Process Guidance Note 6/27 (05)

Secretary of State's Guidance for Vegetable Matter Drying Processes

SCOTTISH EXECUTIVE

Defra would like to acknowledge the work of the Environment Agency's Local Authority Unit in the drafting of this guidance note.

Environment Agency

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1 Introduction

1.1 This note is issued by the Secretary of State, the Welsh Assembly Government (WAG) and the Scottish Executive ("the Government") to give guidance on the conditions appropriate for the control of emissions into the air from vegetable matter drying processes/installations.[1] It supersedes guidance note PG6/27(96) published in September 1996.

1.2 This is one of a series of notes giving guidance on Best Available Techniques (BAT) and Best Available Techniques Not Entailing Excessive Cost (BATNEEC)[2]. The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations.

Site specific BAT/ BATNEEC

1.3 This note is for use under Local Air Pollution Prevention and Control (LAPPC) regime established by the Pollution Prevention and Control Act 1999[3]. It constitutes statutory guidance to regulators under regulation 37 of The Pollution Prevention and Control (England and Wales) Regulations 2000, SI 1973[4]. To the extent it provides guidance on techniques, it also constitutes statutory guidance to regulators under section 7(11) of the 1990 Act, and in any event regulators are expected to have regard to it. The note will be treated as one of the material considerations when determining any appeals made against a decision under either the 1990 or 1999 Acts.

1.4 The note also (where appropriate) gives details of any mandatory requirements affecting air emissions which are in force at the time of publication, such as those contained in Directions from the Government.

1.5 All processes are subject to BAT/ BATNEEC. In general terms, what is BAT/ BATNEEC for one process in a sector is likely to be BAT/ BATNEEC for a comparable process; but in each case it is, in practice, for regulators (subject to appeal) to decide what is BAT/ BATNEEC for the individual process and the regulator should take into account variable factors (such as configuration, size and other individual characteristics of the process) and the locality (such as proximity of particularly sensitive receptors[5]). Ultimately, therefore, what constitutes BAT/ BATNEEC is site specific but this guidance note comprises guidance for the generality of processes in the sector and careful regard should be had to it, in order to maximise consistency of permits as appropriate.

Who is affected

1.6 This guidance is for:

- regulators: who must have regard to the guidance when determining applications and reviewing extant authorisations and permits
- operators: who are best advised also to have regard to it when making applications, and in the subsequent operation of their process
- members of the public: who may be interested to know what the Government considers (in accordance with the legislation) amounts to appropriate conditions for controlling air emissions for the generality of processes in this particular industry sector

1. The term "process(es)" is used in the remainder of the note to mean both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999.
2. BATNEEC is the formulation used in the Environmental Protection Act 1990 and BAT is used in the Pollution Prevention and Control Act 1999. For the purpose of this guidance note, the two concepts are regarded as having essentially the same effect.
3. In accordance with the Pollution Prevention & Control (England and Wales) (Amendment) Regulations 2002, SI 2002/275, processes for the treatment of animal and vegetable matter and food industries transfer from regulation under the 1990 Act to the 1999 Act from 1 April 2005. The relevant date in Scotland under Part 2 of schedule 3 to SSI 2000/323 is 31 December 2002.
4. In Scotland, section 24 of the Pollution Prevention and Control (Scotland) Regulations 2000.
5. Guidance on the relationship between BAT/BATNEEC and air quality objectives is contained in the General Guidance Manual on policy and procedures for A2 and B installations.

1.7 The guidance is based on the state of knowledge and understanding at the time of writing of:

- vegetable matter drying processes
- their potential impact on the environment and
- what constitutes BAT/ BATNEEC for preventing and reducing air emissions

1.8 The note may be amended from time to time in order to keep abreast with developments in BAT including improvements in techniques and new understanding of environmental impacts and risks. Such changes may be issued in a complete revision of this document, or in separate additional guidance notes which address specific issues. (It may not always be possible to issue amending guidance quickly enough to keep in absolute step with rapid changes, which is another circumstance where paragraph **1.5** above might apply.)

1.9 Steps will be taken to ensure that those who need to know about changes are informed. Operators (and their advisers) are, however, strongly advised to check with the regulator whether there have been any changes before relying on this note for the purposes of making an application under the 1990 or 1999 Acts or making any other decisions where BAT/ BATNEEC may be a consideration.

Consultation

1.10 This note has been produced in consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee, and other interested organisations.

Publication

1.11 This and the other published guidance in this series is available, free of charge, via Defra at **www.defra.gov.uk**. There are links to this site from the following web sites:

- Scottish Executive at **www.scotland.gov.uk**.
- Environment Agency at **www.environment-agency.gov.uk**.
- Scottish Environment Protection Agency at **www.sepa.org.uk**.

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1.12 General guidance explaining LAPPC and setting out the policy and procedures, is contained in the “General Guidance Manual on Policy and Procedures for A2 and B Installations” available from **www.defra.gov.uk/environment/ppc/index.htm**, referred to in this document as the "General Guidance Manual.” This is designed for operators and members of the public, as well as for local authority regulators.

1.13 In addition to the General Guidance Manual referred to above, explanation or clarification of certain terms used in this sector guidance note may be found in a general guidance note issued under Part I of the Environmental Protection Act 1991: 'Interpretation of terms used in process guidance notes', known as General Guidance Note 4 - GG4 - published by HMSO in 1991. Where there is any conflict between GG4 and the guidance issued in this note or in the General Guidance Manual, the latter two documents should prevail, as should any subsequent guidance issued in relation to LAPPC.

2 Timetable for compliance and reviews

Existing processes or activities

2.1 The previous guidance advised that upgrading to that standard should usually have been completed by 1 October 1998. In relation to control of offensive odour, the previous guidance required operators to agree with the regulator upgrading plans and timescales for undertaking interim odour arrestment measures, investigate alternative and additional measures and every two years report to the regulator on these measures and on any improvements they consider can be made as a result. Requirements still outstanding from any existing upgrading programme should be completed.

Upgrading for this note

2.2 The new provisions of this note and the dates by which compliance with these provisions is expected are listed in the table below, together with the paragraph number where the provision is to be found. Compliance with the new provisions should normally be achieved by the dates shown. Authorisations/permits should be varied as necessary, having regard to the changes and the timetable.

Table 1: Compliance timetable

Provision	Relevant Paragraph / Row in this note	Compliance Date
Daily inspection of odour arrestment and air handling plant	**5.10**	Within 3 months of the publication of this note
Requirement for an Odour Response Procedure	**6.31**	Within 3 months of the publication of this note
Inclusion of provisions to limit the sulphur content of fuel where a thermal system is used for odour arrestment	**Table 2** , Rows 4 and 5	Within 6 months of the publication of this note
Testing of odour arrestment efficiency and inclusion of BS EN method	**5.17**	Within 12 months of the publication of this note
Testing for sulphur dioxide to ISO 7934 or 7935 and nitrogen oxides to ISO 11564	**5.17**	Within 12 months of the publication of this note
Emission limit for particulate matter reduced to 20 mg/m^3 for sources other than dryers and coolers	**Table 2**, Row 13	Within 12 months of the publication of this note
Emission limit for sulphur dioxide from liquid fuelled dryers reduced to 1700 mg/Nm^3	**Table 2**, Row 7	Within 12 months of the publication of this note
Requirement for emissions to be free from visible smoke	**5.11**	Within 12 months of the publication of this note
Inclusion of a standard for odour arrestment efficiency	**Table 2**, Rows 2 and 3	Within 24 months of the publication of this note *
Management and control of silos for dusty materials	**5.22** and **5.23**	Within 12 months of the publication of this note
Requirement for mist eliminator for scrubbers	**6.7**	Within 12 months of the publication of this note
Inclusion of continuous monitoring provisions for odour arrestment plant	**5.15**	Within 24 months of the publication of this note
Any other provisions	-	To be complied with as soon as practicable, which in most cases should be within 12 months of the publication of this note
* In the case of existing processes where odour arrestment plant has been installed to meet the requirements of the previous guidance notes, the regulator should consider establishing a date for full compliance allowing for the use of the existing equipment until the end of its reasonable operational life provided that emissions from the equipment do not result in offensive odours beyond the process boundary.		

2.3 Replacement plant should normally be designed to meet the appropriate standards specified for new installations or activities.

Relaxation of conditions

2.4 Where provisions in the preceding guidance note have been deleted or relaxed, authorisations should be varied as necessary as soon as reasonably practicable. **Section 7** provides a summary of all changes.

New processes or activities

2.5 For new processes or activities, the authorisation/permit should have regard to the full standards of this guidance from the first day of operation.

Substantially changed processes or activities

2.6 For substantially changed processes or activities, the authorisation/permit should normally have regard to the full standards of this guidance with respect to the parts of the process that have been substantially changed and any part of the process affected by the change, from the first day of operation.

Permit reviews

Reviewing permits

2.7 Under LAPC the requirement is to review conditions in authorisations at least every four years. (Section 6(6) Environmental Protection Act 1990).

2.8 Under LAPPC the legislation requires permits to be reviewed periodically but does not specify a frequency. It is considered for this sector that a frequency of once every six years ought normally to be sufficient for the purposes of Regulation 15(1) Pollution Prevention and Control Regulations 2000.

More frequent review may be necessary in individual cases for the reasons given in Regulation 15(2). Further guidance on permit reviews is contained in chapter 26 of the General Guidance Manual. Regulators should use any opportunities to determine the variations to authorisations/permits necessitated by paragraph 2.2 above in conjunction with these reviews.

2.9 Under both LAPC and LAPPC, conditions should be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

3 Process description

Regulations

3.1 Vegetable matter drying processes are prescribed for:

- Local air pollution control, LAPC, under section 6.9 Part B of Schedule 1 to the Environmental Protection (Prescribed Processes and Substances) Regulations 1991, SI 472 (as amended).
- Local air pollution prevention and control, LAPPC, under section 6.8 Part B of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973.[6]

In the event that any of the following definitions apply, such processes are prescribed for national regulatory agency integrated pollution prevention and control, IPPC, in accordance with the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973:

(1) Processing if it may result in the release into water of any substance listed in paragraph 13 of Part 2 of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973 in a quantity which, in any period of 12 months, is greater than the background quantity by more than the amount specified in relation to the substance in that paragraph, or

(2) treating and processing of materials intended for the production of food products from vegetable raw materials at plant with a finished product production capacity of more than 300 tonnes per day.

3.2 Regulation 9 (1) requires that no person should operate an installation after the prescribed date except under and to the extent authorised by a permit granted by the regulator. The date for section 6.8 Part B processes in England and Wales is 1st April 2005. (See Schedule 3 Part 2 paragraph 9 (3) regarding applications being deemed to have been made for existing Part B processes). In Scotland the prescribed date is 31st December 2002.

3.3 In respect of the interface with Part A:-

(a) it is not envisaged that any vegetable matter drying processes would fall under IPPC control by virtue of the definition in Section 6.8 Part (A1) (f) (that is involve the release of a substance in paragraph 13 of Part 2 of Schedule 1 of the Regulations to water).

(b) it is possible that a vegetable matter drying process could involve the treating and processing for the production of food with a finished product production capacity of more than 75 tonnes per day of animal materials or 300 tonnes of vegetable raw materials (Section 6.8 Part (A1) (d)). In either of these cases the process would fall to national regulatory IPPC control.

