

Sector Guidance Note IPPC SG1

June 2003

# Integrated Pollution Prevention and Control (IPPC)

Secretary of State's Guidance for the  
Particleboard, Oriented Strand Board  
and Dry Process Fibreboard Sector

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



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# 1 Introduction

## Background

- 1.1 This sector guidance note is issued by the Secretary of State and the Welsh Assembly Government (WAG), following consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee, and other interested organisations.
- 1.2 The note constitutes statutory guidance under regulation 37 of the Pollution Prevention and Control (England and Wales) Regulations 2000, SI 1973 ([Ref 1](#)) on the integrated pollution control standards appropriate for the generality of new and existing installations in the manufacture of wood particleboard, oriented strand board and wood fibreboard / dry process fibreboard sector.

These installations require a permit to operate in accordance with the 2000 Regulations under what is known as the Local Authority-Integrated Pollution Prevention and Control (LA-IPPC) regime. Local authority regulators are required by regulation 37 to have regard to this guidance. The Secretary of State / WAG will also treat this guidance as one of the material considerations when determining any appeals made under the Regulations against a local enforcing authority decision.
- 1.3 The guidance also (where appropriate) gives details of any mandatory requirements affecting emissions and impacts from these installations, which are in force at the time of publication. These include requirements contained in directions from the Secretary of State / WAG.
- 1.4 This is one of a series of such guidance notes aimed at providing a strong framework for consistent and transparent regulation of LA-IPPC installations.
- 1.5 General guidance explaining LA-IPPC and setting out the policy and procedures, is contained in the "General Guidance Manual on Policy and Procedures for A2 and B Installations" ([Ref 2](#)) available from [www.defra.gov.uk/environment/ppc/index.htm](http://www.defra.gov.uk/environment/ppc/index.htm), to be 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.

## Best Available Techniques (BAT)

- 1.6 BAT is the main basis for determining standards in LA-IPPC. This sector guidance note addresses what is considered by the Secretary of State/WAG to constitute BAT for the wood Particleboard, oriented strand board, and wood fibreboard/dry process fibreboard sector.

As made clear in chapter 12 of the General Guidance Manual, BAT for each installation should be assessed by reference to the appropriate sector guidance note, and these notes should be regarded by local authorities as their primary reference document for determining BAT in drawing up permits. In general terms what is BAT for one installation is likely to be BAT for a comparable installation. However, determination of what is BAT is ultimately a matter for case-by-case decision taking into account that individual circumstances may affect BAT judgements and what are the appropriate permit conditions.

Thus, for each wood particleboard, oriented strand board, and wood fibreboard/dry process fibreboard installation, local authorities (subject to appeal to the Secretary of State / WAG) should regard this guidance note as a baseline, but ensure they take into account any relevant case-specific factors such as the individual process configuration and other characteristics, its size, location, and any other relevant features of the particular installation. Further guidance on this, including the issue of taking account of operators' individual financial position, is contained in chapter 12 of the General Guidance Manual.

- 1.7 If there are any applicable mandatory EU emission limits, these must be met, although BAT may go further.

## Who is this guidance for?

- 1.8 This guidance is for:
- local authority regulators: who must have regard to the guidance when determining applications and when regulating installations which have a permit
  - operators: who are best advised also to have regard to it when making applications and in the subsequent operation of their activities
  - members of the public: who may be interested to know what standards are envisaged for the generality of installations in this sector
- 1.9 The guidance is based on the state of knowledge and understanding of installations in this sector, their potential impact on the environment, and the available control techniques at the time of writing. The guidance may be amended from time to time in order to keep abreast with developments, including improvements or changes in techniques and new understanding of environmental impacts and risks. Any such amendments may be issued in a complete revision of this note, or in separate additional guidance notes which address specific issues. (N.B. It may not always be possible to issue amending guidance quickly enough to keep in absolute step with rapid changes, which might be another justification in particular cases for diverging from this note.) Steps will be taken to ensure that those who need to know about changes are informed of any amendments. Operators (and their advisers) are, however, strongly advised to check with the relevant local authority whether there have been any amendments before relying on this note for the purposes of applying for a permit or making any other decisions where BAT and related matters may be a consideration.

## Terminology

- 1.10 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 LA-IPPC.

## Installations covered

- 1.11 This note covers installations, described in Section 6.1 Part A(2) of Schedule 1 to the PPC Regulations as follows:
- "Manufacturing wood particleboard, oriented strand board, wood fibreboard, plywood, cement bonded particleboard or any other composite wood based board."*
- 1.12 The installation includes the main activities above plus the directly associated activities which have a technical connection with the main activities and which may have an effect on emissions and pollution.
- 1.13 The manufacturing of cement bonded particleboard and plywood is not specifically covered in this guidance note, however there may be aspects of this guidance, for example point source and fugitive emissions of particulate matter, that are relevant to the operations.

# Review and Upgrading Periods

## Existing installations or activities

- 1.14 The previous guidance PG 6/4 (95) Secretary of State's Guidance Note for Processes for Manufacture of Particleboard and Fibreboard, relating to emissions to air, advised that upgrading to that standard should usually have been completed by 1st October 1996 and compliance with emission limits and controls which apply to presses and wood dryers should usually have been completed by 31 December 1997. Requirements still outstanding from any existing upgrading programme should be completed.
- 1.15 The new provisions of this note and the dates by which compliance with these provisions is expected, are listed in **Table 1** below, together with the paragraph number where the relevant guidance is to be found. Compliance with the new provisions should normally be achieved by the dates shown. Permits should be drafted having regard to this compliance timetable.
- (a) Where this guidance note specifies standards or requirements which are additional to, higher than or different to those in PG6/4(95), Secretary of State's Guidance Note for Processes for Manufacture of Particleboard and Fibreboard, only in exceptional circumstances should upgrading of existing installations and activities having regard to these additional/higher/different standards or requirements be completed later than the compliance date specified in **Table 1** below. (Relaxed or deleted standards or requirements fall within the following paragraph.)
- (b) Where standards or requirements in PG6/4(95), Secretary of State's Guidance Note for Processes for Manufacture of Particleboard and Fibreboard have been deleted in this guidance note or where this guidance note specifies less stringent standards or requirements than those in PG6/4(95) Secretary of State's Guidance Note for Processes for Manufacture of Particleboard and Fibreboard, the new LA-IPPC permit should reflect this straightaway.
- 1.16 A programme for upgrading within the specified timescales, to those new / additional provisions in this guidance which involve significant improvement work, should be submitted to the relevant local authority regulator within 6 months of the date of issue of the permit.

