you respond to complaints.

You should investigate any complaints promptly and take any appropriate remedial action. You should tell the complainant and any one else likely to have been affected what you have done. You should record the details of the complaint and the actions you have taken. An example of a complaint recording is given in [Appendix 1](#).

If you need to substantiate the odour, a record form and advice for sniff testing are also given in [Appendix 1](#), however you must also note its limitations with yourself or your staff who may have become accustomed to the odour ([see adaptation](#) in Appendix 3).

Your permit may require you to notify us of complaints, but even if it doesn't, if you have caused an odour that has led to a complaint then you may have breached a condition. If you believe that it is possible that you have done so you should notify us in accordance with your permit.

You would then normally investigate as follows:

- Is the process under control? (Have you received exceptionally odorous wastes, for example? Has a normally aerobic composting activity become anaerobic? Have putrescible wastes been left standing for too long before processing?)
- Have odour containment measures failed? (Has a door been left open, for example? Have odorous materials been stored outside a containment area? Have adverse conditions, such as weather, overwhelmed containment structures?)
- Have effluent scrubbing measures failed? (Has a carbon scrubber become saturated, for example? Has a biofilter been temporarily overloaded? Does a wet scrubber need maintenance?)

- Have dispersion methods failed? (Have stable atmospheric conditions failed to disperse an odorous plume, for example? Have your neighbours been exposed to emissions because of unfavourable night-time cold drainage flow conditions?)
- Is there a health risk to the local community?

Sometimes, your investigation will show that you need to stop some site activities or take some other remedial action. You should be ready for this. Plan effective and proportionate remedial measures and develop contingency plans to apply them. If you think that a particular activity will cause odour problems, then you should suspend that activity until effective controls are in place. The main exception to this would be when to stop one activity would cause even greater odour problems. If you delay turning a composting windrow, for example, it may make anaerobic conditions worse. In these cases, though, you would normally need more dramatic remedial action, possibly even putting a stop to accepting more waste. However, taking farming as an example, you may not always be able to delay an activity (e.g. emptying litter or manure from livestock sheds) due to health and welfare reasons.

Best practice is to keep auditable records of any investigations you carry out. These records will be invaluable to you in analysing incidents and stopping them from happening again. They may in any event be required as part of your OMP or permit conditions.

## **6.8 Actions when problems arise – your accident management plan**

Your permit may require you to maintain an accident management plan. You may include odour-related accidents in this because this is where your staff would look if something goes wrong. However, if you have an odour management plan, which is likely if you are reading this document, it may be more appropriate to cover such situations in there as long as it not only identifies the appropriate response to a situation, but also who is responsible for taking preventative action and taking action after an incident.

Your ultimate control measure when problems arise is to reduce or cease operations to avoid serious odour pollution. Your odour management plan should include a clear statement of the situations in which you will do this and how you will manage such a situation.

## 7. MONITORING

You need to assess your odorous substances emissions so that you can work out how effective your control measures are. What you do in terms of monitoring will need to reflect the actual or potential impact on the local community. The following includes a brief overview of available monitoring methods and their applicability. Further guidance on these techniques is in preparation.

### 7.1 Your monitoring plan

You should be clear about reasons for monitoring. You may want, for example, to:

- assess impact (complaints, community questionnaires, interviews and judgement);
- assess exposure (walkover surveys, field dilution olfactometry, surrogate monitoring);
- investigate sources and pathways (fence line monitoring, meteorological monitoring);
- measure releases (dynamic dilution olfactometry, surrogate monitoring);
- control processes (temperature, oxygen levels, pH, moisture)

Monitoring can take several different forms:

- sniff testing (to check ambient air on or off site);
- meteorological monitoring. Very simple, low risk, sites may get away with indirect (e.g. local airfield met data) or observation methods. Most, though, will require appropriately configured on-site data-logging instruments;
- complaints (direct complaints, as well as those via us, or via a third party such as a local authority);
- odour diaries;
- surrogate chemicals or process parameters (e.g. H<sub>2</sub>S, ammonia, odourless methane as an indicator of odorous landfill gas etc, pH and flow in a scrubber);
- emissions monitoring if there is a point of discharge;
- grab samples that are diluted to the odour threshold in a laboratory setting (i.e. BSEN 13725 Dynamic Dilution Olfactometry);

Your monitoring plan should include:

- why and how monitoring will take place, for example:
  - your steady state monitoring to confirm that odour is under control – regular sniff tests and if appropriate, continuous monitors or process surrogates;
  - If an odour problem arises, the monitoring you will carry out to establish what needs to be done;
  - If you have put a solution in place the monitoring that you will do to confirm that it has resolved the problem
- how to interpret the results including, whenever feasible, trigger values for further monitoring or remedial action;
- if the terrain is complex, or if odours come from many places, how monitoring will handle this;
- record-keeping and reporting.

### 7.2 Issues to take into account in any ambient air monitoring

Whether using sniff testing or taking samples you should take account of the following:

- It is often difficult for investigators to witness odour incidents (particularly peaks) that are episodic and short-lived.
- Emissions are greatly diluted from their point of release, and are often below detection limits of instruments but can still be detected by people.

- Peaks in exposure may be due to changing dispersion conditions (wind direction, turbulence) or variable emissions (doors opened).
- Emissions from elevated stacks may ground beyond the monitoring point.
- It can be difficult to work out where an emission comes from or to distinguish it from other sources.

While detection can be improved by sampling more air and concentrating this on a sorption device, this only provides average concentrations that bear little relevance to the peak events that cause annoyance / offence etc.

### 7.3 Complaints data

Complaint data is probably the most direct and reliable form of monitoring whether odours are causing a problem. It is important that you record complaints, respond to them and communicate with the complainants as described in [Section 6.7 Responding to complaints](#) above.

In assessing data be aware that it can be vulnerable to systematic bias. It is considered that people tend to *under-report* odour problems. This may be because they:

- don't know who to complain to;
- fear, rejection, indifference or ridicule;
- feel that it is too much effort to register a complaint;
- don't believe that anyone will act on their complaints;
- feel concerned about secondary consequences (e.g. reduced property values);
- do not see that their complaints have been properly dealt with recorded or reported in the past.

You can clearly get better results if you address these issues, where they may apply.

Operators sometimes wonder whether the complaints they get really reflect what the community feels. They often say that just a few individuals make most of the complaints. They also say that people complain about odour, when what they're really concerned about is traffic, dust, noise or property values. In some cases, individuals are wrong about where the smell comes from. Some operators report that individuals in the community run complaint campaigns.

While this may occur on occasions, the opposite is at least as likely. It is true that the level of reaction caused by odour can be confused with other factors but you are likely to be in a position to explain this to complainants. It is also quite common for a few people to make the most complaints. This may be because they are the chosen representatives, they may be more exposed because of their location or circumstances or may simply have a highly developed sense of smell within the normal range, rather than being hypersensitive. If you get complaints from a number of people, it is highly unlikely that they are all hypersensitive. It is very unusual for people who are not genuinely concerned about a smell to make a complaint. As a rule, you should appreciate that your complaints statistics will tend to *underestimate* the impact a community feels.

### 7.4 Sniff testing

Sniff testing is the most common form of odour monitoring. While the factors mentioned in this section need to be taken into account in order to minimise inconsistencies, it can provide perfectly good evidence of an odour problem. A distinct advantage is that while sniff testing may fail to detect odours, it is very unlikely to indicate odours which are not there.