3.4 The vegetable matter drying sector is very diverse and there are a number of other guidance notes which refer to processes which may be carried out in conjunction with an vegetable matter drying process. There are separate Guidance Notes for processes involving the production of meat meal (PG6/1) and fish meal (PG6/19), pet food manufacture (PG6/24), animal feed compounding (PG6/26) and also for processes involving the drying of residues from the extraction of edible oils (PG6/25).

6. In Scotland, section 6.8 Part B of Schedule I of the Pollution Prevention and Control (Scotland) Regulations 2000 (SSI 2000/323).

Process or activity

3.5 This note refers to processes for drying vegetable matter by the application of heat principally for the purpose of animal feed production. There are in principle three main types of raw material:-

- material arising from other food production processes, such as malt and grain distilleries, sugar beet, starch extraction, bakery residues and cider/brewery residues,
- material which is dried as a pre-treatment step before use in animal feed or food manufacturing operations such as ground nut residue
- drying of green crops such as alfalfa and grass.

3.6 In the context of this note, "process" or "activity" comprises the whole process from receipt of raw materials via production of intermediates to dispatch of finished products, including the treating, handling and storage of all materials and wastes relating to the process.

3.7 In the case of grain distillery residues they may be screened and centrifuged, the centrifugate is then evaporated to a syrup and the centrifuge cake further dewatered by screw pressing. The combined syrup and press cake are then dried either directly or indirectly prior to cyclone separation and pelletising: Malt distillery residues differ in that the spent grains (or draff) are separated after mashing and are screw pressed to reduce the moisture content. The expressate and pot ale are evaporated to a syrup and combined with the press cake for final drying, cyclone separation and pelletising: In some circumstances the wet cereal residues may be removed from the production site and processed elsewhere. Often in these cases, pot ale or centrifuged spent wash may be evaporated to a syrup. This latter process (i.e. the evaporation of centrifuged spent wash or pot ale) generally leads to emissions into the air which are trivial and should not normally be taken to be a prescribed process (see Regulation 4 of SI 472/1991).

3.8 In the case of sugar beet drying, the beet co-product from the diffusion process is dried together with molasses in a direct fired rotary kiln dryer Dust is separated by cyclone and added back to the product prior to pelletisation. The green crop drying process is similar except a hammer mill is often used for particle size reduction. The products may be sold directly for use as animal feed or sold to animal feed compounders for blending or may be blended on-site. There is separate guidance for animal feed production from edible oil extraction processes (PG6/25) and for animal feed compounding processes (PG6/26).

3.9 The drying of materials arising from certain food manufacturing processes such as sugar beet and starch processing is likely to be a process involving the processing of vegetable matter resulting in the production of more than 300 tonnes per day of product and hence would fall to national regulatory IPPC control.

3.10 In addition there are a number of drying processes undertaken by agricultural concerns receiving grain, pulses and seed. In these cases the moisture content is generally low compared to the other drying operations outlined above. The following processes were expressly designated an exempt process under both section 6.9 Part B of Schedule 1 to the Environmental Protection (Prescribed Processes and Substances) Regulations 1991, SI 472 (as amended) and under section 6.8 Part B of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973[7] :-

- any process for cleaning, and any related process for drying or dressing, seeds, bulbs, corms or tubers
- the drying of grain or pulses.

3.11 The process may also involve the proportioning and blending of raw materials, grinding, mixing and the addition of liquids such as fats and molasses and may be sold as a meal or pellet.

7. In Scotland, section 6.8 Part B of Schedule I of the Pollution Prevention and Control (Scotland) Regulations 2000 (SSI 2000/323).

4 Potential releases

Pollutants and sources

4.1 The key emissions from these processes that constitute pollution for the purposes of Part I of the Environmental Protection Act 1990 or the Pollution Prevention and Control Regulations 2000 and therefore warrant control are those with may lead to offensive odour beyond the process boundary and also emissions of particulate matter. The odorous emissions are a complex cocktail of chemical species and will vary depending upon the material being dried. The emissions will generally contain volatile organic compounds and may also contain organic sulphur or nitrogen compounds.

4.2 Contained emissions of particulate matter are largely associated with emissions from the drying process and also any product coolers and grinding equipment. The particulate matter released from the drying process will usually be largely from the feed material although the fuel may also contribute to the particulate load. There is the potential for fugitive emissions of particulate matter which may arise from transfer of potentially dusty materials including discharge into hoppers and onto conveyors, and delivery to storage silos and sheds. Also material collected by bag filters may become re-entrained if it is not securely contained and carefully handled. The dust may also be odorous.

4.3 The emissions of odours are required to be contained. The potential release points are:

- raw material reception, storage and handling
- from the physical process operations (grinding etc.)
- from the application of heat during the drying process
- from the cooling process
- from the storage, handling and transport of the product during processing
- from the storage and discharge of liquid waste and effluent from the odour arrestment plant
- from the odour arrestment plant discharge (this may be a stack or vent or may be a biofilter with an area source at ground level).

4.4 The presence of fugitive emissions and odours from building air should be greatly reduced where odours are effectively contained within the processing equipment. It is possible to reduce odours by careful process evaluation and by changing, for example, the raw material type, quality and the process configuration.

4.5 Operators are advised that careful consideration should be given to the impact of relatively minor process changes on odour releases from the process. It will be necessary to review the Odour Response Procedure detailed in **Section 6** to identify the potential effects of the proposed changes.

4.6 Whilst the odours will vary depending on the raw material type, quality and the process configuration, it is possible to divide the releases into high intensity and lower intensity odours. The presence of fugitive emissions and odours from building air should be greatly reduced where odours are effectively contained within the processing equipment and, if the process is well managed, it is often only necessary to arrest the higher intensity odours from the drying/cooling process. The following are the five main odour emission sources along with a preliminary categorisation of the typical odour intensity:-

- Fugitive emissions from dryer feed handling and storage. The feed to the dryer is often and integrated part of another process and fully enclosed. In other cases, providing that the raw materials are effectively managed (based upon raw material quality and storage conditions), these emissions should be lower intensity.

- Fugitive emissions from leakage during transfer in process. These emissions will typically be contained within a building and provided the processing equipment is enclosed and maintained under a negative pressure, emissions from this source should be lower intensity.
- Emissions from the dryer would be regarded as high intensity odours.
- Emissions from the cooler would be regarded as high intensity odours.
- Fugitive emissions from handling and storage of products, waste and effluent should be regarded as lower intensity odours.

4.7 Where the odour arrestment plant comprises a scrubber, emissions of materials which are added to the scrubber for improved performance (such as acids, hypochlorite, sodium hydroxide etc.) may be released with the plume if the scrubber and mist eliminator are not properly managed.

4.8 There will also be characteristic combustion releases from the fuel used in the dryer and also from the odour arrestment plant where a thermal oxidiser or other combustion plant is used. These will include:-

- sulphur dioxide from the burner, influenced by the sulphur content of the fuel.
- oxides of nitrogen from the combustion plant. The emission depends on the nitrogen content of the fuel, the amount of excess air, the flame temperature and the burner type.
- carbon monoxide, which may be emitted if the combustion process is badly managed.
- dioxins and furans from the fuel or feed material
- metals, volatile organic compounds, chlorides and fluorides may also be emitted where the dryer fuel is derived from a waste (such as waste or recovered oil).

(It may be necessary to refer to other guidance notes e.g. PG1/2, PG1/3 and PG1/12 if waste oils or waste derived materials are used for combustion).

5 Emission limits, monitoring and other provisions

5.1 Subject to paragraph **5.2**, it should be the aim that any location at or beyond the site boundary is free from offensive odour as percieved by the regulator. This should be achieved by applying the process controls, management controls and arrestment provisions of this note.

5.2 The locality of a process site will influence the assessment of the potential for odour impact. In cases where the site has a low odour impact due to its remoteness from sensitive receptors and the escape of offensive odour beyond the site boundary would be unlikely to cause harm, the provision in this note to arrest odorous emissions may not be necessary to demonstrate BAT. In these circumstances it is expected that the operations should be optimised to minimise odour emissions (as outlined in paragraphs **6.4** to **6.26**) and also that effective process management is applied (as outlined in paragraphs **6.27** to **6.32**). Assessment of the potential for odour impact beyond the site boundary should take account of all predicted wind directions and weather conditions which are typical of the location in question.

- Monitoring of emissions should be carried out according to the method specified in this section or by an equivalent method agreed by the regulator.
- The reference conditions for limits in **Table 2** are 273K, 101.3 kPa, without correction for water vapour content. In the case of particulate matter emissions from combustion plant in Row 13 emissions should be referenced to 17 % oxygen. The pollutant concentrations in Rows 6 to 11 below should also be expressed at reference conditions 273K, 101.3 kPa, without correction for water vapour content; the percentage oxygen figure should be 6% for solid fuel firing and 3% for liquid and gas fuel firing.

Table 2: Emission limits, monitoring and other provisions

Row	Odour	Emission limit / provision	Type of monitoring	Monitoring frequency (subject to paragraph 5.20)
1	Odour emissions from contained and fugitive sources.	Aim that any location at or beyond the site boundary is free from offensive odour (subject to the provisions of paragraph 5.2).	Determination by process assessment (see 5.7 - 5.10)	Daily
2	Contained High Odour Intensity Process Releases (see Paragraph 4.6 for description).	Where installed any odour arrestment plant installed on high odour intensity emissions (see paragraph 4.6) should have an odour removal efficiency of not less than 95%†.	Determination by manual extractive sampling and analysis by dynamic olfactometry in accordance with BS EN13725 .	On installation of new / replacement odour arrestment equipment and / or in the circumstances described in paragraph 5.17
3	Contained Lower Odour Intensity Process Releases (see Paragraph 4.6 for description).	Any odour arrestment plant installed on lower odour intensity emissions (see paragraph 4.6) should have an odour removal efficiency of not less than 85%†.		
† Where the inlet odour concentrations are very low and the 95% and 85% destruction efficiency is difficult to demonstrate due to measurement reproducibility and equipment efficiency at low concentrations, the final discharge to air should contain less than 500 odour units/m^3. In cases where emissions from both high and lower odour intensity sources are vented to the same odour arrestment plant, odour should be calculated in terms of mass odour flows and the overall destruction efficiency should be sufficient to ensure that the high odour intensity source has been reduced by 95%. For example if the high intensity odour source was 126,000ou/m^3 in 4,000m^3/hr of air and the lower intensity source was 4,000 ou/m^3 in 27,000m^3/hr, this equates to a mass flow of 140,000 ou/s and 30,000ou/s respectively. The required destruction efficiency would lead to a maximum emission of 7,000ou/s from the high intensity source (95%) and 4,500ou/s from the lower intensity source (85%). The maximum permitted emission would be 1,335ou/m^3 in a total flow of 31,000m^3/hr.				