**Table 1: Compliance requirements**

Guidance	Reference	Compliance date
Isocyanate monitoring	<b>Table 3</b> Emission limit values	12 months following publication of this note
Groundwater Contamination Risk Audit	3.58, 3.62 and BAT 30	1 April 2006
Raw Materials / Waste Minimisation Audit	3.74 and BAT 49	Within 18 months of the issue of the permit
Water Audit	BAT 53	1 April 2005
Energy Audit	3.98 and BAT 62	1 April 2004
Hazard Identification / Risk Analysis	BAT 70	1 April 2005
Noise & Vibration	3.108 and BAT 74 - 77	31 July 2004
All Other Requirements	To be complied with as soon as practicable, which in most cases should be within 12 months of the publication of this note.	

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

### **New installations or activities**

- 1.18 For new installations or activities - from the first day of operation the permit should have regard to the full standards of this guidance.

### **Substantially changed installations or activities**

- 1.19 For substantially changed installations or activities - as from the first day of operation, the permit should normally have regard to the full standards of this guidance with respect to the parts of the installation that have been substantially changed and any part of the installation affected by the change.

### **Permit reviews**

- 1.20 Permits should be reviewed in accordance with the guidance in chapter 26 of the General Guidance Manual. The review frequencies given in that chapter are considered appropriate for activities and installations covered by this sector guidance note.



## Summary of releases

Table 2: Summary of direct releases

Source →  Release ↓	De-barking	Chip Washing	Wood Chipping	(Prepared) Wood Particle Storage	Drying	Screening operations	Cyclones	Mixing of Resin/Additives	Presses	Trimming Operations	Cooling Operations	Laminating Line	Effluent Plant	Boilers	WESP
Oxides of sulphur					A									A	
Oxides of nitrogen and carbon					A									A	
Particulate/Total Suspended Solids	A	W	A	A	A	A	A			A		A	W	A	A
Formaldehyde								A W	A		A		W		A W
Isocyanates								A	A		A				
VOC					A				A		A				A
Total aldehydes					A			A	A		A				A
Solid waste or sludge		W						W					W	W	W
Phenol								A	A		A				
Ammonia													W		
Noise	***		***		**	*	**		** #						*
KEY	A - Release to Air, W - Release to Water, *** - High, ** - Medium * - Low # from fans														
N.B. It should be noted that this is not necessarily an exhaustive list. Equally not all installations will necessarily have all these releases															

## 2 Emission limits and other provisions

2.1 This section contains emission limits, mass release rates and other requirements that are judged for the generality of the activities within the sector to represent BAT.

### Contained emissions to air associated with the use of BAT

Table 3: Contained emissions to air associated with the use of BAT

Determinand	Source	Limit	Type of monitoring	Frequency of monitoring
Offensive odour	Whole process	No offensive odour beyond the site boundary	Operator observations	At least daily
Visible emissions	Combustion plant	Ringelmann shade 1	Operator observations – dependent upon type of combustion plant	At least daily
Particulate matter	All contained sources other than wood dryers and Medium Density Fibreboard (MDF) production	50 mg/m <sup>3</sup>	Continuous indicative monitoring (where continuous monitoring is shown by the operator to be impractical, compliance with the emission limits should be demonstrated by selection of abatement equipment which is capable of meeting the specified emission limits and by continuous monitoring of the abatement equipment performance, for example by the installation of optical cross-duct detectors on fabric filters or cyclones)	Continuous (equipment should be checked at least daily to ensure it is functioning correctly)  In cases where it has been shown that continuous monitoring is impractical, or where continuous monitoring only gives an indication of compliance with emission limits, emissions should be tested at least quarterly. A reduced frequency may be appropriate if monitoring results demonstrate consistent and reliable operation of the abatement plant and compliance with the emission limit
	Medium Density Fibreboard (MDF) production – all contained sources	20 mg/m <sup>3</sup>		
	Wood dryers	20 mg/m <sup>3</sup>		
Condensable VOCs (excluding particulate matter)	Each emission to air	130mg/m <sup>3</sup> (calculated as carbon and measured in accordance with the general method described in <a href="#">Appendix 1</a> )	Quantitative	At least quarterly

**Table 3: Contained emissions to air associated with the use of BAT**

Determinand	Source	Limit	Type of monitoring	Frequency of monitoring
Formaldehyde	Replacement plant or new or substantially changed installations; each emission to air except emissions from wood dryers	5 mg/m <sup>3</sup> (measured as formaldehyde)	Quantitative	At least quarterly
	Replacement plant or new or substantially changed installations; each emission to air from wood dryers	20 mg/m <sup>3</sup> (measured as formaldehyde)	Quantitative	At least quarterly
	Existing installations; Each emission to air including emissions from wood dryers	20 mg/m <sup>3</sup> (measured as formaldehyde)	Quantitative	At least quarterly
Total aldehydes	Each emission to air from wood dryers	20 mg/m <sup>3</sup> (calculated as carbon)	Quantitative	At least quarterly
Temperature	Dryer inlet Dryer outlet Stack draught	n/a	Quantitative (surrogate indicative measure)	Continuously monitored and recorded.
Phenol	Presses and dryers	5 mg/m <sup>3</sup> (averaged over a 2 hour period as monohydric phenol)	Quantitative	At least quarterly
Isocyanate	Presses and dryers	0.1 mg/m <sup>3</sup> (averaged over a 2 hour period as total NCO group)	Quantitative	At least quarterly
Sulphur dioxide	From fuel burnt in combustion plant. Sulphur content of fuel	When burning gas oil <sup>Note 1</sup> - 0.2% wt/wt sulphur in fuel (before 1/01/2008) 0.1% wt/wt sulphur in fuel (from 1/01/2008) When burning other oils - 1% wt/wt sulphur in fuel	Certification by supplier using test method ASTM D86 distillation.	n/a
<p>Note 1: Gas oil as defined in the Sulphur Content of Liquid Fuels Directive (1999/32/EC). N.B. Additional emission limits, in particular for heavy metals and dioxins and furans, are being considered.</p>				