Template forms and advice for sniff testing and other useful forms are given in [Appendix 1](#).

Never put yourself or others at risk by attempting to sniff potentially hazardous emissions.

The credibility of operator self-monitoring can suffer for a number of reasons. Many sites are also not staffed at night, when dispersion conditions can be poor. The public may perceive self-interested bias. Staff working at the site get used to (adapt to) odours from the site and this adaptation means that even

if you try to assess your site objectively, you may not be the best person to do so. Anyone who has become used to a smell may not even be aware of the fact, because their sense of smell continues to respond normally to other odours. More information on [adaptation](#) can be found in [Appendix 3](#). You should therefore consider whether using external, independent contractors, is appropriate.

The points in [Section 7.2](#) also need to be taken into account.

## 7.5 Odour diaries and community surveys

You may recruit community members to take part in monitoring. Designated residents could, for example, do walk-over surveys (offsite), either on a regular basis or in response to complaints. They could also keep odour diaries (Templates for odour diaries and other useful forms are given in [Appendix 1](#)). It may be better if you initiate this engagement with the community. You must keep complete and accurate records of any such monitoring.

You could ask key individuals, in strategic locations in the community to keep a diary of times and dates when they detect smells, to start building up a pattern of odour problems. You shouldn't expect individuals to keep such records for a long time. And if you don't do anything to improve things, reporting rates will usually fall. But if you ask for and act upon information, you can improve your relations with key members of the community and have less of an impact on everyone else.

Community surveys can give you a useful snapshot of the level of odour annoyance. Open surveys, where you make it clear what you are trying to achieve, are easier to design. The responses you get may, though, be vulnerable to bias. It is more difficult and expensive to design and carry out disguised surveys (in which you try to gather information about odour impact indirectly). A considerable amount of planning needs to go into any survey. You need to make sure that the individuals and companies who carry out your surveys are competent to do so, so that there's as little bias as possible in the results.

Community data isn't much use unless it identified the person who provided the information. When you gather such personal details, you must by law comply with the Data Protection Act, 1998. In particular, you must tell people what the information will be used for and to whom it may be sent. You can find more details on how to comply with the Data Protection Act, 1998 on the Information Commissioner (ICO) website <http://www.ico.gov.uk>.

## 7.6 Grab samples and dilution olfactometry

**Dynamic Dilution Olfactometry (BS EN 13725):** The standard method for measuring odour is Dynamic Dilution Olfactometry (BS EN 13725:2003). It reduces the subjectivity of sniff testing by an individual. This involves diluting a grab sample in the laboratory to a point where a panel can just begin to detect the odour. The result is the number of dilutions used when half of the panel can detect the odour. So a dilution detection level of 100:1 would be a concentration of 100 odour units  $m^{-3}$  ( $ou_E/m^3$ ). (Remember that  $1ou_E m^3 =$  the level of detection). The sample could be from an emission point, or it could be a sample of ambient air. This laboratory method is very useful. If you are testing highly variable emission sources, you will need to do multiple tests, which can quickly become expensive.

**Field dilution olfactometry** aids such as the Scentometer or the Nasal Ranger may assist investigators in their characterisation of ambient odours. The investigator breathes filtered air through the device while they adjust the amount of unfiltered ambient air until the odour is just detectable, this results in a crude field measurement of odour concentration. This provides immediate quantitative results.

It is subject to the same limitations as sniff testing (olfactory sensitivity of the user, short term adaptation, the need for the tester to be physically present during peak exposures as well as poor usage technique). Nevertheless, when used rigorously in accordance with the manufacturer's instructions, the method can provide more objective results which tend to underestimate the actual exposure.

## Taking samples

- Many odorous chemicals stick to or react with their surroundings. So you should use non-stick, inert sample containers. Silica-lined steel canisters or Tedlar bags are suitable. Using the lung principle in combination with Tedlar bags avoids the sample travelling through the pump (more sample may be lost in a pump).
- You won't be able to measure any odorous chemicals that dissolve into the water phase in a sample therefore you need to take steps to avoid condensation in the sample.
- Micro-organisms can make the odour in a sample increase.

## 7.7 Chemical monitoring techniques

A range of chemical monitoring techniques can be used under some circumstances. For example:

- Non-specific instruments (flame ionisation [FID], electrochemical detectors for example). Instruments that use a flame ionisation detector will respond to all volatile hydrocarbons, whether odorous or not. Landfill gas emissions are dominated by methane. So the instrument can often still provide a good measure of methane and, by association, odour. It may also be useful for detecting fugitive emissions – see below;
- Long path-length monitoring (e.g. LIDAR) also just measures Volatile Organic Compounds (VOCs). It can, though, be useful for detecting odour sources, because it allows you to take measurements across an emissions plume. Concentrations that are highly variable over a short period of time (seconds) probably come from nearby. More stable concentrations may suggest an emissions point which is further away. For ground level emissions it should be possible to move the monitor upwind of the suspected source to assess background levels;
- The Jerome gold foil instrument or instruments based on metal-oxide semi-conductors can measure extremely low levels of H<sub>2</sub>S. But they may seriously underestimate the overall odour exposure if organosulphide chemicals (mercaptans) or other odorous chemicals are present;
- Gas chromatograph mass spectrometer (GCMS) can, theoretically, be used to give speciation or a finger print of a particular chemical combination. However, the chemicals causing the odour are usually minor components so that the print it gives may not be representative of the odour;
- Electrochemical detectors (electronic noses) used in arrays can be useful to detect a change of state in operating conditions as process controls. They are unlikely to be of value in measuring exposure in ambient air.

Individual chemical monitoring techniques may be used as process controls, continuous emissions monitoring, analysis of grab samples and assessment of ambient air.

## 7.8 Measuring odour surrogates and process controls

In a few cases, you will be able to monitor for odour surrogates. For example:

- odorous chemicals found as part of the mix (hydrogen sulphide or ammonia, for example);
- non-odorous chemicals associated with odours (methane, for example, or even carbon 14 as a surrogate for landfill hydrocarbons when there is interference from naturally occurring methane in coal deposits);
- process measurements, such as:
  - pH in a scrubber
  - that the conditions in a windrow are aerobic

With surrogate measurements, the key is that the ratio of surrogate concentration to odour units must be relatively constant and known. The issues associated with the Jerome instrument above is a good example of this.

Most of the chemical instrumentation listed above can be used as surrogates – that is they may be measuring a single substance which is not actually the odorous chemical but is present in a constant relationship to it.

## 7.9 Fugitive emissions

Finding fugitive emissions can often be quite straightforward. But it is important that you don't focus only on sources that are easy to identify and measure. Don't ignore sources that are less obvious, episodic or otherwise inconvenient.

Looking for fugitive emissions in a complex process (e.g. a refinery or chemical plant) requires a detailed knowledge of valves, flanges and vents, what processes are taking place and what substances are where.

A flame ionisation instrument provides instant readings of hydrocarbons and may be useful, but only where there are significant releases of hydrocarbons, where those hydrocarbons can be associated with odorous emissions and there are no other significant sources of hydrocarbons which are not associated with odours. (Don't do a survey when it is windy.) If this reveals a leaky valve, for example, you don't need to quantify the leak – you should just fix it.

If you do need to measure concentration, then use a grab sample, followed by dilution olfactometry.