Row	Sulphur dioxide	Maximum concentration of sulphur in fuel	Type of monitoring	Monitoring frequency (subject to paragraph 5.20)
4	All oil-fired thermal oxidisers or combustion plant used for odour control and all oil-fired dryer emissions.	1% wt/wt	Statement of compliance	With each delivery
5	All oil-fired thermal oxidsers or combustion plant used for odour control and all oil-fired dryer dryers. Whre the fuel used is gasoil as defined in the Sulphur Content of Liquid Fuels (England and Wales) Regulations 2000.	0.2% wt/wt (before 1/01/2008) 0.1% wt/wt (from 1/01/2008)		

Row	Sulphur dioxide	Emission limit / provision	Type of monitoring	Monitoring frequency (subject to paragraph 5.20)
6	Emissions from direct-fired drying operations using solid fuel where the net rated thermal input of any individual dryer is 20MW or more	3000mg/m^3.	Extractive test to ISO 7934 or ISO 7935	Annual
7	Emissions from direct-fired drying operations using liquid fuel (other than those processes subject to controls under Rows 4 and 5 above) where the net rated thermal input of any individual dryer is 20MW or more	1700mg/m^3.		
8	Emissions from direct-fired drying operations using gaseous fuel where the net rated thermal input of any individual dryer is 20MW or more	35mg/m^3.		

Row	Nitrogen oxides (expressed as nitrogen dioxide)	Emission limit / provision	Type of monitoring	Monitoring frequency (subject to paragraph 5.20)
9	Emissions from direct-fired drying operations using solid fuel where the net rated thermal input of any individual dryer is 20MW or more	400mg/m^3.	Extractive test to ISO 11564	Annual
10	Emissions from direct-fired drying operations using liquid fuel where the net rated thermal input of any individual dryer is 20MW or more	400mg/m^3.		
11	Emissions from direct-fired drying operations using gaseous fuel where the net rated thermal input of any individual dryer is 20MW or more	200mg/m^3.		

Row	Particulate matter	Emission limit / provision	Type of monitoring	Monitoring frequency (subject to paragraph 5.20)
12	Emissions from dryers and coolers	150mg/m^3.	Indicative monitoring plus annual extractive test to BS ISO 9096: 2003	Continuous
13	Emissions from process sources other than dryers and coolers (except where the final discharge of the arrestment plant is within buildings)	20mg/m^3.		

5.3 In the case of existing processes where odour arrestment plant has been installed to meet the requirements of the previous guidance notes, the regulator should consider permitting the use of the existing plant until the end of its reasonable operational life provided that emissions from the plant meet the provisions of paragraph **5.1**. The regulator should still require that the available plant is optimised for odour removal and should establish an odour arrestment efficiency based upon operating data. Where emissions from the odour arrestment plant do not meet the provisions of paragraph **5.1**, the plant should be required to be upgraded to the specified efficiency in **Table 2**.

- In determining the 'reasonable operational life' of odour arrestment plant, the operator would be expected to continue to maintain and repair the plant to prolong it's operational life. The regulator should consider the physical condition of the arrestment plant (potential for leaks, unavailability of spares, increased frequency of malfunction or failure) and the odour arrestment efficiency (the arrestment plant no longer capable of achieving the interim odour arrestment efficiency determined as above) as key indicators of plant reaching the end of it's operational life.

5.4 It may be the case that operators can demonstrate that lower odour removal efficiencies than those in **Table 2** will meet the provisions of paragraph **5.1**.

Existing plant

For existing plant, provided the operator can satisfactorily demonstrate that the operation of plant at lower odour removal efficiencies meets the provisions of **5.1** then these lower odour removal efficiencies should apply.

New / replacement plant

Where it can be demonstrated that the provisions of paragraph **5.1** are being met new/replacement plant may be operated at odour removal efficiencies lower than those specified in **Table 2** To provide such demonstration, operators should determine, using dispersion modelling or alternative appropriate techniques, what percentage efficiencies are required to meet the provisions of paragraph **5.1**.

Monitoring, investigations and recording

5.5 The need for and scope of testing, and the frequency and time of sampling depend on local circumstances, operational practice and the scale of operation. As part of proper supervision the operator will monitor emissions, make tests and inspections of the process and keep records, in particular:

- The operator should keep records of inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. The records should be:
  - kept on site
  - kept by the operator for at least two years; and
  - made available for the regulator to examine

Information required by the regulator

5.6 The regulator needs to be informed of monitoring to be carried out and the results; the results should include process conditions at the time of monitoring.

- A summary of the data identifying the times, dates and duration of alarm events from indicative continuous monitoring of the performance the particulate matter arrestment plant and of the odour arrestment plant in accordance with paragraphs **5.15** and **5.16** should be submitted to the regulator at least every 6 months.
- The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used.
- The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of the completion of the sampling.
- Adverse results from **any** monitoring activity (both continuous and non-continuous) should be investigated by the operator as soon as the monitoring data has been obtained/received. The operator should:
  - identify the cause and take corrective action

- record as much detail as possible regarding the cause and extent of the problem, and the action taken by the operator to rectify the situation
- re-test to demonstrate compliance as soon as possible; and
- notify the regulator

- The operator should hold either on site or available for inspection if required, a list of key arrestment plant and should have a written procedure for dealing with its failure, in order to minimise any adverse effects. (See paragraph **6.31**)

Odours - principles of BAT in this note

5.7 The approach promulgated in this note to reflect BAT/BATNEEC includes:

- An emission standard for odour (**Table 2** Row 1) and a performance standard for odour arrestment plant (**Table 2**, Row 2)
- Containment of odours.
- Daily inspections of odour arrestment plant .
- Indicative tests for odour arrestment plant (**5.13**) in the case of offensive odours being detected or complaints being received.
- The preparation of an Odour Response Plan (see paragraph **6.31**) which will include an assessment of all emission sources, control methods, odour impacts, abnormal operations and measures to mitigate effects in the case of abnormal conditions.

Odorous emissions - general guidance

5.8 The following general guidance is provided to assist regulators in assessment of compliance with the odour condition of Row 1 in **Table 2**.

Whilst it is possible to measure the odour strength using a standardised method (dynamic olfactometry as detailed in BS EN 13725:2003), it is not possible to use dynamic olfactometry to quantify the offensiveness of the odour. It is also not possible to use dynamic olfactometry as a field measurement.

In general odour effects are not caused by one single pollutant or chemical species, odour is a 'cocktail' of chemical species emitted from a process. The nose is an extremely sensitive receptor of odour - it can respond to small variations in concentration over periods of a few seconds and at concentrations of fractions of a part per billion.

Different people respond differently to the same odour, and the nature of any odour can vary (because of meteorology, process changes etc.) both in time and between different areas very close to one another.

Assessment of offensiveness of odour should take account of the nature of the odour, the frequency with which it arises, and its persistence. Local authorities should bear in mind that dispersal of odour may, from time to time, be adversely affected by temporary meteorological conditions

5.9 The assessment as to whether an odour is offensive should be left to the perception of the regulator. The provisions of this note which detail BAT/BATNEEC should be sufficient to enable vegetable matter drying processes to operate without causing offensive odour beyond the process boundary (subject to the comments in paragraph **5.7**). Further guidance on assessment of odour can be found in "Odour Measurement and Control- An Update "published by National Environmental Technology Centre, Culham, Abingdon. Oxon OX14 3DB. ISBN 0-85624--8258. (Ref. h)

Odorous emissions - monitoring installation performance

5.10 The operator should monitor the performance of the installation for emissions which may result in offensive odours beyond the boundary of the site. This assessment should include inspections of the process, buildings and equipment to check that emissions are being contained and treated to meet the standards of this note.

In addition to the continuous indicative monitoring outlined in paragraph **5.15**, the odour arrestment plant should be inspected at least once a day to verify correct operation and to identify any malfunctions. This inspection should include:

- Identification of any leaks in air handling equipment and ductwork. Where a key component of the odour arrestment plant cannot be adequately accessed for inspection then arrangements to enable this should be made.
- In the case of scrubbing equipment, thermal oxidisers and other combustion equipment, the inspection should include verification of the operation of the continuous monitoring equipment, any blockages and also identification of any leaks of either odorous air or liquid.
- In the case of biofilters, the surface should be inspected to identify any cracking of the surface or voids in the bed, leaks around the edge of the filter or air handling equipment, review of the moisture content (considering both flooding and drying out) and looking for signs of compaction or uneven flow.
- In the specific case of soil biofilters, the growth of plants and weeds should be inspected as any excessive flow or odour escape is often indicated by scorching of the earth or plant growth dying off.

Visible emissions

5.11 Visible emissions should be limited and monitored as follows. Abnormal emissions require action as described in paragraph **5.12**.

- Emissions from combustion processes used for arrestment of odour should be free from visible smoke.
- All releases to air, other than condensed water vapour, should be free from persistent visible emissions.
- All emissions to air should be free from droplets.

Abnormal events

5.12 The regulator needs to be notified about certain events, whether or not there is related monitoring showing an adverse result, and the operator should respond to problems which may have an adverse effect on emissions to air.

- In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions the operator should:
  - investigate and undertake remedial action **immediately**
  - adjust the process or activity to minimise those emissions; and
  - promptly record the events and actions taken
- The regulator should be informed without delay if there is an emission that is likely to have an effect on the local community.
- A simple wind direction indicator (such as a windsock or wind vane) should be installed in order that likely emission paths and areas of potential odour impact can be identified in the case of abnormal emissions.

Indicative tests for odour arrestment plant

5.13 If offensive odours are detected beyond the process boundary or complaints received but there is no obvious cause of odour release it may be necessary to check the odour arrestment plant performance. **Table 3** Provides guide values which would indicate problems with arrestment plant. Depending upon the type of arrestment plant used, the following are the indicative tests it is envisaged would normally be used:

- In the case of thermal oxidisers or combustion equipment, the combustion efficiency is a good indication of performance. Emissions tested in accordance with the first bullet of paragraph **5.14** below should normally be below 100mg/m^3. If emissions exceed this indicative guide value it is likely that the odour destruction efficiency of the arrestment plant is reduced and it should be further investigated to identify reasons for the reduced performance.

  The table below provides indicative guide values which if exceeded indicate that the odour destruction efficiency of the arrestment plant is reduced and the plant should be further investigated to identify reasons for the reduced performance.

Table 3: Indicative guide values

Row	Odour Indicators	Indicative Guide Values
1	Emissions of carbon monoxide from thermal oxidisers or combustion equipment.	100 mg/m^3 expressed as a 30-minute mean at 273K and 101.3kPa.
N.B. The above values are only to be used in conjunction with the provisions of paragraph **5.13**		

Continuous monitoring - general

5.14 Whilst there are no reliable continuous emission monitoring options for odours, where thermal oxidation or combustion equipment is used for odour control, continuous monitoring of carbon monoxide is an option (see paragraph **5.13**). Where continuous monitoring (as described in **5.15**, **5.16** and **5.17**) is required it should be carried out as follows:

- The activation of alarms should be automatically recorded.
- All continuous monitors should be operated, maintained and calibrated (or referenced) in accordance with the manufacturers' instructions, which should be made available for inspection by the regulator. The relevant maintenance and calibration (or referencing) should be recorded
- All continuous monitoring readings should be on display to appropriately trained staff.
- Instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of arrestment plant failure or malfunction.
- Purchasers of new or replacement monitoring equipment should specify the requirement for less than 5% downtime over any 3-month period, on ordering.

Continuous monitoring - odour arrestment plant

5.15 Where odour arrestment plant is used, continuous monitoring (linked to alarms) should be installed in order to demonstrate compliance with the provisions of this note.