## Benchmark emissions to water associated with the use of BAT

2.2 Limit values for water discharges will be specified in individual cases taking account of the receiving environment. Wastewater treatment systems can maximise the removal of metals using precipitation, sedimentation and possibly filtration. The reagents used for precipitation may be hydroxide, sulphide or a combination of both, depending on the mix of metals present. It is also practicable in many cases to re-use treated water. The following table provides information regarding achievable levels associated with the use of wastewater treatment systems.

**Table 4: Emissions to water associated with the use of BAT**

Determinand	Benchmark release concentration, mg/litre
COD	130 (trade effluent consent) or 30 (surface water)
BOD	100
Total hydrocarbon oil	5
Total suspended solids	20
Ammoniacal nitrogen expressed as N	15
Formaldehyde	10

## 3 Techniques for pollution control

- 3.1 This section summarises, in the outlined BAT boxes, what BAT should be in most circumstances. The boxes should not be taken as the only source of permit conditions; compliance with emission limits and other provisions contained in this sector guidance note together with any relevant case-specific considerations will also need to be taken into account.
- 3.2 The standards cover the techniques and measures which, in combination with those in the relevant previous (LAPC/IPC/Waste) guidance, have been identified as representing BAT in a general sense. They also cover the other requirements of the Pollution Prevention and Control (England and Wales) Regulations 2000 and requirements of other regulations, such as the Waste Management Licensing Regulations and the Groundwater Regulations insofar as they are relevant to an IPPC Permit. For the sake of brevity these boxes simply use the term "BAT".
- 3.3 Given the potential for fire and explosion at these installations, regulators should have particular regard to avoiding the imposition of requirements that would put at risk the health, safety or welfare of persons at work.
- 3.4 Where techniques or operating conditions are referred to in the BAT boxes below, provided that it is demonstrated to the satisfaction of the regulator that an equivalent or better level of control of environmental impacts will be achieved, then other techniques or operating conditions may be used.

### Installation description and in-process controls

#### Main Activities

- 3.5 The meaning of "installation" and "directly associated activity" is addressed in chapter 2 of the General Guidance Manual.
- 3.6 Generic steps in the manufacture of particleboard (see [Figure 3.1](#)):
- raw material selection
  - pre-treatment (de-barking, chipping, washing/steaming (MDF), milling)
  - size classification
  - drying
  - mixing with resin
  - forming the resinated material into a mat
  - hot pressing
  - cooling
  - finishing
- 3.7 Equipment common to this sector includes:
- **Debarkers:** used to remove bark from logs
  - **Woodchippers, hammermills, flakers, refiners:** used to reduce the size of wood to that suitable for the production process. Roundwood is comminuted using flakers
  - **Dryers:** used to dry wood product. In the case of particleboard and OSB, drying is before blending with resin. For MDF, drying may be carried out after the wood fibre is mixed with resin
  - **Resin mixer:** used to mix the wood product with resin
  - **Presses:** used to apply heat and pressure to the mat of wood particles and resin
  - **Wet ElectroStatic Precipitator (WESP):** used to abate gaseous pollutants from the process
  - **Cyclones:** used to recover wood dust for re-use in the process
  - **Bag filters:** used to abate particulate matter from the process

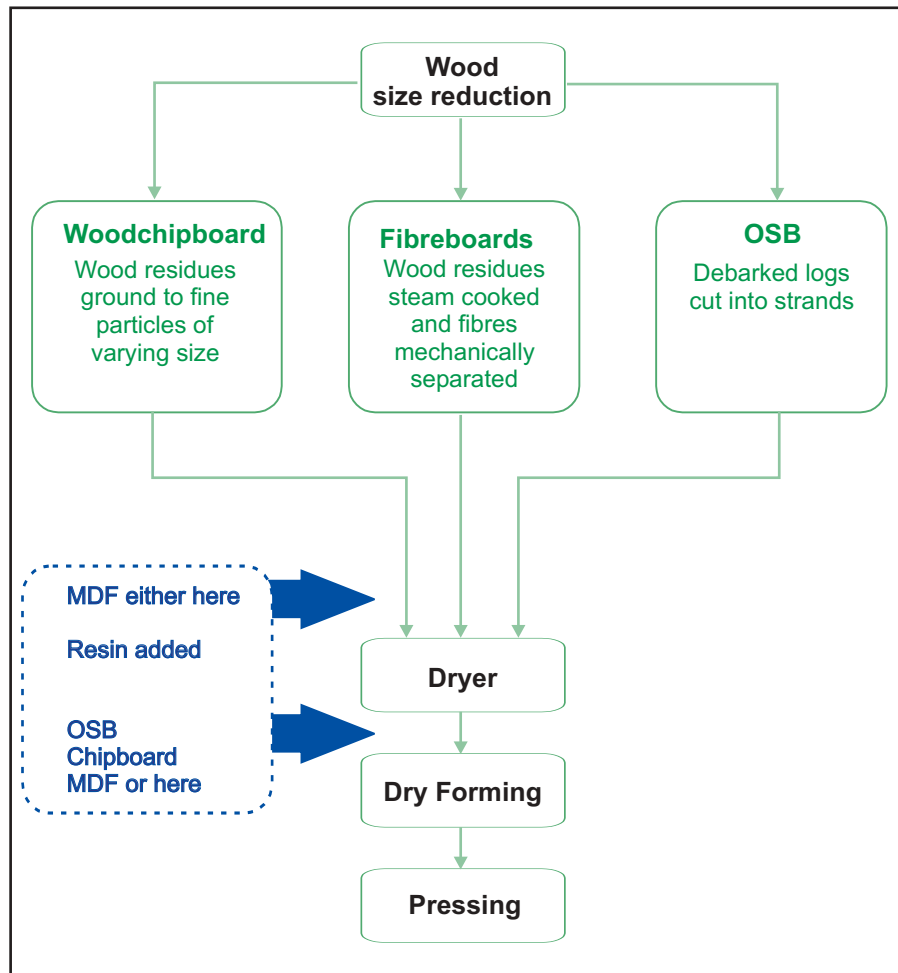
- 3.8 A key production aspect of particleboard is the surface quality of the board. The following characteristics are considered important, density, porosity, homogeneity, smoothness, strength, thickness and swelling of particles. In applications where the particleboard is to be coated with foils, resin impregnated papers or laquers the most important properties of the surface layers are:
- uniformity
  - moisture and density distributions
  - chip characteristics
  - strength and smoothness
- 3.9 The size and homogeneity of wood particles mostly affects surface quality.