**Flux boxes** quantify fugitive odour emissions from a surface such as a windrow or pond. A number of variations are possible. Flux boxes can be open, sealed or purged. The surface area covered can also vary. There are significant issues to be aware of. The presence of the box may significantly affect the flow. Area emissions are usually inconsistent across an emitting surface and over time. For example, emissions between the top and the bottom of a windrow may differ. And more fugitive emissions may emerge from a landfill when the barometric pressure is falling, or when there are technical difficulties with the landfill gas extraction system. Furthermore emissions measured over time won't give the peak emission rates that we usually look for.

You can find an example of using flux boxes to assess surface emissions in the Environment Agency Guidance LFTGN 07, [Guidance on Monitoring Landfill Gas Surface Emissions](#). However, pay careful attention to the limitations of this method, and to how to interpret results.

## 7.10 Monitoring records

Whatever you do, your records need to include enough information about the emissions measurement for you to use that data in your analysis.

Results for a grab sample analysed by laboratory-based olfactometry must, for example, include:

- date, time and details of emissions point sampled, and why you chose them;
- how you preserved the samples (condensation, holding time and conditions);
- method of sampling (e.g. stack sampling through a 3 metre stainless sampling tube);
- the laboratory where the results were analysed, and any certification status;
- any laboratory observations that might affect how you interpret results.

## APPENDIX 1 – FORMS

This appendix provides examples of:

1. a report form for sniff testing;
2. a complaint form;
3. an odour diary.

Word versions of these are [available](#)<sup>7</sup>.

### Odour reporting form (sniff testing)

You may need to carry out an assessment either to work out whether you are complying with your permit, or as a part of an investigation into a complaint.

You can use routine assessments to build up a picture of the impact the odour has on the surrounding environment over time. You can develop ‘worst case’ scenarios by doing assessments during adverse weather conditions or during particularly odorous cycles of an operation. Ideally, you should use the same methodology to follow up complaints.

Please note:

- Staff normally exposed to the odours may not be able to detect or reasonably judge the intensity of odours off-site. You might be better off using office staff or people who have not recently been working on the site to do this.
- Don't use anyone who has a cold, sinusitis or a sore throat, because these can affect the sense of smell.
- To improve (or to check) data quality, you can get two people to do the test independently at the same time.
- Those doing the assessment should avoid strong food or drinks, including coffee, for at least half an hour beforehand. They should also avoid strongly scented toiletries and deodorisers in the vehicle used during the assessment.

Where you test will depend on:

- whether you are responding to a complaint;
- whether you are checking your state of compliance at sensitive receptors;
- whether you are trying to establish the source of an odour;
- wind direction.

The assessment may involve someone walking along a route that you have selected either because of these factors, or in response to the conditions they found when they got there. Another option is to choose fixed points so that you can evaluate the changing situation over several weeks or months. Or the test points may vary from test to test according to local conditions, which would help you identify worst case conditions.

You should also keep a note of any external activities (such as agricultural practices) that could be either be the source of the odour, contribute to the odour, or be a confounding factor. Remember that an odour may become diluted or even change over a distance.

You should also take the factors given in [Section 7.2 Monitoring – Ambient Air](#) into account.

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<sup>7</sup> Via EPR guidance at [http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx#Horizontal\\_guidance](http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx#Horizontal_guidance)  
H4\_Odour\_Guidance\_consult\_v1\_2\_0906262

Odour report form					Date
Time of test					
Location of test e.g. street name etc					
Weather conditions (dry, rain, fog, snow etc):					
Temperature (very warm, warm, mild, cold, or degrees if known)					
Wind strength (none, light, steady, strong, gusting)					
Wind direction (e.g. from NE)					
Intensity (see below)					
Duration (of test)					
Constant or intermittent in this period					
What does it smell like?					
Location sensitivity (see below)					
Is the source evident?					
Any other comments or observations					

Sketch a plan of where the tests were taken, the potential source(s).



<p><b>Intensity (Detectability)</b></p> <p>1 No detectable odour</p> <p>2 Faint odour (barely detectable, need to stand still and inhale facing into the wind)</p> <p>3 Moderate odour (odour easily detected while walking &amp; breathing normally)</p> <p>4 Strong odour</p> <p>5 Very strong odour (possibly causing nausea depending on the type of odour)</p>	<p><b>Location sensitivity where odour detected</b></p> <p>0 not detectable</p> <p>1 Remote (no housing, commercial/industrial premises or public area within 500m)</p> <p>2 Low sensitivity (no housing, etc. within 100m of area affected by odour)</p> <p>3 Moderate sensitivity (housing, etc. within 100m of area affected by odour)</p> <p>4 High sensitivity (housing, etc. within area affected by odour)</p> <p>5 Extra sensitive (complaints arising from residents within area affected by odour)</p>
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## Odour Complaint Report Form

Time and date of complaint:	Name and address of complainant:
Telephone number of complainant:	

Date of odour:	
Time of odour:	
Location of odour, if not at above address:	
Weather conditions (i.e., dry, rain, fog, snow):	
Temperature (very warm, warm, mild, cold or degrees if known):	
Wind strength (none, light, steady, strong, gusting):	
Wind direction (eg from NE):	
Complainant's description of odour:	
<input type="checkbox"/> What does it smell like?	
<input type="checkbox"/> Intensity (see below):	
<input type="checkbox"/> Duration (time):	
<input type="checkbox"/> Constant or intermittent in this period:	
<input type="checkbox"/> Does the complainant have any other comments about the odour?	
Are there any other complaints relating to the installation, or to that location? (either previously or relating to the same exposure):	
Any other relevant information:	
Do you accept that odour likely to be from your activities?	
What was happening on site at the time the odour occurred?	
Operating conditions at time the odour occurred (eg flow rate, pressure at inlet and pressure at outlet):	
Actions taken:	
Form completed by:	Date      Signed

**Intensity (Detectability)**

- 1 No detectable odour
- 2 Faint odour (barely detectable, need to stand still and inhale facing into the wind)
- 3 Moderate odour (odour easily detected while walking & breathing normally)
- 4 Strong odour
- 5 Very strong odour (possibly causing nausea depending on the type of odour)

<b>Odour Diary</b>		Sheet No
Name:	Address:	
Telephone Number:		

Date of odour:							
Time of odour:							
Location of odour, if not at above address:							
Weather conditions (dry, rain, fog, snow etc):							
Temperature (very warm, warm, mild, cold or degrees if known):							
Wind strength (none, light, steady, strong, gusting):							
Wind direction (eg from NE):							
What does it smell like? How unpleasant is it? Do you consider this smell offensive?							
Intensity – How strong was it? (see below 1-5):							
How long did go on for? (time):							
Was it constant or intermittent in this period:							
What do believe the source/cause to be?							
Any actions taken or other comments:							

**Intensity (Detectability)**

- 1 No detectable odour
- 2 Faint odour (barely detectable, need to stand still and inhale facing into the wind)
- 3 Moderate odour (odour easily detected while walking & breathing normally)
- 4 Strong odour
- 5 Very strong odour (possibly causing nausea depending on the type of odour)

## APPENDIX 2 – ODOUR MEASURES FOR SPECIFIC SECTORS

### 1. Activities that always need an odour management plan

The following are activities where odour is frequently a problem. If you operate one of these you must have an odour management plans unless otherwise agreed, in writing, by the Environment Agency. If you hold a standard permit you do not need to submit it but it should be available for inspection.