- In the case of thermal oxidisers or combustion equipment, emissions should be continuously monitored and continuously recorded for carbon monoxide, or the operating temperature may be used as a surrogate measurement. The monitor should be fitted with an audible and visual alarm to activate if the operating temperature falls below 1123K (850^{o}C) or if the carbon monoxide level exceeds the indicative guide value in **5.13**.
- In the case of scrubbing equipment, the pH or Redox of the liquor and liquor flow should be continuously monitored. All liquid scrubbers should be fitted with an audible and visual alarm to activate if the liquor circulation fails or if the pH or Redox falls outside the operating range established during commissioning testing.
- If a bioscrubber is used, in addition to flow and pH or Redox monitoring, the pressure drop across the scrubber packing should be continuously monitored. The monitor should be fitted with an audible and visual alarm to activate if the pressure drop falls outside the operating range established during commissioning testing.
- If a biofilter is used the pressure drop across the biofilter should be continuously monitored. This can be achieved by measuring the delivery pressure on the main fan. The monitor should be fitted with an audible and visual alarm to activate if the pressure drop falls outside the operating range established during commissioning testing. If the process has more than one fan for different process areas and these fans are not operated when the areas are not in use (for example during the winter period when production levels are low) the value used for alarming may need to be variable depending upon the volume of air being treated and process conditions. In this case, where the alarm level is varied, the set point of the alarm should be recorded.
- The operating levels of the pH, Redox and pressure drop where monitored should be recorded daily.
- The cooling liquid flow of all direct or indirect condensers used for pre-treatment of emissions (including spray tower scrubbers) should be continuously monitored.

Continuous monitoring - particulate matter

5.16 Continuous **indicative** monitoring can be used as a management tool. In conjunction with continuous recording it identifies any trends in emissions; for example, that emissions are gradually increasing, which may indicate a need for maintenance. It can also be used with or without continuous recording to trigger an alarm when there is a sudden increase in emissions; for example if arrestment plant fails. For a given concentration of particulate, the output level varies with the instrument. It should be noted that not all monitors provide a linear response to an increase in particulate matter. The monitor should be set up to provide a baseline output when the plant is known to be operating under the best possible conditions; i.e. such that emissions are fully compliant with the authorisation/permit. The instrument manufacturer should be able to set an output level which corresponds to around 75% of the emission limit, to trigger alarms. Thus the alarms are activated in response to this significant increase in particulate loading above the baseline, so that warning of the changed state is given before an unacceptable emission occurs. The regulator may wish to agree the alarm trigger level.

- Emissions from particulate arrestment plant (except where the final discharge of the arrestment equipment is within buildings) where the exhaust airflow exceeds 100 m^3/min should be continuously indicatively monitored for particulate matter. (By continuous indicative monitoring is meant monitoring to indicate the relative performance and/or process variation. Such monitoring does not provide data to demonstrate compliance with a numerical emission limit.) The indicative monitor should be fitted with a visual and audible alarm which activates at a reference level agreed with the regulator.

- The above continuous monitoring provision does not apply to wet emissions, for example from scrubbers, and in these circumstances emissions should be tested for particulate matter at least once a year in accordance with paragraph **5.18**.
- Also the above continuous monitoring provision should be disapplied where emissions do not exceed the relevant emission limit in Rows 12 and 13 of **Table 2** without the use of arrestment plant. This should be demonstrated by a single sampling exercise undertaken in accordance with paragraph **5.14**. A further such monitoring exercise may be required in the event of a substantial change to the process.

Calibration and compliance monitoring

5.17 Calibration and compliance monitoring should meet the following provisions as appropriate:

- Testing of odour arrestment plant should be carried out if possible when the process is operating at peak production
- Odour testing should take place on commissioning of new/replacement plant to demonstrate compliance with the requirements of **Table2**, row 2. In addition, it may be necessary to carry out monitoring of emissions of odour at other times where the process is subject to justified complaint of offensive odour and the investigations carried out in accordance with paragraphs **5.9**, **5.10** and **5.12** cannot identify a cause for the odour.
- No monitoring result should exceed the emission concentration limits specified in **Table2**
- The destruction efficiency of any odour arrestment plant required to meet the provisions in **Table2** should be tested in accordance with the main procedural requirements of BS.EN13725:2003. This testing should be carried out by dynamic olfactometry based upon manual extractive sampling undertaken simultaneously at the inlet and outlet of the odour arrestment plant. At least three samples should be taken from both the inlet and outlet. Where the odour arrestment plant comprises an open top biofilter, the guidance in **Appendix 2** should assist in developing a sampling protocol.
- Non-continuous emissions monitoring of particulate should be carried out once a year according to the main procedural requirements of BS ISO 9096: 2003, with averages taken over operating periods excluding start-up and shutdown. Sampling equipment should be capable of collecting particulate matter of 0.1 microns diameter or less, with an efficiency of at least 75%. This provision is not neccessary where the final discharge of the arrestment plant is within buildings or the volume of discharged air is less than 100m^3/min or where emissions do not exceed the relevant emission limit in Rows 5 and 6 of **Table 2** without the use of arrestment plant.
- Non-continuous emissions monitoring of sulphur dioxide and nitrogen oxides should be carried out once per year from dryers where the net rated thermal input of any dryer exceeds 20$MW_{(th)}$ according to the main procedural requirements of ISO 7934/7935 and ISO 11564 respectively.

5.18 Where oil-fired thermal oxidisers or combustion equipment is used for arrestment of odours, every delivery of liquid fuel should be confirmed by the fuel suppliers as being compliant with the Sulphur Contents of Fuels (England and Wales) Regulations 2000, as required by **Table2**

- Where waste or recovered oil is burned it may be necessary to specify additional controls depending upon fuel quality. In this case a certificate of fuel analysis from the supplier together with the necessary calculations, should be submitted to the regulator at least once every three months where the oil supplier remains constant,

and as soon as possible following a change in oil supplier; receipt of oils should be logged. To enable calculation of the emission to be carried out from the analysis it will also be necessary to undertake some stack gas sampling at the installation for metals, chlorides, sulphur dioxide and fluorides.

- In the event of a change in oil supplier, the regulator should be notified in writing forthwith.

5.19 Exhaust flow rates should be consistent with efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the workplace environment.

- The introduction of dilution air to achieve emission concentration limits should not be permitted.

Varying monitoring frequency

5.20 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. When determining "consistent compliance" factors to consider include:

(a) the number of arrestment plant continuous indicative monitor alarms.
(b) the number and frequency of complaints regarding offensive odour.
(c) how the indicative surrogate performance monitoring of the odour arrestment plant reflects actual plant performance, for example, the operating temperature and carbon monoxide emissions of a thermal oxidiser or combustion equipment are a good surrogate indicator compared to the pressure drop across a biofilter which is a less reliable surrogate indicator.
(d) the variability of monitoring results, for example, results which range from 5 - 19 mg/m^3 , against an emission limit of 20 mg/m^3 might not qualify for a reduction in monitoring
(e) the margin between the results and the emission limit, for example, results which range from 95 - 96% destruction when the limit is 85% destruction efficiency might not qualify for a reduction in monitoring.

- As the odour arrestment performance of a biofilter is very dependant upon operating conditions and biomass loading, it is not appropriate that reduced monitoring be applied.
- Consistent compliance should be demonstrated using the results from at least three or more monitoring exercises carried out over a period of at least two years.
- Any significant process or arrestment plant changes which might have affected the destruction efficiency of the equipment should be taken into account.
- Where emission limit values for particulate matter are consistently met without the use of arrestment equipment, the annual monitoring provision for those pollutants should be dispensed with, subject to the caveats of this paragraph.

Sampling provisions

5.21 Care is needed in the design and location of sampling systems in order to obtain representative samples for all release points.

- The operator should ensure that adequate facilities for sampling are provided on stacks or ducts.
- Sampling points on new plant should be designed to comply with the British or equivalent standards. e.g. BS ISO 9096: 2003, BS EN 13284-1or BS ISO 12141:2002 for sampling particulate matter in stacks.

- Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of any error invoked.

Emissions from silos

5.22 Where silos are used for meal storage the following measures relating to arrestment plant on silos and other silo management techniques are only applicable where the silo vents to the external environment or where silo emissions may escape from inside a building into the external environment.

- All new or replacement silo filtration plant should be designed to operate to an emission standard of less than 10 mg/m^3 for particulate matter.

5.23 Silo systems require appropriate inspections and assessments to minimise potential for emissions during the filling process.

- Operators should have a procedure in place to ensure that visual assessment of emissions from silo inlet connections and the silo arrestment plant are undertaken throughout the duration of all bulk deliveries. The start and finish times of all deliveries should be recorded.

Inspection of filtration plant

- Silo arrestment plant and filtration plant serving other process operations should be inspected at the frequency specified below:

Table 4: Filtration plant inspection frequency

Filter cleaning method	Frequency of visual inspection
Fitted with reverse jets	at least once a month
Fitted with mechanical shakers	at least once a week
Requiring manual shaking	daily inspection or prior to any delivery being made if deliveries are not daily

- The outlet should be checked for signs that emissions have occurred. The equipment should also be checked for defects in the air flow or the cam shakers. If emissions or defects are detected then corrective action should be taken promptly and before another delivery takes place. Any failure of the silo management system (e.g. high level alarms, filter, pressure relief valve) should lead to full investigation of the operation of the plant and equipment.
- Reduced inspection frequency of bag filter (or cartridge) arrestment plant may be appropriate, as follows:
  (a) where pressure drop sensors or other continuous monitors are used to monitor the arrestment plant; such monitors should be inspected according to manufacturers' recommendations to ensure their proper operation.
  (b) where continuous camera operation enables observation of all emission points from the arrestment plant and pressure relief valves.
  (c) for filters fitted with reverse jets or with mechanical shakers where operating experience has demonstrated satisfactory operation of the arrestment plant.
  (d) where the process operation is infrequent.

6 Control techniques

6.1 Vegetable matter drying is carried out under carefully controlled process conditions within enclosed atmospheric dryers. The adoption of effective materials handling and spillage prevention practices and good engineering practice in dryer design (such as recirculation of waste gases) can greatly reduce the volumes of air necessary for odour containment by avoiding uncontrolled odour release. The selection of the most effective control system may be affected by the presence of large quantities of particulate matter and moisture in the waste gases.

6.2 The following are examples of relevant odour control techniques:

(a) the potential for process change to minimise odour release should be reviewed for example by avoiding drying operations completely, changing operating temperature or change of dryer design (for example by steam drying)

(b) good housekeeping and raw material handling practices

(c) containment of odours within process equipment by maintaining material handling and storage facilities such that they are leakproof and spillproof as far as possible

(d) control and minimisation of odours from residual materials, effluent and waste

(e) containment of strong odour sources and treatment in odour control equipment

(f) it is possible to reduce odorous emissions by careful process optimisation - for example dryer design, moisture content, processing temperature and raw material and additive characteristics will have a significant impact on odour.

Summary of best available techniques

6.3 The following Table provides a summary of the best available techniques that can be used to control the process in order to meet the emission limits and provisions in **Section 5**. Provided that it is demonstrated to the satisfaction of the regulator that an equivalent level of control will be achieved, then other techniques may be used.