## Overview of activities in this sector

### Reconstituted wood products

- 3.10 Reconstituted wood products manufactured in the UK such as particleboard, Medium Density Fibreboard (MDF) and Oriented Strand Board (OSB) are composed of wood which is combined with resins and other additives and formed into a mat, which is then pressed into a board. A generic process flow diagram is shown in [Figure 3.1](#). The manufacturing processes and raw materials of these boards differ slightly and are described in more detail in manufacturing processes.
- 3.11 The manufacturing processes are summarised in [Figure 3.4](#), [Figure 3.6](#) and [Figure 3.8](#). The processes all involve size reduction of the raw wood, followed by drying, mixing with resin/adhesive and pressing at above ambient temperatures. The processes involve the use of all parts of the sawn log and generate as little solid waste as possible. The solid waste that is generated is usually burnt in boilers used to provide heat for either dryers and/or presses. The principal environmental emissions from this manufacturing process are from dryers and presses and the associated abatement techniques employed for these emissions. Specifically in the UK wet electrostatic precipitators (WESPs) have been used to abate gaseous releases and these generate waste water on a discontinuous basis.
- 3.12 Additionally noise from debarking and wood size reduction operations is potentially problematic for this sector.

Figure 3.1: Generic process flow diagram



## Manufacturing process

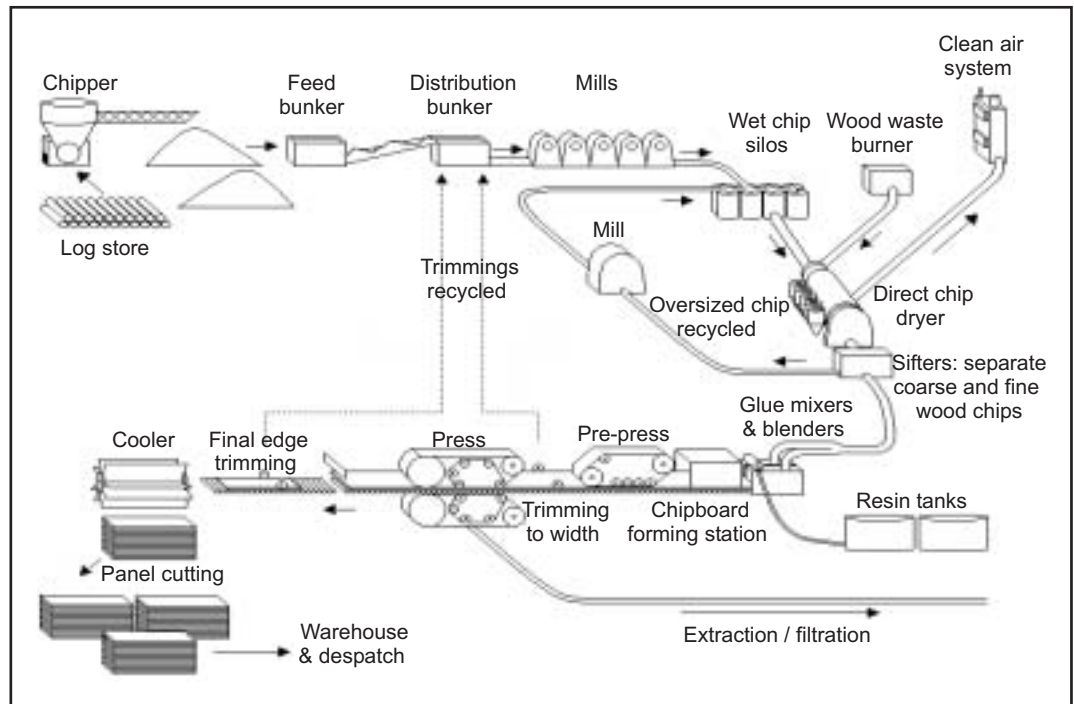
3.13 This section describes the manufacturing processes of:

- particleboard
- MDF
- OSB

### Particleboard

3.14 Particleboard manufactured in the UK is generally of three layers, although single layer or five layer particleboard can be manufactured if required. The outer two layers are referred to as the surface or face layers and the inner layer is referred to as the core layer. The outer or face material is generally finer than core material. By altering the relative properties of the face and core layers, the bending and stiffness of the board can be increased. [Figure 3.2](#) illustrates an example particleboard process.