If your activities are not on the list but you know you have an odour problem you should also have an odour management plan.

<b>Waste activities</b>
Landfill of biodegradable waste
Biological treatment,
Composting in open windrows (available as a standard permit)
Composting in vessels (available as a standard permit)
Mechanical biological treatment (available as a standard permit)
Sewage sludge treatment (available as a standard permit)
Clinical waste treatment (available as a standard permit)
Animal carcass incineration (available as a standard permit)
Mobile plant for the treatment of waste soils and contaminated material, substances or products (available as a standard permit)
<b>Chemicals</b>
Manufacture, use or recovery of compounds containing sulphur, ammonia, amines and amides, aromatic compounds, styrene, pyridine and esters
<b>Food and farming</b>
Food production involving any form of cooking or heating and brewing
Intensive livestock within 400m of a sensitive receptor
<b>Other</b>
Refining
Distilling or heating tar or bitumen

### 2. Appropriate measures for particular sectors

The following are taken from the EPR Sector Guidance Notes. They are the key appropriate measures, BAT, reasonable steps, due diligence etc referred to in your permit condition. They cannot cover every detail of the design and operation of the plant and it remains your responsibility to comply with the condition in the permit. In some cases there is a fuller description in the SGNs. The term annoyance is used throughout this section and can be taken to mean nuisance/ offence/ pollution/ offence etc as described in [Section 2](#).

#### Gasification, liquefaction and refining (EPR 1.02)

Odour can be a significant issue for some processes and they should be designed and operated appropriately. This applies particularly to sour gas processes, where special care is needed when handling rich amine streams, sour condensates and when processing gas, which is sweet but contains traces of very highly odorous sulphur compounds. These are mainly natural mercaptans and even at very low concentrations they are foul smelling. They typically partition into the hydrocarbon condensate product, which should be handled very carefully and should be sweetened by a suitable process.

##### Indicative BAT

You should, where appropriate:

1. Vent odorous releases regardless of size (e.g. instrument purge lines) via suitable traps
2. Provide a blanketed fixed roof emergency tank for off-specification or unstabilised/unsweetened condensate;
3. Have closed effluent systems vented to flare;
4. Have arrangements to collect and treat any spills of unsweetened condensate immediately with sodium hydroxide.

### **Glass manufacturing (EPR 3.03)**

#### **Indicative BAT**

You should where appropriate:

1. Minimise releases of odour from melting operations (release of binder breakdown products from recycled material) by pre-treating the fibre or adding oxidising agents.
2. Significant emissions of hydrogen sulphide can arise from stone wool cupola melting operations. These should be minimised by combustion in an afterburner system.
3. Odours from forming area emissions should be minimised by wet scrubbing and adequate dispersion. If the odour problem persists, you should use an oxidising agent in the wet scrubber. Ensuring this is kept separate from the process water system.
4. Odour releases from curing ovens should be minimised by:
  - good oven maintenance and cleaning;
  - wet scrubbing;
  - adequate dispersion;
  - provision for the rapid extinguishing of any fires;
  - incineration of curing oven waste gases.
5. Odour releases from product cooling should be minimised by ensuring procedures are in place to prevent over-curing of the product.

### **Large volume organic chemicals (EPR 4.01) and Speciality Organic Chemicals (EPR 4.02)**

For both these sectors, the requirements for odour control will be installation-specific and depend on the sources and nature of the potential odour.

#### **Indicative BAT**

You should where appropriate:

1. Manage the operations to prevent release of odour at all times.
2. Where odour releases are expected to be acknowledged in the permit, (i.e. contained and treated prior to discharge or discharged for atmospheric dispersion):
  - for existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance;
  - for new installations, or for significant changes, the releases should be modelled and it is expected that you will achieve the highest level of protection that is achievable with BAT from the outset;
  - where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made;
  - where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in our view, to increase the odour impact at receptors, you should take appropriate and timely action, as agreed with us, to prevent further annoyance (these agreed actions will be defined either in the permit or in an odour management statement).
3. Where odour generating activities take place in the open, or potentially odorous materials are stored outside, a high level of management control and use of best practice will be expected.
4. Where an installation releases odours but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that you will work towards achieving the standards described in this guidance note, but the timescales allowed to achieve this might be adjusted according to the perceived risk.

### **Inorganic chemicals (EPR 4.03)**

The requirements for odour control will be installation-specific and depend on the sources and nature of the potential odour. Some compounds, such as hydrogen sulphide and mercaptans or ammonia and amines, are particularly pungent but many other compounds such as chlorine or sulphur dioxide can also cause offence at low levels. Where there are highly odorous materials, use the strictest techniques to prevent trace emissions.

Even the treatment of otherwise innocuous substances can cause an unpleasant odour, e.g. the biological treatment of waste-water. Poor design or operation of facilities intended to be aerobic may not provide sufficient aeration. This can cause anaerobic conditions and the formation of odorous compounds. You should also remember that volatile compounds may be released when the waste-water is first exposed to the atmosphere. You may need to prevent their emission by covering the tank or separator and recovering the compounds.

#### **Indicative BAT**

See box above for Large volume organic chemicals (EPR 4.01) and Speciality Organic Chemicals (EPR 4.02).

### **Waste incineration (EPR 5.01)**

#### **Indicative BAT**

You should minimise odour by:

1. enclosing odorous waste all the way to the furnace (ACI, CWI)
2. confining waste to designated areas (all)
3. ensuring that putrescible waste is incinerated within an appropriate timescale (MWI, CWI, ACI, SSI)
4. refrigeration of such waste which is to be stored for longer than an appropriate timescale (CWI, ACI)
5. regular cleaning and (for putrescible wastes) disinfection of waste handling areas (all)
6. design of areas to facilitate cleaning (all)
7. ensuring that the transport of waste and ash is in covered vehicles, where appropriate (all)
8. ensuring good dispersion at all times from any release points (all)
9. preventing anaerobic conditions by aeration, turning of waste and short timescales (SSI, MWI)
10. chlorination of waters being returned to STW or in storage (SSI)
11. drawing air from odorous areas at a rate which will ensure that odour is captured (all); and
12. treating such extracted air prior to release to destroy the odours - see below:
  - The use of these techniques should obviate the need for odour masking or counteractants;
  - You should, as far as possible, feed odorous air into the combustion process;
  - Where further treatment is required, you should consider the following:
    - scrubbing for odour control typically would use counter current columns with acids or oxidising agents such as potassium permanganate. A 3-stage scrubbing sequence using sulphuric acid, sodium hydroxide/hydrogen peroxide and sodium hydroxide may be effective;
    - carbon filters are effective, especially where the total quantity of organic compounds is small. Otherwise they can be expensive to run and lead to a significant waste that needs to be treated or disposed of. If it cannot be recovered then preferably spent odour abatement carbon should be fed to the furnace, to destroy the odorous compounds, recover the energy content of the carbon and minimise waste arisings.

## Landfill (EPR 5.02)

Odour is a key issue, particularly for biodegradable waste landfills. Odour is typically associated with:

- trace components in landfill gas
- handling of odorous wastes
- covering of biodegradable wastes

Preventative measures relating to the above are key.