Table 5: Summary of control techniques

Release source	Substance	Control techniques
Raw material, effluent and waste storage	Odour	Within enclosed silos, tanks, containers or stores under negative pressure and vented to odour arrestment plant Spillage management including tank level management
Loading and unloading processes	Odour	Backventing of storage tanks as necessary Spillage management
Drying and cooling processes	Odour	Within process equipment under negative pressure and vented to odour arrestment plant as necessary Gas recirculation Condensing moisture depending upon effluent disposal issues Appropriate construction
Ventilated air	Odour	Vent to suitable arrestment plant • preliminary condensers • biofilters • thermal oxidisers/combustion plant • scrubbers • located to take account of sensitive receptors
Waste gas from dryer and odour arrestment plant	Odour	dispersion of any residual odorous releases
Waste gas from dryer and odour arrestment plant	Sulphur oxides	Limit sulphur in fuel
Waste gas from dryer odour arrestment plant	Carbon monoxide	Good combustion

Table 5: Summary of control techniques

Release source	Substance	Control techniques
Waste gas from dryer odour arrestment plant	Nitrogen oxides	Good combustion
Raw material and product storage	Particulate matter	Potentially dusty materials should be stored in buildings or appropriate containers
Silos	Particulate matter	Process control on delivery to silos Dust arrestment • bag filters • cartridge filters
Dryer and cooling processes	Particulate matter	Process controlI In-line solid material recovery from waste gases • cyclones • scrubbers
Pelletising and grinding processes	Particulate matter	Process control Spillage management Dust arrestment • bag filters • cartridge filters • cyclones/wet arrestors

Techniques to control emissions from contained sources

Odour control

6.4 Emissions from the process operations covered by this note comprise odours of mixed chemical species. The main principles for preventing odour emissions are;

- containment of the odours in the process equipment,
- raw material handling operations (as detailed below); and
- final treatment by arrestment of odour emissions.

Containment is achieved by ensuring that all operations with potential releases are carried out within enclosed equipment under a slight negative pressure and other fugitive odours are controlled by building extract ventilation.

6.5 Ventilation should be provided to maintain an adequate negative pressure within the process equipment (including tanks and vessels for holding condensate) to contain process releases within the equipment during process operation. The required ventilation rate will depend upon many factors (such as environmental conditions, raw material quality, effectiveness of process containment) but generally maintaining a negative pressure should be sufficient to prevent fugitive releases. The ventilation equipment should be vented to odour arrestment plant as necessary to meet the provisions of **Table 2**.

6.6 Suitable odour arrestment plant should be provided and operated at all times where necessary, to meet the provisions of **Section 5** of this note (further information is available at Ref. h). Examples of the type of arrestment plant which are suitable include biofilters, high efficiency biological scrubbers, multi-stage chemical scrubbers, thermal incinerators and other forms of combustion plant. In the case of vegetable matter drying processes, adsorption equipment is not anticipated to offer adequate odour removal due to the types of chemical species in the odour and the risk of odour breakthrough and re-entrainment.

- The presence of significant moisture and also the nature of the particulate matter in the dryer exhaust gas is likely to mean that primary particulate matter arrestment will rely upon cyclones. In this case the presence of particulate matter may have an adverse affect on the operation of the odour arrestment plant and it is likely that additional particulate matter removal will be necessary using for example a scrubber before arrestment of the odour.

- The process may produce emissions of differing odour intensity (building air and drying odours) and it may be more effective to separate the odour streams and divert to different odour arrestment plant (where it is necessary to control the lower intensity odours to meet the provisions of Row 1 of **Table 2**). High odour intensity emissions and those incondensable gases (such as cooking emissions) should be diverted to thermal oxidation/combustion or multi-stage scrubbers, whilst those of lesser odour intensity may be treated in a single stage scrubber or biofilter.
- It may be appropriate to provide a number of smaller biofilters rather than one large bed to achieve more even gas flows throughout the filter. This will also provide standby facilities in case of breakdown or failure of one bed if the biofilter capacity is designed for this purpose.
- The presence of water vapour in the emissions from drying and cooling processes can adversely effect the operation of the odour arrestment plant. The water vapour will significantly increase emission volumes and is likely to condense within odour arrestment plant and this can lead to corrosion of materials of construction. Also in the case of scrubbing equipment, the condensation of significant volumes of water vapour will result in continuous liquid overflow and dilution of the scrubbing liquor. Where scrubbing systems are used for odour control the emissions from cooking, drying and preliminary cooling operations should be condensed (for example by the use of a direct condenser such as a spray tower or quench scrubber or an indirect condenser) prior to odour treatment of the non-condensable gases. Pre-treatment of process gases by condensation should also be considered for thermal oxidation and combustion systems as the removal of condensable gases will reduce the odour load for treatment in the combustion system. There may be occasions when condensation of the water vapour could lead to the generation of an effluent stream which is difficult to treat before discharge. In this case it may be more appropriate to control the amount of condensation across the odour arrestment plant by careful temperature management in order to minimise condensation. The use of condensers should be carefully evaluated for all odour arrestment plant taking account of local circumstances.

6.7 Where odour arrestment plant is required it needs to be optimised to meet the odour destruction efficiency provisions of **Table 2**. Depending upon the type of arrestment plant used, this optimisation will include the following:

- In the case of thermal oxidisers or combustion equipment the operating temperature of the system will need to be maintained above 1123K (850^{o}C). In the case of boilers, care is needed in their use for odour arrestment as the operating temperature and residence time may not have been designed for odour arrestment and there is the potential for quenching in the boiler. In addition, a minimum firing rate for the boiler to ensure that the boiler conditions are always optimised for odour removal should be established. The measurement of odour arrestment efficiency of the boiler can be used to demonstrate the correct operating parameters of the boiler.
- In the case of scrubbing equipment, it is likely that multi-stage scrubbing will be necessary to meet the odour destruction efficiency provisions of **Table 2**. In order to optimise the performance of the scrubber, it is important to ensure that it is well designed (adequate gas/liquid contact), well maintained, that the odours are sufficiently reactive with the scrubbing liquor to remove the odour and also that the reaction products do not themselves produce a volatile odour. In addition, additives to the liquor need to be automatically dosed with control by pH/Redox (overdosing can lead to secondary odours from the scrubber associated with the chemical reagent).

- Mist eliminators should be fitted where droplet emissions occur and, in relation to new or replacement scrubbing plant, where there is a potential for such occurrence.
- If a bioscrubber is used, it is important to ensure that it is well designed (adequate gas/liquid contact), well maintained and that potential odours from scrubbing liquor are well managed. The scrubber will require regular inspection to identify possible blockage by biomass. In addition the pH of the liquor will need to be controlled as the microbial activity of the biomass will be adversely affected by high alkalinity (which is a potential problem with emissions from certain vegetable matter drying processes).
- Biofiltration can be undertaken using packaged, enclosed biofilters or open biomass (such as peat/heather). If a peat and heather biofilter is used, it is essential to control the pH of the biomass as the microbial activity will be adversely affected by high alkalinity (which is a potential problem with the high levels of ammonia). In this case it may be necessary to pre-treat the emissions for example by water scrubbing (this will also have the beneficial effect of humidifying the air). In order to optimise the performance of the biofilter, the biomass must be maintained below 30^{o}C, must be kept moist, must have a gas flow at all times and leakage through edges and fissures must be avoided. Biofilters will require regular treatment to overcome consolidation - this may be regular surface turning or deconsolidation by digging-out the bed.
- The required residence time for the biofilters will depend upon many design conditions and will have to be sufficient to meet the provisions of Rows 2 and 3 of **Table 2**. However the recommended residence time for peat and heather filters is a minimum of 60 seconds for lower intensity odours.

6.8 The use of odour masking agents and counteractants should not be permitted (other than as a scrubber liquor additive).

6.9 Emissions of particulate matter from dryers, grinders, extruders, bagging equipment and coolers should be contained, extracted and arrested if necessary to meet the visible emission provisions or the limits described in **Table 2** for particulate matter. In the case of emissions which are both odorous and contain particulate matter, it may be necessary to treat the releases from the particulate matter arrestment plant to remove the odour before final dispersion of residual odour.

6.10 The methods of removal of collected particulate matter from arrestment plant should be undertaken carefully to avoid re-entrainment of dust. The discharge from particulate matter arrestment plant should be to screw auger, pneumatic transfer, enclosed containers or enclosed conveyors. The potential for blockage of the rotary valve, discharge point or hopper should be continuously monitored and alarmed (for example by the use of a rotation sensor on the rotary seal or a level indicator in the hopper). These indicative monitors should be fitted with an audible and/or visual alarm to activate when blockages occur.

Silos

6.11 The silo management system includes the high level alarms, arrestment plant and pressure relief device. If best practice is being applied then any failure of the silo management system leads to full investigation of the operation of the plant and equipment. Continuous high level monitoring systems are currently available for use in storage silos. They may be used telemetrically to monitor stock within the silo. They may also be used to automatically stop delivery of material to the silo. It is expected that such systems will become more widely used in the future.

6.12 Careful delivery by trained personnel will avoid materials being blown into silos at a rate which is likely to result in pressurisation of the silo, especially towards the end of the delivery when the quantity of material entering the ducting is reduced. If deliveries are accepted from tankers without on board relief valve and filtration systems, particular care to avoid pressurisation of silos when venting air through the silo at the end of the delivery is needed.

6.13 The following measures relating to arrestment plant on silos and other silo management techniques are only applicable where the silo vents to the external environment or where silo emissions may escape from inside a building into the external environment.

- All dusty or potentially dusty materials should be stored in silos, in confined storage areas within buildings, or in fully enclosed containers / packaging. Where the storage is open within a building, then suitable precautions should be taken to prevent wind whipping.
- When delivery to a silo or bulk storage tank takes place, displaced air should either be vented to suitable arrestment plant (for example cartridge/bag filters) or back-vented to the delivery tanker, in order to minimise emissions. Arrestment plant fitted to silos should be of sufficient size (and kept clean) to avoid pressurisation during delivery.
- In order that fugitive emissions are minimised during the charging of silos, transfer lines should be securely connected to the silo delivery inlet point and the tanker discharge point, in that order. Tanker drivers should be informed of the correct procedures to be followed.
- Bulk storage tanks and silos containing dry materials should be equipped with audible and/ or visual high level alarms, or volume indicators, to warn of overfilling. The correct operation of such alarms should be checked in accordance with manufacturers' instructions. If manufacturers instructions do not specify, then the check should be weekly or before a delivery takes place, whichever is the longer interval.
- If emissions of particulate matter are visible from ducting, pipework, the pressure relief device or dust arrestment plant during silo filling, the operation should cease; the cause of the problem should be rectified prior to further deliveries taking place. Tanker drivers should be informed of the correct procedure to be followed.
- Seating of pressure relief devices on silos should be checked at least once a week, or before a delivery takes place, whichever is the longer interval.
- Immediately it appears that the device has become unseated during silo filling, no further delivery should take place until corrective action has been taken. The pressure relief device should be examined to check for defects before being re-set and a replacement fitted if necessary. Tanker drivers should be informed of the correct procedure to follow.
- Deliveries to silos from road vehicles should only be made using tankers with an on-board (truck mounted) relief valve and filtration system. This means that venting air from the tanker at the end of a delivery will not take place through the silo. Use of alternative techniques may be acceptable provided that they achieve an equivalent level of control with regard to potential for emissions to air.
- Care should be taken to avoid delivering materials to silos at a rate which is likely to result in pressurisation of the silo. If compressed air is being used to blow powder into a silo then particular care is required towards the end of the delivery when the quantity of material entering the ducting is reduced and hence the air flow is increased.
- All new silos should be fitted with an automatic system to cut off delivery in the event of pressurisation or overfilling. Use of alternative techniques may be acceptable provided that they achieve an equivalent level of control with regard to potential for emissions to air.