Figure 3.2: Particleboard process diagram



- 3.15 Raw materials for particleboard consist of wood particles. Primarily:
- recycled woodchips
  - wood chips
  - sawdust
  - wood shavings
- 3.16 This material may be transported to the facility or generated onsite and stored until needed. Sawmills which generate chips onsite, will debark logs, saw wood to proper length and chip. The raw material for particleboard manufacture may then be further reduced in size by means of hammermills, flakers or refiners.
- 3.17 After milling, the material is either screened using vibrating or gyratory screens, or the particles are air-classified. This step removes fines and separates the core material from the surface material. The screened material is then transported to storage bins/silos. The core or surface material is taken from storage to dryers. Rotary dryers are the most commonly used in UK. Both single and triple-pass dryers are used. Some facilities also use tube dryers to dry the raw material.
- 3.18 The fuel for dryers can be waste wood from the site, natural gas or oil. Dryers may use a combination of these fuels depending on circumstances, for example, where an "interruptible" gas supply is provided to the site.
- 3.19 The moisture content of the particles entering the dryers may be as high as 50% (or 100% oven-dry wood). Drying reduces the moisture content to between 2% - 8%. Dryer inlet temperatures may be as high as 871°C (1144K) if the wood particles entering the dryer are wet. Where the wood particles are dry the inlet temperature is generally no higher than 260°C (533K). When drying core material the dryers generally operate at higher temperatures than when drying surface material due to:
- the difference in core and surface particle characteristics (core material is more coarse), and
  - lower moisture content is more desirable for core material
- 3.20 Where the moisture content of the incoming raw material is highly variable, a two-stage drying process can be used. The first stage (pre-dryer) equalises the moisture content of the raw material, the second stage is the main dryer. In such an arrangement tube dryer types may be used as a pre-dryer followed by a rotary dryer for the second stage.



- 3.21 After drying, the particles are ducted through a primary cyclone in order to recover product. From the cyclone the product/particles are transferred, usually pneumatically, to holding bins. From the holding bins core and surface material are transferred to the blenders. In the blenders the particles are mixed with resin and any other additive that may be required to give the final board specific properties. Resin is mixed with the wood particles using spray nozzles, tubes or atomisers.
- 3.22 The blender then discharges the resinated material into a plenum over a belt. The belt conveys the resinated material to the forming machine. The forming machine deposits the material as a continuous mat. The forming machine uses air to convey the resinated material, which is dropped, or thrown, into an air chamber above a moving belt or screen. The material then floats down into position. Where different layers are required, different forming heads can be used in series, or air currents can produce a gradation of particle size from face to core.
- 3.23 As the material (now a mat) leaves the forming machine it may be pre-pressed prior to trimming and pressing. The mats are then cut to the desired length and conveyed to the press. The press applies heat and pressure to activate the resin and bond the fibres into a solid panel. **Figure 3.3** shows a schematic of a multi-opening press. Platens range in size from 1.2m x 2.4m to 2.4m x 8.5m. The total press time is generally 2.5 minutes for single-opening presses and 4.2 - 5.8 minutes for multi-opening presses. Typical production capacities are shown in **Table 5**.

Figure 3.3: Schematic of multi-opening board press

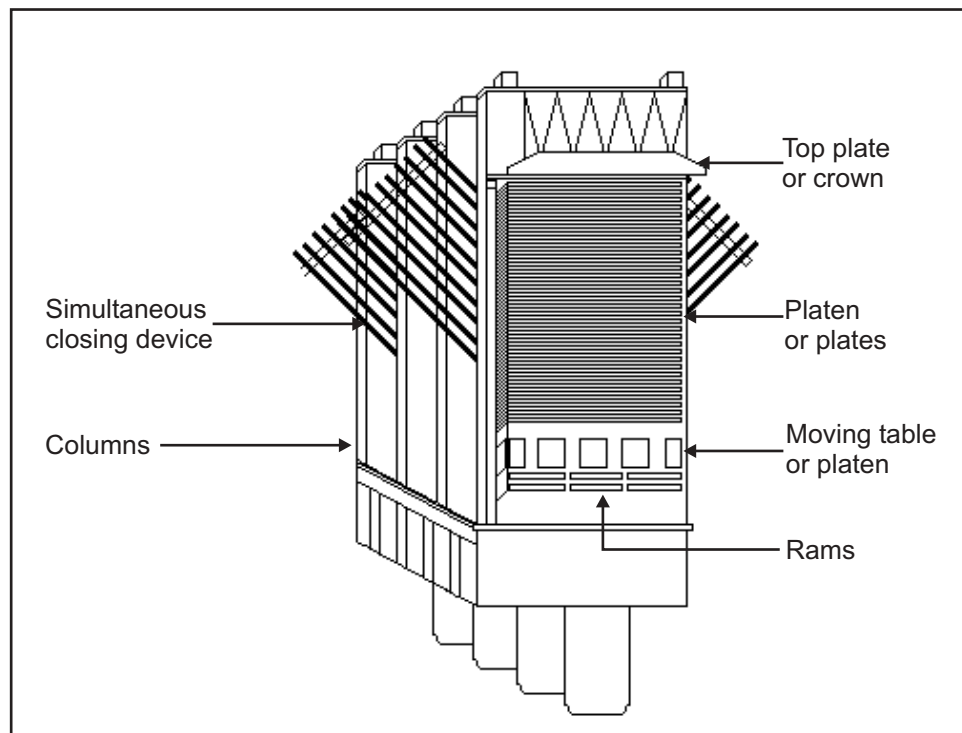
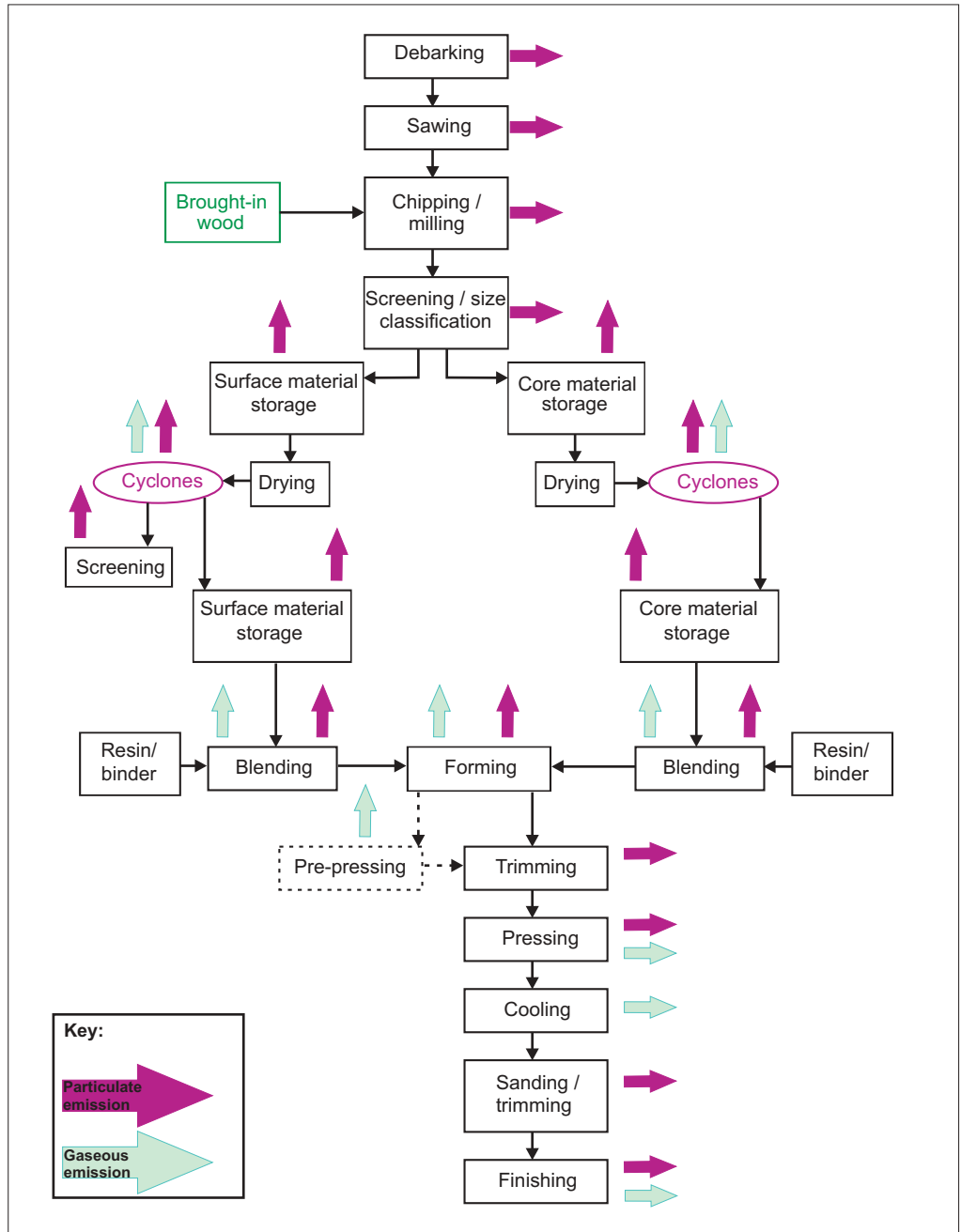