[Getting the Basics Right](#) identifies odour as a key issue for landfills for biodegradable waste. Odour is typically associated with trace components in landfill gas, the handling of odorous wastes and unsuitable emplacement and inadequate covering of biodegradable wastes. Given the fugitive nature of odour emissions, you should give emphasis to preventative measures relating to landfill gas management and waste acceptance and emplacement.

Within the landfill sector, particular care should be given to the following measures.

1. You should have procedures to deal with:
  - waste materials, such as wastes from transfer stations, which have started to decompose prior to landfilling;
  - old waste disturbed by digging;
  - malodorous wastes;
  - agricultural and sewage treatment residues;
  - leachate and leachate treatment systems;
  - landfill gas.
2. You should have procedures in place to maintain a description of the types of odorous substances deposited and generated (intentional and unintentional). This should include:
  - the treatment applied before landfill, which should limit wastes which are inherently odorous;
  - the distinction between wastes which are inherently odorous where the impact is likely to be more immediate and those wastes which may give rise to odour because of microbiological action in the landfill (organic or inorganic).
3. You should undertake a regular odour impact assessment. The impact assessment should cover a range of reasonably foreseeable odour generation and receptor exposure scenarios and the effect of different mitigation options. Your assessment should include point sources (such as flares) as well as linear or area sources (tipping faces, cracks in the cap).
4. You should ensure:
  - sulphate wastes are disposed of in cells in which biodegradable waste is not accepted;
  - there is co-ordination between the gatehouse staff and staff at the tipping face where known odorous wastes are being accepted;
  - the potential for odours during the excavation of waste or removal of cover, (for example, during the installation of gas wells, or for other operational needs) is assessed.
5. You should:
  - keep tipping areas as small as possible;
  - cover waste as soon as possible;
  - design, construct and maintain intermediate capping to prevent the possible release of odours.
6. You should:
  - implement an effective landfill gas management plan in conjunction with good operational practice (such as not leaving odorous waste uncovered) to prevent such releases;
  - ensure full containment of the waste, including temporary and/or phased capping of the site;
  - ensure landfill gas control systems are well constructed, operated and maintained;
  - consider point source emissions such as those from landfill gas flares in selecting and assessing the control system;

- install active landfill gas extraction as soon as possible to minimise the release of uncontrolled landfill gas emissions.

7. You should:

- use an enclosed leachate treatment operation where the proximity of the operation to a receptor is likely to cause an odour problem;
- provide enclosed leachate storage where the proximity of the storage to a receptor is likely to cause an odour problem;
- effectively seal leachate sumps/wells/side wall drainage systems (retaining any necessary access for monitoring and maintenance).

## Waste treatment (EPR 5.06)

### Indicative BAT

1. The requirements for odour control will be installation-specific and depend on the sources and nature of the potential odour. In general:
2. Where odour can be contained, for example within buildings, the Operator should maintain the containment and manage the operations to prevent its release at all times.
3. Where odour releases are expected to be acknowledged in the Permit, (i.e. contained and treated prior to discharge or discharged for atmospheric dispersion):
  - For existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance.
  - For new installations, or for significant changes, the releases should be modelled and it is expected that the Operator will achieve the highest level of protection that is achievable with BAT from the outset.
  - Where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made.
  - Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in the view of the Regulator, to increase the odour impact at receptors, the Operator should take appropriate and timely action, as agreed with the Regulator, to prevent further annoyance (these agreed actions will be defined either in the Permit or in an odour management statement).
4. Where odour generating activities take place in the open, (or potentially odorous materials are stored outside) a high level of management control and use of best practice will be expected.
5. Where an installation releases odours but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that the Operator will work towards achieving the standards described in this Note, but the timescales allowed to achieve this might be adjusted according to the perceived risk.
6. The objective is to prevent emissions of odorous releases that are offensive and detectable beyond the site boundary. This may be judged by the likelihood of complaints. However, the lack of complaint should not necessarily imply the absence of an odour problem.
7. Assessment of odour impact should cover a range of reasonably foreseeable odour generation and receptor exposure scenarios, including emergency events and the effect of different mitigation options.
8. For complex installations, for example where there are a number of potential sources of odorous releases or where there is an extensive programme of improvements to bring odour under control, an odour management plan should be maintained.
9. Emphasis should be placed on pre-acceptance screening and the rejection of specific wastes, for example, mercaptans, low molecular weight amines, acrylates or other similarly highly odorous materials, that are only suitable for acceptance under special handling requirements. These may include dedicated sealed handling areas with extraction to abatement.
10. Scrubber liquors should be monitored to ensure optimum performance, i.e. correct pH, replenishment and replacement.

## **Clinical waste (EPR 5.07)**

### **Duration of storage**

Clinical waste has the potential to produce odour, create litter and to attract vermin or pests if the waste is not processed directly upon arrival at the facilities. This depends on a number of factors including the:

- age of the waste (when it was produced);
- type of waste;
- ambient conditions;
- integrity of packaging;
- how it was stored and handled previously.

Where all parties in the waste chain have employed good practice procedures, and waste is processed as soon as practical to prevent accumulation and nuisance, it is not necessary to stipulate storage times either in the permit or site procedures.

As a result, no particular storage time should be specified in a permit. It is recommended that permit conditions are used to control any potential problems arising from the storage of clinical waste e.g. odour and vermin.

### **Appropriate measures include**

1. Your site operating procedures should:
  - manage the waste in a manner that ensure that the problems with odour, litter and vermin/pests do not occur;
  - facilitate the transfer, treatment, and incineration of waste in rotation based on identification of its type, age on arrival, date of arrival and duration of storage on site;
  - enable the identification and prioritisation of wastes that may cause offence to the senses.
2. Where waste is identified as causing (or is likely to cause) any of the problems identified above you must be able to demonstrate that all parties in the waste chain have discharged their duty of care. i.e. the waste is disposed of as soon as reasonably possible in a manner that minimises the potential for nuisance there or elsewhere.
3. Where problems are occurring you should review all relevant procedures. If this is not sufficient to resolve the problems we may stipulate storage times for the specific site in question.

## **Paper and pulp (EPR 6.01)**

Point source odour emissions are only expected where pulping incorporates the use of chemical recovery systems. Fugitive odorous sulphur compounds, mercaptans and sulphides are released from anaerobic plant offgases or anaerobic conditions in water circuits, primary sedimentation or sludge. The microbial action converts sulphites and sulphates, from a wide variety of sources in the water circuit.

### **Indicative BAT**

The following should be used where appropriate in this sector:

Where fugitive odours are released from anaerobic conditions, control by:

1. reducing sulphates and sulphites;
2. the control of slime;
3. maintaining the system pH above neutral (except machines purposely running under acid conditions);
4. providing alternative sources of oxygen, e.g. nitrate in the ETP;
5. addition of iron salts to render residual sulphides non-volatile.

### **Intensive Farming – Pig and Poultry (EPR 6.09)**

Odour can be an issue for intensive pig and poultry farms with sources of odour such as from:

- livestock housing;
- manure and slurry management (including spreading).

Odour is often associated with ammonia and dust releases. Measures to reduce ammonia can also minimise odours. Appropriate measures to limit odour include:

- careful siting of odorous activities (including storage) to reduce impacts on neighbours;
- reducing protein content of feed;
- use of feed, slurry or manure/litter additives;
- design of housing, including drainage and ventilation;
- good housekeeping;
- reducing litter moisture content (poultry);
- reducing dust emissions;
- covering feed, carcass, slurry and manure stores;
- use of appropriate slurry and manure treatment method(s);
- use of injection or low trajectory spreading methods for manure/slurry;
- timing of spreading to avoid sensitive periods e.g. weekends, and adverse wind and other weather conditions;
- avoiding spreading odorous material near to sensitive receptors;
- reducing duration of storage of manure/slurry.