Techniques to control fugitive emissions

Materials handling

6.14 Adequate provision should be made for the containment of liquid and solid spillages.

- All spillages should be cleared as soon as possible and in the case of solid materials this should be achieved by the use of vacuum cleaning, wet methods, or other appropriate techniques.
- Dry sweeping of dusty spillages should not be permitted in circumstances where it may lead to the deposition of dust outside the site boundary.
- All dusty, or potentially dusty materials should be stored in covered containers, sealed bags or purpose built silos or hoppers. The storage of dried products should be permitted inside processing buildings provided that adequate steps are taken to prevent entrainment of particulate matter outside the building, for example by the use of plastic strip curtains on building access points, screening, covering or dampening.
- The bulk transfer of dry raw materials, other than delivery to site storage, should be by suitable mechanical handling systems - for example, screw feeder, gravity or pneumatic means.
- All internal transport of dusty materials should be carried out to prevent, or where prevention is not practicable, minimise air borne dust emissions.
- Where conveyors are used they should be of sufficient capacity to handle maximum loads. External conveyor discharges should be arranged to minimise free fall at all times.
- External conveyors used for transport of dusty material should be fully enclosed, subject to technical feasibility, cost, and whether adequate protection against wind whipping can be provided by other means such as the fitting of side boards.
- Where necessary, in order to minimise emissions of dust, extraction should be provided from transfer points to arrestment plant - for example, a bag filter.
- Emissions from bulk storage vessels during offloading should either be vented to suitable arrestment plant, for example a bag filter for particulate matter, or back-vented to the delivery tanker to minimise emissions of odour and dust.
- Where raw materials are delivered to bulk storage by tipper lorries, the raw material acceptance area should be provided with protection against wind whipping of particulate matter (i.e. a covered, screened area) and local exhaust ventilation should be installed and emissions should be discharged through suitable arrestment plant-for example, a bag filter-to minimise dust emissions.
- Where materials are removed from site in bulk vehicles, the loading area should be provided with protection against wind entrainment of particulate matter, for example carried out in a covered, screened area. The discharge of products into the vehicles should be carried out in order to minimise the generation of airborne dust, and fall heights from discharge pipes should be reduced. Where necessary, these areas should be fitted with local exhaust ventilation discharging through suitable arrestment plant, for example bag filters, to minimise emissions of dust.
- All tanks for liquid material storage should be fitted with level indicators or high level alarms to warn of potential overfilling (it may be acceptable to rely upon regular dipping of the tanks associated with a documented material transfer protocol). All such tanks should be vented to odour arrestment plant where necessary to meet the provisions of Row 1 of **Table 2**.

Process operations

6.15 Process operations should be carried out to minimise releases of odour.

- Process tanks and vessels should be enclosed to minimise emissions.
- Where possible submersible pumps should be used to minimise the potential for odour escape.
- Provision should be made for effective and rapid cleaning of any area of spillage. High pressure jetting, steam cleaning or mechanical cleaning with foaming chemical systems are effective methods of cleaning and, where used, sufficient hosing points should be made available. Spillages should be contained and cleared as soon as reasonably practicable.
- Ventilation should be provided to maintain an adequate negative pressure within the dryers, extruders and coolers. The ventilation equipment should be vented to suitable arrestment plant.

6.16 Where the processing of raw materials or the packing of dried vegetable matter into bags necessitates the installation of local exhaust ventilation, suitable arrestment plant, for example bag filters, should be installed to minimise emissions of dust.

6.17 The on - site transfer of raw materials to the processing plant should be undertaken in a manner to prevent spillage and minimise disturbance of material. The material transfer method should be suitable for the raw materials handled and the final use of the material, for example, small-scale and infrequent material handling may be by containers or bins, and in other cases slurries should be pumped and finely divided materials moved by gravity; screw auger or pneumatic means.

6.18 A high standard of housekeeping should be maintained. A regular programme of cleaning should be instigated and this should also address external horizontal surfaces and ledges, for example, gutters and roofs, as well as roads and internal surfaces. External surfaces and ledges should normally be cleared at least once a year; roads and internal surfaces will often require more frequent cleaning. Cleaning operations should be carried out by methods which minimise emissions of particulate matter to the air, for example by vacuum cleaning, wet cleaning or other appropriate methods.

- Roadways and other areas where there is regular movement of vehicles should be hard surfaced, and kept clean, in order to minimise the emission of airborne dust.

6.19 The spray application of materials to finished products in vehicles solely for the purpose of providing a beneficial odour, should not be permitted in circumstances where it may lead to offensive odour beyond the process boundary

Effluent and waste

6.20 The effluent produced has the potential to generate a significant odour. All effluent should therefore be carefully handled and treatment should be carried out in a manner which will minimise the emission of offensive odours and will render any emission inoffensive and harmless.

- All effluent should be drained via interceptor traps to the normal sewerage system or to an effluent treatment plant or storage tank.
- All effluent storage tanks should be vented to suitable odour arrestment plant where necessary to meet the provisions of Row 1 of **Table 2**. A minimum extracted air volume should be maintained to the tank at all times (depending upon the tank design it may be necessary to isolate the tank from the odour arrestment plant during emptying to avoid tank damage). Care should be taken in emptying the effluent tanks to minimise odour release - consideration should be given to venting the collecting tanker to the odour arrestment plant.
- All effluent storage tanks should be emptied regularly and at least once every week.
- All effluent tanks should be fitted with level indicators or high level alarms to warn of potential overfilling.

- All tanks and effluent storage systems including cesspits and septic tanks should be adequately covered and effluent treatment systems should be properly maintained in accordance with the maintenance programme included in the Odour Response Procedure (paragraph **6.29**).
- All effluent tanks should be protected by a bund to contain spillages and the tanker connection point should also be provided with bunding or spillage containment kerbs. Provision should be made for effective and rapid cleaning of any area of spillage. High pressure jetting or steam cleaning are effective methods of cleaning and, where used, sufficient hosing points should be made available. Spillages should be contained and cleared immediately.

6.21 All potentially odorous wastes should be stored within an enclosed storage area, tank or container whilst awaiting removal for either disposal or further processing.

- The storage area should be provided with extract ventilation to suitable arrestment plant where necessary to meet the provisions of Row 1 of **Table 2**.
- All waste should be removed as soon as the waste container is full and at least once per week. High odour intensity waste should be moved more frequently where necessary to ensure compliance with Row 1 of **Table 2**.
- Waste should not be moved from process buildings to another building or outside unless in sealed containers. (Covered skips should not be regarded as sealed containers).

Air quality

Ambient air quality management

6.22 In areas where air quality standards or objectives are being breached or are in serious risk of breach and it is clear from the detailed review and assessment work under Local Air Quality Management that the Part B process itself is a significant contributor to the problem, it may be necessary to impose tighter emission limits. If the standard that is in danger of being exceeded is not an EC Directive requirement, then industry is not expected to go beyond BAT to meet it. Decisions should be taken in the context of a local authority's Local Air Quality Management action plan. For example, where a Part B process is only responsible to a very small extent for an air quality problem, the authority should not unduly penalise the operator of the process by requiring disproportionate emissions reductions. More guidance on this is provided in paragraph 360 of the Air Quality Strategy which gives the following advice:

"*The approach from local authorities to tackling air quality should be an integrated one, involving all strands of local authority activity which impact on air quality and underpinned by a series of principles in which local authorities should aim to secure improvements in the most cost-effective manner, with regard to local environmental needs while avoiding unnecessary regulation. Their approach should seek an appropriate balance between controls on emissions from domestic, industrial and transport sources and draw on a combination and interaction of public, private and voluntary effort.*"

Dispersion and dilution

6.23 Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are harmless. This is the basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 (D1). The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure. It is necessary that the assessment also take into account the relevant air quality standards that apply for the emitted pollutants.

Revised stack height calculations should not be required unless it is considered necessary because of a breach or serious risk of breach of an EC Directive limit value and because it is clear from the detailed review and assessment work that the Part B process itself is a significant contributor to the problem.

The calculation procedure of D1 is usually used to calculate the required stack height but alternative dispersion models may be used in agreement with the regulator. D1 relies upon the unimpeded vertical emission of the pollutant. A cap or other restriction over the stack impedes the vertical emission and hinders dispersion. For this reason where dispersion is required such flow impeders should not be used. A cone may sometimes be useful to increase the exit velocity and achieve greater dispersion.

An operator may choose to meet tighter emission limits in order to reduce the required stack height.

6.24 The assessment of stack or vent height should take into account the need to ensure that no offensive odour is emitted beyond the boundary.

Stacks, vents and process exhausts

6.25 Liquid condensation on internal surfaces of stacks and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission. Adequate insulation will minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint. Stacks and ductwork should be leakproof.

6.26 Unacceptable emissions of droplets could possibly occur from wet arrestment plant where the linear velocity within the associated ductwork exceeds 9 m/sec. The use of mist eliminators reduces the potential for droplet emissions.

- Where a linear velocity of 9 m/sec is exceeded in the ductwork of existing wet arrestment plant, it should be reduced to the extent that is practicable to ensure that droplet fallout does not occur.
- Flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
- Exhaust gases discharged through a stack or vent should achieve an exit velocity greater than 15 m/sec during normal operating conditions to achieve adequate dispersion.
- Stacks or vents should not be fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions.

Management

Management techniques

6.27 Important elements for effective control of emissions include:

- proper management, supervision and training for process operations;
- proper use of equipment;
- effective preventative maintenance on all plant and equipment concerned with the control of emissions to the air; and
- it is good practice to ensure that spares and consumables are available at short notice in order to rectify breakdowns rapidly. This is important with respect to arrestment plant and other necessary environmental controls. It is useful to have an audited list of essential items.

- Spares and consumables - in particular, those subject to continual wear - should be held on site, or should be available at short notice from guaranteed local suppliers, so that plant breakdowns can be rectified rapidly.

Appropriate management systems

6.28 Effective management is central to environmental performance; It is an important component of BAT and of achieving compliance with permit conditions. It requires a commitment to establishing objectives, setting targets, measuring progress and revising the objectives according to results. This includes managing risks under normal operating conditions and in accidents and emergencies. It is therefore desirable that processes put in place some form of structured environmental management approach, whether by adopting published standards (ISO 14001 or the EU Eco Management and Audit Scheme [EMAS]) or by setting up an

environmental management system (EMS) tailored to the nature and size of the particular process. Operators may also find that an EMS will help identify business savings.

Regulators should use their discretion, in consultation with individual operators, in agreeing the appropriate level of environmental management. Simple systems which ensure that LAPC considerations are taken account of in the day-to-day running of a process may well suffice, especially for small and medium-sized enterprises. While authorities may wish to encourage wider adoption of EMS, it is outside the legal scope of an LAPC authorisation/LAPPC permit to require an EMS for purposes other than LAPC/LAPPC compliance. For further information/advice on EMS refer to EMS Additional Information in **Section 8**.