Table 5: Typical production capacities

	Single opening presses	Continuous presses	Multi-opening
Production capacity (per day)	260 - 1100 m <sup>3</sup>	800 - 1800 m <sup>3</sup>	500 - 1200 m <sup>3</sup>
Operating temperature range	Up to 220°C	Up to 200°C	Up to 200°C

- 3.24 Presses are generally heated either by steam, or hot oil and hot water.
- 3.25 Following the pressing operation, boards are usually cooled before sanding and trimming to the required size. Other finishing operations may include edge painting, the application of a laminate or veneer. The finished product is then packaged ready for despatch.

Figure 3.4: Particleboard process flow diagram



## Medium Density Fibreboard (MDF)

- 3.26 MDF is a "dry formed panel product manufactured from lignocellulosic fibres combined with a synthetic resin or other suitable binder". The panels are compressed in a hot press to a density of between 450 - 950 kg/m<sup>3</sup>. MDF has a more uniform density throughout the board than particleboard and has smooth tight edges, which can be machined.
- 3.27 Wood chips are either prepared onsite (by de-barking, sawing, chipping) or bought in from other facilities, for example, sawmills. If required wood chips are washed/steamed to remove dirt and other debris. Refer to [Figure 3.5](#).
- 3.28 The wood chips are steamed or cooked to soften prior to refining. The refiners (also known as attrition mills) use single or double rotating disks to mechanically pulp the chips to obtain wood fibre. This material looks something like light brown cotton wool. The fibre is then transported from the refiners to the drying and blending areas. Typically tube dryers are used to reduce the moisture content of the fibre to the required level. Dryers are typically fired by either gas or oil. Where the moisture content of the fibre is highly variable two-stage dryers may be used; the first stage to equalise the moisture content, the second stage is the main dryer. The drying and blending sequence is dependent upon the method used to blend or mix the resin with the fibre. Some plants inject resins into a short retention time blender; other plants inject resin into a blowline system. Where resin is added in a separate blender, the fibres are dried and separated from the gas stream by a primary cyclone, then conveyed to the blender. In the blender the fibre is mixed with resin and any other additive as required and conveyed to a dry storage bin. Typically urea-formaldehyde (UF) resin is used, however, melamine resins, polymeric di-phenylmethane di-isocyanate resin (pMDI) and phenolic resins may also be used.
- 3.29 Where a blowline is used the fibre is blended with resin (and other additives as required) in the blowline that discharges to the dryer. After drying the resinated fibre is separated from the gas stream by a primary cyclone and then conveyed to a dry fibre storage bin.
- 3.30 From the dry storage bin resinated fibre is pneumatically transferred to the forming machine. In the forming machine resinated fibre is deposited onto a continuously moving belt or screen. The continuously formed mat is pre-pressed before being loaded into the hot press. Depending upon the type of press some operations may trim the mat between pre-pressing and final hot press. The recycled material from this trimming is fed back into the forming machine.
- 3.31 The final press applies heat and pressure to activate the resin and bond the fibres into a solid panel. The mat may be pressed in a continuous hot press, or the pre-compressed mat may be cut into individual mats that are then loaded into a batch type hot press.
- 3.32 Press platens are typically heated by thermal oil. After pressing, the boards are cooled, sanded, trimmed to the required dimension and finished, prior to packing for despatch.