Other measures that may be considered include:

- landscaping to form physical barriers; and
- the use of odour masking/neutralising agents.

Details of the above and other measures are provided in the EPR Intensive Farming guidance [How to Comply](#).

### **Food and Drink general (EPR 6.10)**

Odour may arise at various points of the process and should be addressed if it has the potential to cause annoyance.

#### **Indicative BAT**

You should as appropriate:

1. Ensure that the effluent treatment plant is adequately sized and maintained, and check that site waste water drains do not become blocked. Where present, aeration tanks should be kept aerated and mixed at all times except where maintenance necessitates shut-down of the aeration system. Alternative operational arrangements should be implemented during shut-down to avoid odour nuisance;
2. Design and operate abatement plant to cope with maximum loadings and volumes;
3. Design extraction from odorous activities to minimise air flows to the abatement plant.

### **Treating and Processing Poultry (EPR 6.11)**

Odour is potentially a significant emission. Design of plant is key in reducing odour emissions. Maintenance of the wastewater treatment plant and of the drainage system (prevention of blockages), as well as careful management of waste, should minimise releases of odour.

#### **Indicative BAT**

In addition to good housekeeping, the key factors in controlling odour from the storage of blood / by-products are exposure, time and temperature. For example the storage of solids below 5<sup>0</sup>C and blood below 10<sup>0</sup>C is reported to reduce odour problems.

You should as appropriate:

1. Minimise chicken slurry production by controlling feeding rate prior to transportation of live birds to site;
2. Storage of putrescible waste in sealed containers;
3. Frequent cleandown of waste containers to prevent build-up of malodorous material;
4. Frequent e.g. daily removal off site of blood/ by-products;
5. Refrigeration of blood/ animal by-products / putrescible material if extended on-site storage is carried out;
6. Install abatement (e.g. activated carbon) on blood storage tank vents;
7. Backventing road tankers through the abatement unit during blood collection ;
8. Use of screens/catchpots to prevent meat scraps / fats from entering drainage system;
9. Enclosure of effluent treatment plant / sludge handling systems;
10. Control of hydraulic retention times in effluent systems.

### **Red meat processing (EPR 6.12)**

#### **Indicative BAT**

In addition to good housekeeping, the key factors in controlling odour from the storage of blood / by-products are exposure time and temperature. For example the storage of solids below 5<sup>0</sup>C and blood below 10<sup>0</sup>C is reported to reduce odour problems.

The following should be used where appropriate in this sector:

1. Minimise manure production by controlling feeding rate prior to transportation of animals to site;
2. Storage of putrescible waste /by-products/ in sealed containers;
3. Frequent cleandown of waste containers to prevent build-up of malodorous material;
4. Frequent e.g. daily removal off site of blood/ by-products;
5. Refrigeration of blood/ animal by-products / putrescible material if extended on-site storage is carried out;
6. Enclosure of potentially odorous operations;
7. macerator equipment used to chop and wash inedible offal;
8. effluent treatment plant;
9. Install odour abatement e.g. activated carbon filter on the blood storage tank vents;
10. Back vent road tankers through the odour abatement unit during blood collection;
11. Use of screens/catchpots to prevent meat scraps / fats from entering drainage system;
12. Ensure that effluent treatment plant is adequately maintained. Where present, aeration tanks should be kept aerated and mixed at all times except where maintenance necessitates shut-down of the aeration system. Implement alternative operational arrangements during shut-down to avoid odour nuisance;
13. Control of hydraulic retention times and desludging in effluent systems to prevent malodours.

### **Dairy and Milk (EPR 6.13)**

#### **Indicative BAT**

Odour should be prevented or minimised by:

1. careful materials handling;
2. good cleaning practices and
3. appropriate effluent treatment.

More information is given on these in the In-process controls section of the Sector Guidance Note.

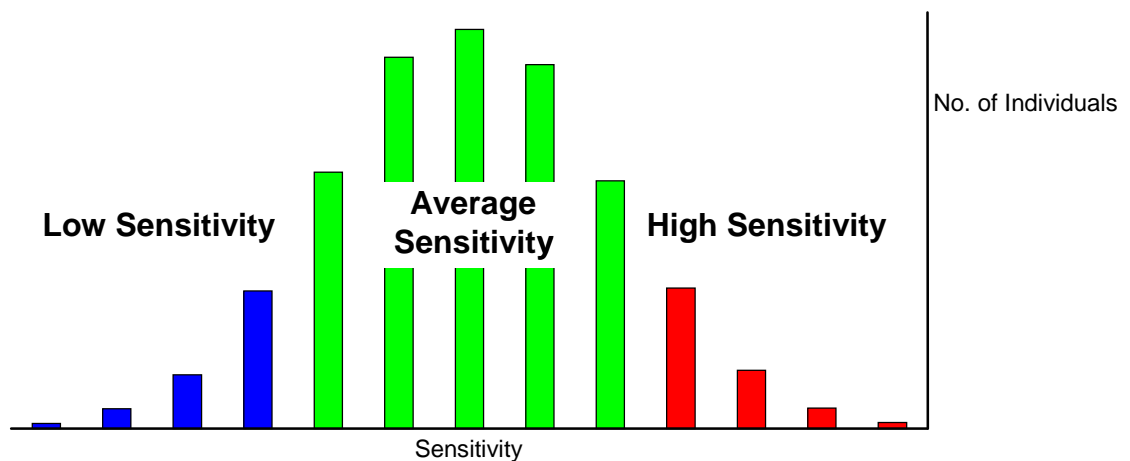
## APPENDIX 3 – IMPORTANT ODOUR INFORMATION

Most of the information in this appendix is numerical. It will help you understand odour issues and terms and is particularly useful for modelling exposure as described in [Appendix 4](#).

### Odour detection thresholds and odour units

Within any group of people, odour detection thresholds will vary widely. This variation between people across a community correlates well with the distribution shown in Figure A3.1.

Figure A3.1: Normal range of odour sensitivities



Published odour detection threshold values for individual chemicals are based on the concentration at which half of a test group can just detect the odour. That is, half of the population should detect the odour, while the other half does not.

Recognition thresholds and annoyance / nuisance etc benchmarks are expressed as multiples of the odour threshold concentration.

An **odour unit** is a measure of the concentration of a mixture of odorous compounds. It is determined by means of olfactometry.

Odour unit values are determined by a standard method given in the draft CEN standard on olfactometry. An odour unit as defined by the CEN standard is 1 ou<sub>E</sub>. (European Odour Unit)

1 ou<sub>E</sub>/m<sup>3</sup> is the point of detection. As a very approximate guide:

- 1-5 ou<sub>E</sub>/m<sup>3</sup> the odour is recognisable;
- 5 ou<sub>E</sub>/m<sup>3</sup> is a faint odour;
- 10 ou<sub>E</sub>/m<sup>3</sup> is a distinct odour.

The values for normal background odours such as from traffic, grass cutting, plants, etc, amount to anything from 5 to 40 ou<sub>E</sub>/m<sup>3</sup>.