Training

6.29 Staff at all levels need the necessary training and instruction in their duties relating to control of the process and emissions to air. In order to minimise risk of emissions, particular emphasis should be given to control procedures during start-up, shut down and abnormal conditions.

Training may often sensibly be addressed in the EMS referred to above.

- Training of all staff with responsibility for operating the process should include:
  - awareness of their responsibilities under the permit
  - minimising emissions on start up and shut down
  - action to minimise emissions during abnormal conditions
- The operator should maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an impact on the environment. These documents should be made available to the regulator on request.

Maintenance

6.30 Effective preventative maintenance should be employed on all aspects of the process including all plant, buildings and the equipment concerned with the control of emissions to air. In particular:

- A written maintenance programme should be provided to the regulator with respect to pollution control equipment; and
- A record of such maintenance should be made available for inspection.

All external pipework used for scrubbing liquor, cleaning water, irrigation water and process liquid transfer should be protected against frost.

Odour Response Procedure

6.31 The operator should prepare an Odour Response Procedure as outlined in **Appendix 3**. This is a summary of the foreseeable situations which may compromise his/her ability to prevent and/or minimise odorous releases from the process and the actions to be taken to minimise the impact. It is intended to be used by operational staff on a day-to-day basis and should detail the person responsible for initiating the action.

- The Odour Response Procedure should include a list of essential spares for the odour arrestment plant. The equipment manufacturer should recommend which spares are subject to wear and foreseeable failure and are critical for the correct operation of the odour arrestment plant (such as pumps, nozzles etc.) and these should be held on site. It may be acceptable for certain spares to be available on guaranteed short delivery if the absence of a supply at the site would not lead to complete failure of the odour arrestment plant or to offensive odours beyond the site boundary.

6.32 The Odour Response Procedure (see **Appendix 3** and paragraph **6.31**) should include analysis of actions in the case of arrestment plant breakdown or malfunction. Immediate arrangements should be made to divert odour streams to other suitable arrestment plant. Failure to provide suitable temporary arrestment plant may lead to the suspension of the process and consequently emergency standby arrangements should be detailed in the Odour Response Procedure. This may include:

- suspending process operations
- reducing the scale of high odour intensity process operations, for example stopping cooking operations or reducing throughput
- by-pass emissions to stand-by or alternate odour arrestment plant, for example using a boiler as an emergency odour arrestment system.

7 Summary of changes

Reasons for the main changes are summarised below.

Table 6: Summary of changes

Section / Paragraph / Row	Change	Reason	Comment
Table 2, Row 1	Emissions to be free from offensive odour beyond the process boundary	To meet objectives of the legislation - free from offence to the senses	Reflects BAT
Table 2, Rows 2 and 3	Inclusion of a standard for odour arrestment efficiency	To set a quantitative standard for odour removal	Reflects BAT
Table 2, Rows 4 and 5	Inclusion of provisions to limit the sulphur content of fuel where a thermal system is used for odour arrestment	To minimise oxides of sulphur releases	Reflects BAT
Table 2, Row 7	Emission limit for sulphur dioxide from liquid fuelled dryers reduced to 1700 mg/m^3	To minimise oxides of sulphur releases	Reflects BAT
Table 2, Row 13	Emission limit for particulate matter reduced to 20 mg/m^3 for sources other than dryers and coolers	BAT for particulate matter control will achieve better emissions than those required by the previous note	Reflects BAT
Paragraph **5.11**	Requirement for emissions to be free from visible smoke	To prevent visible emissions	To meet objectives of the legislation - free from offence to the senses
Paragraph **5.10** and **5.13**	Assessment of process and releases in the case of odours being detected, abnormal conditions or complaints	To identify causes and solutions to possible odour releases	Clarification of previous guidance
Paragraph **5.16** and **5.17**	Inclusion of continuous monitoring provisions for particulate arrestment plant	BAT for operational control - also clarification of previous guidance and addition of thermal systems	Recording of monitors continuously replaced with alarm recording
Paragraph **5.15**	Inclusion of continuous monitoring provisions for odour arrestment plant	BAT for operational control - also clarification of previous guidance and addition of thermal systems	Recording of monitors continuously replaced with alarm recording
Paragraph **5.10**	Daily inspection of odour arrestment and air handling plant	To identify abnormal activities	Replaces requirement for daily olfactory assessment
Paragraph **5.17**	Testing of odour arrestment efficiency and inclusion of BS EN method	Reflects BAT - quantifies odour plant performance	New methods available
Paragraph **5.17**	Testing for sulphur dioxide to ISO 7934 or 7935 and nitrogen oxides to ISO 11564	Reflects BAT	New methods available
Paragraph **5.18**	Requirement for sulphur contents of fuel to be certificated	Odour plant may be an oil-fired thermal system	Reflects EU requirements
Paragraphs **5.22** and **5.23**	Requirements for management and control of silos	To avoid dusty emissions	Clarification of previous guidance
Paragraph **6.4** and **6.5**	Requires negative pressure in dryer	To avoid fugitive odour release	Reflects BAT
Paragraph **6.6**	Removal of condensable gases before scrubbing	Optimise odour arrestment	Reflects BAT

Table 6: Summary of changes

Section / Paragraph / Row	Change	Reason	Comment
Paragraph **6.7**	Requirement for mist eliminator for scrubbers	To prevent droplets	Clarification of previous guidance
Paragraphs **6.6** to **6.10**	Details on design and operation of odour and dust arrestment plant	Additional guidance	Reflects BAT
Paragraphs **6.11**, **6.12** and **6.13**	Requirements for management and control of silos	To avoid dusty emissions	Clarification of previous guidance
Paragraph **6.31**	Requirement for an Odour Response Procedure	Abnormal conditions are a key odour risk and there needs to be a documented procedure in advance of the problem	Expanding previous guidance
Paragraph **6.21**	Requirements for management and monitoring of effluent and condensate storage	To avoid fugitive odour release	Reflects BAT
Appendix 3	Additional guidance on the preparation of an Odour Response Plan	To provide additional guidance for operators and regulators	Reflects current knowledge

8 Definitions and further information

This guidance	Process Guidance Note 6/26 (04)
Previous guidance	Process Guidance Note 6/26 (1996)
LAPC	explained in the Introduction of this guidance
LAPPC	explained in the Introduction of this guidance
Permit	the written permission to operate an installation prescribed for LAPPC – (the replacement for authorisation under LAPC)
Authorisation	the written authority to operate a process prescribed for LAPC - (will be replaced by permit under LAPPC)
Local enforcing authority	is replaced by the word 'regulator' in LAPPC
Regulator	replaces the phrase 'local enforcing authority' from LAPC
Existing process	should be taken to have the following meaning (which is based on paragraph 14 of Schedule 3 to SI 1991 /472): • a process which was being carried on at some time in the 12 months immediately preceding the first day of the month following publication of this guidance note; • a process which is to be carried on at a works, plant or factory or by means of mobile plant which was under construction or in the course of manufacture or in the course of commission on the first day of the month following publication of this guidance note, or the construction or supply of which was the subject of a contract entered into before that date.
New process	not an existing process.
Authorised person	under section 108 of the Environment Act 1995, "authorised person" has replaced the term "inspector".
Installation	should be interpreted in accordance with the guidance contained in the the General Guidance Manual on Policy and Procedures for A2 and B Installations. www.defra.gov.uk/environment/ppc/manual/index.htm
Process	the term "process has been used in this guidance note to refer to both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999.

Health and safety

Operators of processes and installations must protect people at work as well as the environment:

- requirements of a permit or authorisation should not put at risk the health, safety or welfare of people at work
- equally, the permit or authorisation must not contain conditions whose only purpose is to secure the health of people at work. That is the job of the health and safety enforcing authorities

Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because:

- emission limits under the Environment Protection Act 1990 or Pollution Prevention and Control Act 1999 relate to the concentration of pollutant released into the air from prescribed activities
- exposure limits under health and safety legislation relate to the concentration of pollutant in the air breathed by workers
- these limits may differ since they are set according to different criteria. It will normally be quite appropriate to have different standards for the same pollutant, but in some cases they may be in conflict (for example, where air discharged from a process is breathed by workers). In such cases, the tighter limit should be applied to prevent a relaxation of control

EMS additional information

Further information/advice on EMS may be found from the following:

- Envirowise at **www.envirowise.gov.uk** and **www.energy-efficiency.gov.uk** and Environment and Energy Helpline freephone 0800 585794
- ISO 14001 **www.bsi.org.uk** or telephone BSI information centre (020 8966 7022)
- EU Eco Management and Audit Scheme (EMAS) **www.emas.co.uk** or telephone the Institute of Environmental Management and Assessment (01522 540069)

Regulators and process operators may also like to be aware of:

BS 8555: a new standard to help SMEs implement an EMS, by offering a five-phase approach, is contained in BS 8555 which was published in 2003 following on from work undertaken by the Acorn Trust. The Institute of Environmental Management and Assessment, which has taken over the Trust's activities, is developing a scheme of accredited recognition for companies achieving different phases of BS 8555. BS 8555 can be used to achieve ISO 14001 and registration to the higher standard, EMAS.

Some of the **High Street banks**, such as NatWest and the Coop, now offer preferential loan rates to organisations that can demonstrate they are committed to improving their environmental performance. The NatWest also produce a self help guide for SMEs, 'The Better Business Pack', focusing on waste, utilities, transport and supply chain issues. It gives tools, guidance and examples. Contact: WWF-UK on 01483 426444.

References

(a) Secretary of State's Guidance (England and Wales): General Guidance Manual on Policy and Procedures for A2 and B Installations , March 2003 - available from the Defra website and, in hard copy, from the Defra Publications line 08459 556000 **www.defra.gov.uk/environment/ppc/index.htm**

(b) DOE/WO Additional Guidance AQ17(94), issued to local authorities by the Air and Environment Quality Division of DEFRA and by the Welsh Office, provides further advice on the assessment of odour. The Scottish equivalent of AQ17(94) is SN 11(94).

(c) Current air quality objectives are specified in:
- The Air Quality (England) Regulations 2002 SI 3043
- The Air Quality (Wales) Regulations 2002 WSI 3182 (W.298)
- The Air Quality (Scotland) Regulations 2002 SSI 297

(d) HMIP Technical Guidance Note D1: "Guidelines on Discharge Stack Heights for Polluting Emissions", published by The Stationery Office, ISBN 0-11-752794-7.

(e) M1 Sampling requirements for monitoring stack emissions to air from industrial installations, Environment Agency July 2002 **(EA website)**

(f) M2 Monitoring of stack emissions to air. Environment Agency May 2003 **(EA website)**

(g) Odour Measurement and Control- An Update published by National Environmental Technology Centre, Culham, Abingdon. Oxon OX14 3DB. ISBN 0-85624-8258.

(h) BS EN 13725:2003 - "Air Quality - Determination of Odour Concentration by Dynamic Olfactometry"

(i) IPPC H4 - Horizontal Guidance For Odour: Part 1 - Regulation and Permitting, Part 2 - Assessment and Control, (To be published by EA, EHS, SEPA.)

Web addresses

The final consultation drafts and final published versions of all guidance notes in this series can be found on **www.defra.gov.uk/environment/index.htm**.