Figure 3.5: MDF process diagram

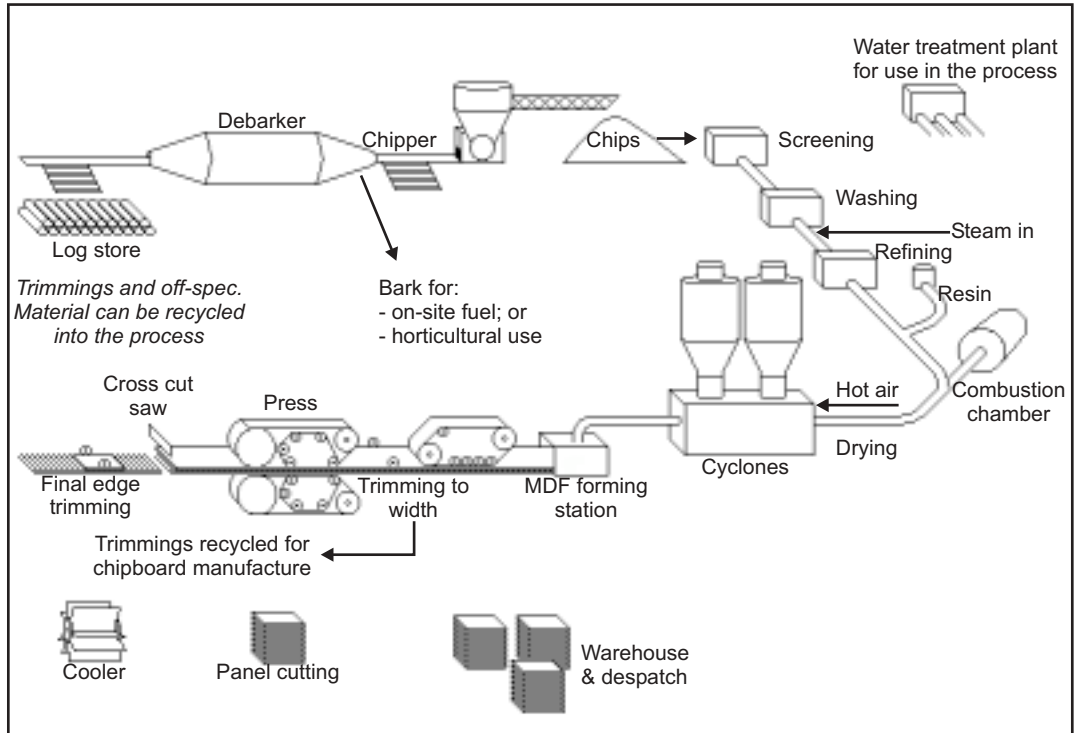
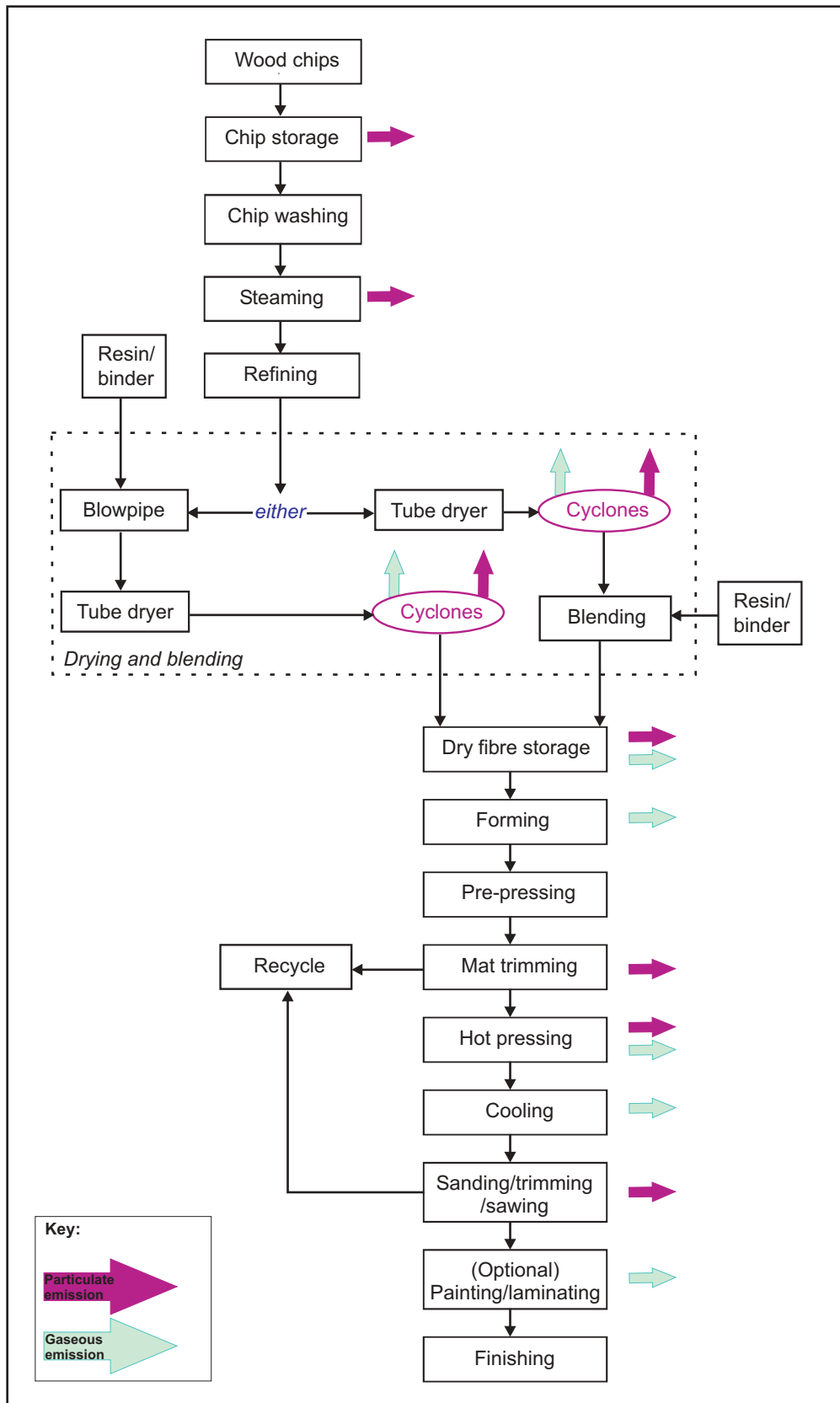