A rapidly fluctuating odour is often more noticeable than a steady background odour at a low concentration. People can detect and respond to odour exposure that lasts as little as one or two seconds.

## Offensiveness scores

Offensiveness or hedonic scores are measured on a scale of -4 (foul) to +4 (delicious). This score refers to the type of smell, irrespective of its strength (intensity).

Table A3.1: Offensiveness (hedonic) scores for everyday odours<sup>8</sup>

Description	Hedonic Score
Bakery (fresh bread)	3.53
Coffee	2.33
Hay	1.31
Raw potato	0.26
Rope (hemp)	-0.16
Kippery-smoked fish	-0.69
Paint	-0.75
Mothballs	-1.25
Disinfectant, fresh tar	-1.60
Wet wool, wet dog	-2.28

Raw potato is about neutral. Even smells that most people describe as positive and delicious (such as fried chicken or baking bread) can become annoying to anyone subjected to them continuously.

## Adaptation

Adaptation to odours varies with the odour. People can adapt to some smells within fractions of a second. For other smells, the process may take days or weeks. Adaptation also happens in proportion to both the intensity of the odour and how long someone is exposed to it. The person will begin to recover when they're no longer exposed to the smell, or when it is reduced. Both adaptation and recovery tend to occur rapidly at first, then more slowly as time goes on.

Ground level emissions are dispersed in turbulent air. Concentrations of the odour can vary widely from second to second. As a result, adaptation does not occur. Your neighbour, that is, continues to be annoyed about it. Meanwhile your staff, who are constantly exposed to the odour inside the building, become immune to it.

Long-term adaptation can happen when people are exposed to high levels of specific odours for a long time. Receptor epithelial cells are normally replaced every 30 to 40 days. It can take healthy individuals, therefore, this long to regain their sense of smell.

Some chemicals, such as ammonia, result in far less adaptation. People will smell the emissions for as long as they are exposed to them.

The relevance of adaptation is described in the context of monitoring in [Section 7.4 - Sniff testing](#).

<sup>8</sup> Dravnieks A, Masurat T, Lamm R A, "Hedonics of Odours and Odour Descriptors": in Journal of the Air Pollution Control Association, July 1984, Vol. 34 No. 7, pp 752-755

## A suggested table for characterising odour sources

Surveying a complex site for odour requires a thorough understanding of what is going on at the site, and of what odorous materials are held or processed there. The table below may help you compile information on odour sources.

**Table A3.2 Odour sources**

Source description	Composting feedstock pile
Odorous materials	Source segregated green and kitchen waste from households, bi-weekly collection
Containment / release point	Open air surface of the pile. Inside a process building, but with no effective odour containment.
Odour description	Variable depending upon feedstock makeup and condition. May include a strong component of rotting food.
Intensity at or near the point of release (1 to 10)	Difficult to characterise because the source is within a process building. Initially quite intense but the perception rapidly diminishes upon exposure. Not possible to distinguish from other sources within the process building.
Pattern of release	Expected to peak during waste receipt and other waste movement activities. Material is normally processed daily so that no waste would be left overnight.
Potential for problems	Equipment failures or excessive waste inputs may result in extended holding times for feedstock materials. In bad weather, waste may arrive wet, with anaerobic decay already advanced.

## Cold drainage flow

Cold drainage flow occurs on cool, clear, still nights, when cooled air flows downhill. This is what causes frost pockets. It can happen on smooth slopes above about one degree through to rough slopes above five degrees. Drainage flow speed can be between three and five metres/second. This can concentrate odour in low-lying places.

This phenomenon will only apply to ground level sources. Stack releases will typically be well above the layer of cold air stratification. We are not aware of any readily available modelling packages that might help quantitatively anticipate the impact of cold drainage.

A general awareness of this phenomenon may, though, help explain peculiar patterns of complaint or suggest what further investigations you might need.

There are ways to minimise this problem. You can, for example, plant trees just outside places where the streams develop. Or you can use wind machines to break up the cold stratification layer by mixing it with warmer air at higher levels.

## APPENDIX 4 - MODELLING ODOUR EXPOSURE

A detailed discussion of how to model exposure is beyond the scope of this guidance. Odour modelling is specialised enough that only those who have a good technical understanding of modelling methods and who are familiar with the requirements of the Environment Agency should do it. They will be able to highlight the inherent uncertainties. The following criteria, should, though, be followed.

You can use modelling to:

- predict the impact of a new proposal, comparing with benchmarks;
- compare the cost effectiveness of odour mitigation options;
- work out emission limits for point source emissions, either  $\text{mg}/\text{m}^3$  for a single odorous substance or  $\text{ou}_E/\text{m}^3$  for mixtures of substances. We don't use exposure values at receptors in your permit because they are almost impossible to measure. In the rare occasions that they are used, modelling first converts them to emission rates from the point source. We can then use stack monitoring to check compliance;
- indicate how much improvement is needed or size abatement equipment;
- calculate a suitable chimney height to provide an acceptable exposure at receptors.

However, there are much greater uncertainties associated with odour modelling than with the modelling of other pollutants.

- The human nose responds to odour exposure over a 1 to 5 second interval. Average exposure levels may very well be below the detection threshold but still expose people to short term concentrations which are much higher ([Appendix 3](#));
- The model is predicting that the hourly average concentrations noted on the map will be exceeded for 175 hours over the course of a year;
- UK odour benchmark levels are based on research which associates these levels with 10% of the population reporting annoyance;
- The model cannot account for situations when the wind speed is below about 5 miles per hour.

When you model the impact of emissions for a **new proposal**, you must take into account any existing odour sources. This is true regardless of whether the activities are regulated under the same permit, owned by the same operator or even if they come from activities we don't regulate. Don't include natural and household sources of odour in this assessment.

When it comes to appraising various options, you are interested in the relative impact of each option. So it is not critical for modelled exposure levels to be absolutely accurate.

The modelling method commonly used in the UK calculates a 98th percentile of hourly average odour concentrations over a year. The results are expressed as odour unit contours on a map. You can check unacceptable levels of odour pollution against exposure benchmarks. When the results are interpreted, they must take uncertainty into account, especially in terms of emissions and weather data.

### Dispersion model requirements

The standards for modelling are in document [Review of Dispersion Modelling for Odour Predictions](#), available from our website.

## Benchmark levels

When the hourly average concentrations of odour are modelled over a year (8760 hours in a year), two per cent (175 hours) of those hourly average concentrations must not exceed 1.5 odour units for **highly offensive** odours, 3.0 odour units for **moderately offensive** odours or 6.0 odour units for **less offensive** odours. Any modelled results that project exposures above these benchmark levels, after taking uncertainty into account, should be interpreted as predicting an unacceptable level of odour pollution.

Examples of these three categories are:

Highly offensive

- processes involving animal or fish remains
- brickworks
- creamery
- fat and grease processing
- wastewater treatment
- oil refining
- livestock feed factory

Moderately offensive

- intensive livestock rearing
- fat frying (food processing)
- sugar beet processing
- these are odours which do not obviously fall within the HIGH or LOW categories

Less offensive

- chocolate manufacture
- brewery
- confectionery
- fragrance and flavourings
- coffee roasting
- bakery

The World Health Organisation<sup>9</sup> (WHO 1987) has produced guideline values for the avoidance of substantial annoyance for a few single substances, namely carbon disulphide in viscose emissions, hydrogen sulphide, styrene, tetrachloroethylene, toluene. You may find these useful as part of a wider assessment but the values should be used with caution as they are based on a different averaging method and a different assessment of what is acceptable.