Welsh Assembly Government web-site **www.wales.gov.uk**.

Local Authority Unit of the Environment Agency for England and Wales. **www.environment-agency.gov.uk/business/lapc**.

Scottish Environment Protection Agency (SEPA) **www.sepa.org.uk**.

Energy saving and environmental management measures can increase industry profits. Envirowise (formerly ETBPP) show how at **www.envirowise.gov.uk** (or freephone 0800 585794).

Appendix 1: Extract from Pollution Prevention and Control (England and Wales)[8] Regulations 2000 SI 1973[9]

(The processes for local air pollution control are listed under **"Part B"**. The "Part A1" processes are for national regulatory control. The "Part A2" processes are subject to local authority integrated pollution prevention and control.)

6.8 The treatment of animal and vegetable matter and food industries

Part A (1)

(a) Tanning hides and skins at plant with a treatment capacity of more than 12 tonnes of finished products per day.

(b) Slaughtering animals at plant with a carcass production capacity of more than 50 tonnes per day.

(c) Disposing of or recycling animal carcasses or animal waste, other than by rendering or by inceration falling within Section 5.1 of this part of this Schedule, at plant with a treatment capacity exceeding 10 tonnes per day of animal carcasses or animal waste or, in aggregate of both.

(d) Treating and processing materials intended for the production of food products from-

(i) animal raw materials (other than milk) at plant with a finished product production capacity of more than 75 tonnes per day;

(ii) vegetable raw materials at plant with a finished product production capacity of more than 300 tonnes per day (average value on a quarterly basis).

(e) Treating and processing milk, the quantity of milk received being more than 200 tonnes per day (average value on an annual basis).

(f) Processing, storing or drying by the application of heat of the whole or part of any dead animal or any vegetable matter (other than the treatment of effluent so as to permit its discharge into controlled waters or into a sewer unless the treatment process involves the drying of any material with a view to its use as an animal feedstuff) if -

(i) the processing, storing or drying does not fall within another Section of this Schedule or Part A(2) of this Section and is not an exempt activity: and

(ii) it may result in the release into water of any substance listed in paragraph 13 of Part 2 of this Schedule in a quantity which, in any period of 12 months, is greater than the background quantity by more than the amount specified in relation to the substance in that paragraph.

8. For activities carried out in Scotland the PPC (Scotland) Regulations should be referred to. For activities carried out in Ireland the PPC (Ireland) Regulations should be referred to.
9. Every effort has been taken to ensure that this Appendix is correct at the date of publication, but readers should note that the Regulations are likely to be subject to periodic amendment, and this Appendix should not therefore be relied upon as representing the up-to-date position after the publication date.

Part A (2)

(a) Disposing of or recycling animal carcasses or animal waste by rendering at plant with a treatment capacity exceeding 10 tonnes per day of animal carcasses or animal waste, or, in aggregate, of both.

Part B

(b) Processing, storing or drying by the application of heat of the whole or part of any dead animal or any vegetable matter (other than the treatment of effluent so as to permit its discharge into controlled waters or into a sewer unless the treatment process involves the drying of any material with a view to its use as an animal feedstuff) if -

(i) the processing, storing or drying does not fall within another Section of this Schedule or Part A(1) or Part A(2) of this Section and is not an exempt activity: and

(ii) the processing, storing or drying may result in the release into the air of a substance described in paragraph 12 of Part 2 of this Schedule or any offensive smell noticeable outside the premises on which the process is carried out.

(c) Breeding maggots in any case where 5 kg or more of animal or of vegetable matter or, in aggregate, of both are introduced into the process in any week.

Interpretation of Section 6.8

"animal" includes a bird or a fish; and

"exempt activity" means-

(i) any activity carried out on a farm or agricultural holding other than the manufacture of goods for sale;

(ii) the manufacture or preparation of food or drink for human consumption but excluding-

(1) the extraction, distillation or purification of animal or veg-etable oil or fat otherwise than as a process incidental to the cooking of food for human consumption;

(2) any process involving the use of green offal or the boiling of blood except the cooking, of food (other than tripe) for human consumption;

(3) the cooking of tripe for human consumption elsewhere than on premises on which it is to be consumed;

(iii) the fleshing, cleaning and drying of pelts of fur-bearing mammals;

(iv) any activity carried on in connection with the operation of a knacker's yard as defined in article 3(1) of the Animal By-Products Order 1999;

(v) any activity for the manufacture of soap not falling within Part A (1) of Section 4.2;

(vi) the storage of vegetable matter not falling within any other Section of this Schedule;

(vii) the cleaning of shellfish shells;

(viii) the manufacture of starch;

(x) the processing of' animal or vegetable matter at premises for feeding a recognised pack of hounds registered under article 13 of the Animal By-Products Order 1999;

(x) the salting of hides or skins, unless related to any other activity listed in this Schedule;

(xi) any activity for composting animal or vegetable matter or a combination of both, except where that process is carried on for the purposes of cultivating mushrooms;

(xii) any activity for cleaning, and any related process for drying or dressing, seeds, bulbs, corms or tubers;

(xiii) the drying of grain or pulses;

(xiv) any activity for the production of cotton yarn from raw cotton or for the conversion of cotton yarn into cloth:

"food" includes-

(i) drink;

(ii) articles and substances of no nutritional value which are used for human consumption; and

(iii) articles and substances used as ingredients in the preparation of food; and

"green offal" means the stomach and intestines of any animal, other than poultry or fish, and their contents.

Appendix 2: Method for sampling of emissions from biological (earth, peat and heather) filters using gas detection tubes

METHOD FOR SAMPLING OF EMISSIONS FROM BIOLOGICAL (EARTH, PEAT AND HEATHER) FILTERS USING GAS DETECTION TUBES

1. Routine monitoring of emissions from biological filters can be readily undertaken using gas detection tubes. However, it is important to ensure that a number of representative samples are obtained and that care is taken in the interpretation of results. The number of samples necessary will depend upon the gas distribution within the biological filter.

2. It is essential that samples are taken from a representative volume of emitted gas as near surface dispersion will significantly affect measured concentrations. Therefore, it is necessary to reduce dispersion and obtain a volume of gas from which to sample. This can be achieved by placing a purpose-made enclosure on top of the filter bed and allowing the emitted gases to accumulate.

3. The enclosure itself should be approximately 0.5 m^3 - 1 m^3 in volume, preferably with a 1 m square open base. The top of the enclosure should have an opening of approximately 50 mm diameter to facilitate sampling. The enclosure call be simply fabricated using a timber frame and plywood or hardboard sides and top with mastic or other suitable sealant applied to the side and top joints.

4. It will be extremely difficult to achieve a seal at the filter bed surface, however the enclosure should be located in order to minimise leakage from the points of contact with the filter bed. The enclosure should remain at the sample location for at least 10 minutes prior to sampling to ensure that a representative sample of emissions is oThe gas detection tubes should be used in accordance with the manufacturer's instructions and results should be evaluated against the indicative guide values in **Table 3**.

5. Amines and amides are a common interference with gas detection tubes for ammonia and therefore results obtained from ammonia gas detection tubes should be compared to a 2 ppm v/v indicative guide value. It may be necessary to monitor for hydrogen sulphide and mercaptans separately depending upon the detector tube specification and in this case the sum of the individual results should be compared with the indicative guide value in Row 3 of **Table 3** obtained (allowing the volume of the enclosure to be purged three times).

6. This method is only suitable for open biomass type biofilters where no final discharge vent or stack exists.

7. Additional information is available in BS EN13725 - "Air Quality - Determination of Odour Concentration by Dynamic Olfactometry" and "Odour Measurement and Control-:\n Update "published by National Environmental Technology Centre, Culham, Abingdon. Oxon OX14 3DB. ISBN 0-85624--8258.

Appendix 3: Guidance on the Preparation of an Odour Response Procedure

What is an Odour Response Procedure?

An Odour Response Procedure is a summary, provided by the operator, of the foreseeable situations which may compromise his/her ability to prevent and/or minimise odorous releases from the process and the actions to be taken to minimise the impact. It is intended to be used by operational staff on a day-to-day basis and should detail the person responsible for initiating the action.

The procedure is intended primarily to document foreseeable events which are outside of the control of the operator and those that are preventable by maintenance and operational control (for example pump failure, biofilter compaction or filter breakthrough). The procedure should include a maintenance programme for all odour arrestment plant and other odour containment measures (such as building structure, ventilation plant).

What is the Format for the Odour Response Procedure?

The Odour Response Procedure should be a written document which is available on-site and should be submitted to the regulator. The regulator may wish to set conditions in the permit/authorisation which reflect the undertakings given in the Procedure (for example maximum arrestment plant by-pass times, reduced throughput etc).

What should be included in the Odour Response Procedure?

There are four main reasons for releases which may lead to emissions of offensive odour which are:

1. changes in process conditions leading to more odour generation or a change in the odour characteristics

2. conditions which result in fugitive releases due to reduced odour containment

3. failures or reduced performance of odour arrestment plant

4. factors affecting the dispersion between the source and the receptor.

The occurrence of 2 and 3 above can be limited by the production of, and compliance with, an effective plant and building maintenance programme. Examples of other issues which should be considered in each of these categories are given in the Table below.

In order to prepare an assessment of possible abnormal conditions and the options for mitigation of the odour, the operator will need to consider:

- the activity which produces the odour and the point of odour release
- possible process or control failures or abnormal situations
- potential outcome of a failure in respect of the likely odour impact on local sensitive receptors
- what actions are to be taken to mitigate the effect of the odour release and details of the persons responsible for the actions at the site.

Table 7: Examples of issues to consider relating to odour release

Factors leading to odour release	Examples of issues to consider
Those which have potential to affect the process and the generation of odour	• Materials input - seasonal variation in weather may affect odour of materials particularly if putrescible. • Process parameters such as changes in temperature/pressures • Rate of throughput or increased hours of operation • High levels of ammonia within the process buildings (possibly due to high ambient temperatures).
Those which affect the ability to arrest/minimise odour	• Poor performance of biofiltration or poisoning (may be the result of poor maintenance or mis-operation) • Flooding of the biofilter due to abnormally high rainfall • External failure of other utilities, e.g. water supply, gas supply for combustion equipment where the operator has signed up to an interruptible gas supply • Mechanical breakdown of arrestment equipment such as pumps, fans etc • Power failure • Compaction of the biofilter or surface fissures • Saturation of a carbon filter bed and subsequent breakthrough of odours • Below optimum temperature of a thermal oxidiser or boiler etc • Saturation of scrubber liquor, blocked injection nozzles etc.
Those which affect the ability to contain odour	• Building damage which affects integrity due to for example storms • Power failure • Failure of automatic doors, i.e. in open position • Failure in procedures to maintain containment (human error)
Those affecting dispersion between the source and sensitive receptors‡	• Short term weather patterns which fall outside of the normal conditions for that area and are highly unusual (not just the normal meteorological pattern) - inversions and other conditions unfavourable to dispersion should have been considered in designing the process • Weather - wind direction, temperature, inversion conditions if these are normal variants of local weather • Loss of plume buoyancy/temperature
‡ The process design should incorporate control measures in order that the aim that, under the normal range of meteorological conditions for the area, no emissions result in offensive odour that is detectable beyond the process boundary.	