In the rare occasions where you are modelling the odour impact of a single substance, find its detection threshold from standard literature. Then with a knowledge of whether specific chemicals would be considered highly, moderately or less offensive, a benchmark concentration can be calculated for these also. So, for example, methyl methacrylate has a detection threshold of  $0.38\text{mg}/\text{m}^3$ . It is highly offensive and so it should be modelled to 1.5 odour units (see above). Since 1 odour unit is the detection threshold, the equivalent concentration is  $1.5 \times 0.38 = 0.57\text{mg}/\text{m}^3$

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<sup>9</sup> WHO (1987). *Air quality guidelines for Europe*. Copenhagen, World Health Organization Regional Office for Europe, 1987 (WHO Regional Publications, European Series No. 23).

## APPENDIX 5 – WHAT WE ARE LOOKING FOR IN AN ODOUR MANAGEMENT PLAN

How you wish to present your OMP is up to you. If there are many sources of odour and a range of receptors (people who could be affected) you may wish to adopt a traditional risk layout. For example,

Source of the odour	Receptor	Likelihood	Control measures	Actions if odour starts causing a problem	Who is responsible for taking action
Windrow turning	Community centre	Moderate - Community centre only used Wednesday and Friday in the week for mother and baby clinics	Meteorological data - wind socks on site to determine the wind direction. Ensure boundary atomisers are working	Stop actions on site if the wind is toward the receptor. Office staff to odour survey.	Site manger or suitably trained personnel. Site manager will contact office staff by two way radio
etc,					

In some cases, however, there are only a few sources and receptors but many potential control measures. In which case it may be simpler to state the sources and receptors and then group the control measures and actions in whatever way is most sensible for the activities.

Whatever format you choose, the following provides an indication of the sort of things we will be looking for in your OMP. The level of detail required will depend on the scale of your operations and the risk of odour.

### General Indicators

You should have general commitments:

- To locate and manage activities so as to reduce the risk of odour problems
- If problems arise, to identify the source and propose / implement measures to reduce the odours
- In the event of a serious or ongoing odour pollution, explain how you will reduce or cease your operations until such time as other measures can be put in place
- To regularly inspect and maintain the integrity of your infrastructure (including, roads, building, ducts, pipes, drainage/lagoons/sewerage, process equipment and controls)
- To ensure that your odour control equipment is designed, operated and maintained such that it operates effectively to control odour at all times (including the availability of essential spares and consumables)
- To maintain a high level of site cleanliness, including the prompt clean-up of any potentially odorous spills.
- To train your staff on odour management
- To proactively engage with your neighbours to minimise their concerns and complaints including responding to their complaints effectively

- To notify us in the event of odorous releases or other relevant conditions
- To regularly review and update the OMP.

**Identify the potential sources of odour:**

- From normal operations (including business and/or seasonal variations)
  - raw materials (e.g. quality control, receipt and storage)
  - operational activity
  - waste treatment/disposal activities (where not main operation)
- From abnormal conditions
  - meteorological (e.g. wind direction or strength, rainfall/flooding, low/high temperature, inversions)
  - breakdowns of process, waste treatment, abatement, instrumentation and other equipment, utility supplies
  - staffing issues (illness etc)
  - human error
  - accident scenarios (may be linked or refer to accident management plan).

For example the sources for a landfill would normally be:

- odorous materials arriving on site, including specifically wastes from transfer stations which have started to decompose, agricultural and sewage treatment residues;
- odour at the point of deposition
- landfill gas and gas management systems
- leachate and leachate management systems
- other – e.g. disturbance of the cap or other excavation of waste/removal of cover, (for example, during the installation of gas wells, or for other operational needs);

**For each source:**

- consideration of pathways may be appropriate
- identify the risk of odour and its likely impacts and sensitive (and other) receptors.
- identify appropriate control measures showing that you have considered:
  - minimising the inventory of odorous materials
  - minimising the evaporation of odour into the air
  - containment and abatement
  - dispersion
  - monitoring to show that your control measures are being effective
  - contingencies, should your monitoring show that they are not being effective
  - responsibilities when odour problems arise

Guidance on each of these elements is given in the previous sections of this guidance. It may be appropriate to group sources.

For monitoring, considerations include location, frequency and aspects being measured, checked or inspected. Monitoring may include process control elements; exposure and pathways (including source characterisation); the measurement of releases (and emissions where there is a point discharge); and meteorology. Feedback from staff and odour diaries used by members of the community may usefully complement more formal operator monitoring (including complaint data). The plan should indicate why and how monitoring will occur, and how complications will be dealt with, such as complex terrain and staff becoming accustomed to odours. Relevant trigger levels for actions should be identified if appropriate.

Your plan should include information on how you will receive and act (if necessary) upon complaints or concerns (including investigation, remedial action and communication thereon). This should include concerns raised by your own staff.

You should have adequate record-keeping and reporting arrangements in place, in accordance with the requirements of your permit.

Your OMP may refer out to other plans and procedures where appropriate, for example for a landfill you might refer to:

- agreements with suppliers
- pre-treatment
- waste acceptance procedures (including reference to sulphate wastes)
- quarantine arrangements etc
- landfill gas management plan
- leachate management plan

## APPENDIX 6 – GLOSSARY OF TERMS

**Adaptation:** The normal desensitisation of individuals to particular odours. See [Adaptation](#).

**Bespoke Permits:** A regulated site may not qualify for a Standard Permit, either because it poses a higher environmental risk or because it cannot work within the limitations imposed by Standard Permits. If so, we will issue a Bespoke Permit. This is tailored to the individual circumstances and environmental hazards posed by the site. See also: Standard Permits.

**Detection threshold:** The concentration (e.g. ppm) at which an odorous chemical can be just detected. This is usually assessed as an average for populations, because individual people will vary highly in their response.

**Environmental Permitting Regulations:** These regulations came into effect in April 2008. They replaced much of the PPC and Waste Management Licensing Regulations. The regulations implement, in large part, the IPPC and Waste Framework Directives.

**Hedonic tone:** The degree of pleasantness or unpleasantness (offensiveness) for a particular odour.

**Intensity:** An assessment of odour strength based on an initial perception. This perception strength will rapidly diminish with constant exposure. The relationship between odour intensity and odour concentration depends on the specific intensity of the chemical or mixture being detected. Assessments can be made using the German method VDI 3883.

**Neighbour:** Anyone outside the site who is affected by odour from the site.

**Odorous materials / substances / wastes:** Materials that contain and emit volatile odorous chemicals.

**Olfactory fatigue:** Often confused with adaptation, this phenomenon is believed to be exclusively associated with exposure to H<sub>2</sub>S. At a concentration of about 100ppm, the H<sub>2</sub>S causes rapid paralysis of nerves in the nose. This results in complete but temporary loss of smell.

**OMP:** Odour Management Plan.

**Standard Permit:** A type of permit issued under the Environmental Permitting Regulations in which the Environment Agency carries out a generic risk assessment and defines a risk envelope. Suitable operators only have to show that they fit within the risk envelope to be eligible for the a standard permit. They do not have to do their own risk assessment. The permit cannot be tailored to site specific requirements.