Figure 3.6: MDF process flow diagram



## Oriented Strand Board (OSB)

- 3.33 Oriented strand board (OSB) panels are structural panels made from wood flakes specially produced from logs at the plant. **Figure 3.8** shows a typical process flow diagram for OSB manufacture. Whole logs are cut to approximately 2.5 metre lengths then passed through the de-barker. Following de-barking the wood may be cut into lengths of approximately 0.84 metres. These lengths are referred to as bolts. From this point the wood (or bolt) is fed into the flakers, where the logs are sliced into flakes approximately 3.8 cm wide by 3 cm long by 0.07 cm thick. Flakes are then either conveyed to storage bins or screened to separate surface material from core material prior to storage. This storage is termed "wet storage".
- 3.34 Flakes are dried to a moisture content of between 4 - 10%. This is a low moisture content in order to compensate for the moisture that is gained during the addition of resin or other additives. Dryers are normally fired with wood residue from the plant, but may also be capable of using oil or gas as a fuel. Dryers are normally dedicated to drying either core or surface material, this allows the moisture content of the material to be adjusted independently. Such independent adjustment is important where different resins are used in core and surface materials.
- 3.35 Following drying the flakes are pneumatically conveyed from the dryer and separated from the gas stream at a primary cyclone. Here, flakes are screened to remove fines and separated by surface area and weight. The gas stream continues through the cyclone and collected fines are passed to dry storage bins for use as fuel in either the boiler or wood dryer.
- 3.36 The dried flakes are conveyed from the cyclone to the blender where they are mixed with resin, wax and other additives as required. Phenol-formaldehyde (PF) is most commonly used in the UK although pMDI and melamine urea formaldehyde (MUF) resins may be used. The resins used require the application of heat for curing. From the blender, the resinated flakes are metered out on a continuously moving screen.
- 3.37 The flakes are oriented either by electrostatic forces or mechanically into a single direction as they fall to the screen below. The next layer of flakes is oriented perpendicular to the previous layer. The alternating orientation of the layers result in a structurally superior panel when compared to random orientation of flakes (waferboard). The continuously formed mat is cut to the required length then passed to the accumulation press loader and sent to the hot press. The press applies heat and pressure to activate the resin and bond the wafers into a solid reconstituted product. In most hot presses heat is provided by thermal oil which is generated from a boiler fed on wood waste from the site. After cooling the bonded panel is trimmed to its final dimensions, finished (if required) and packaged ready for despatch.

Figure 3.7: OSB process diagram

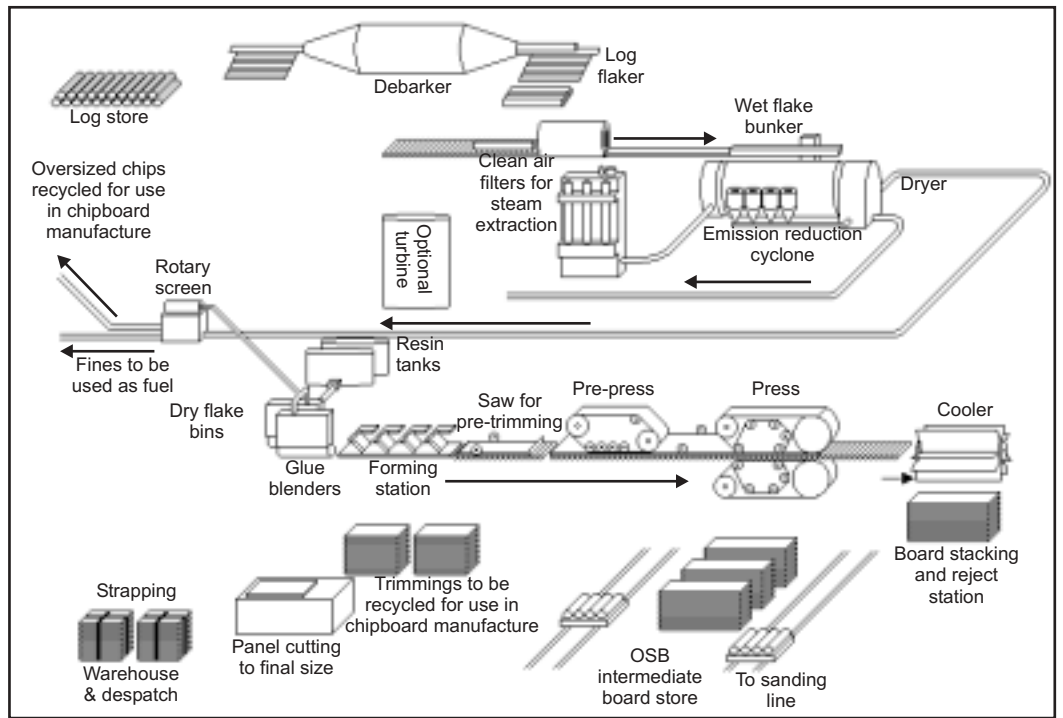
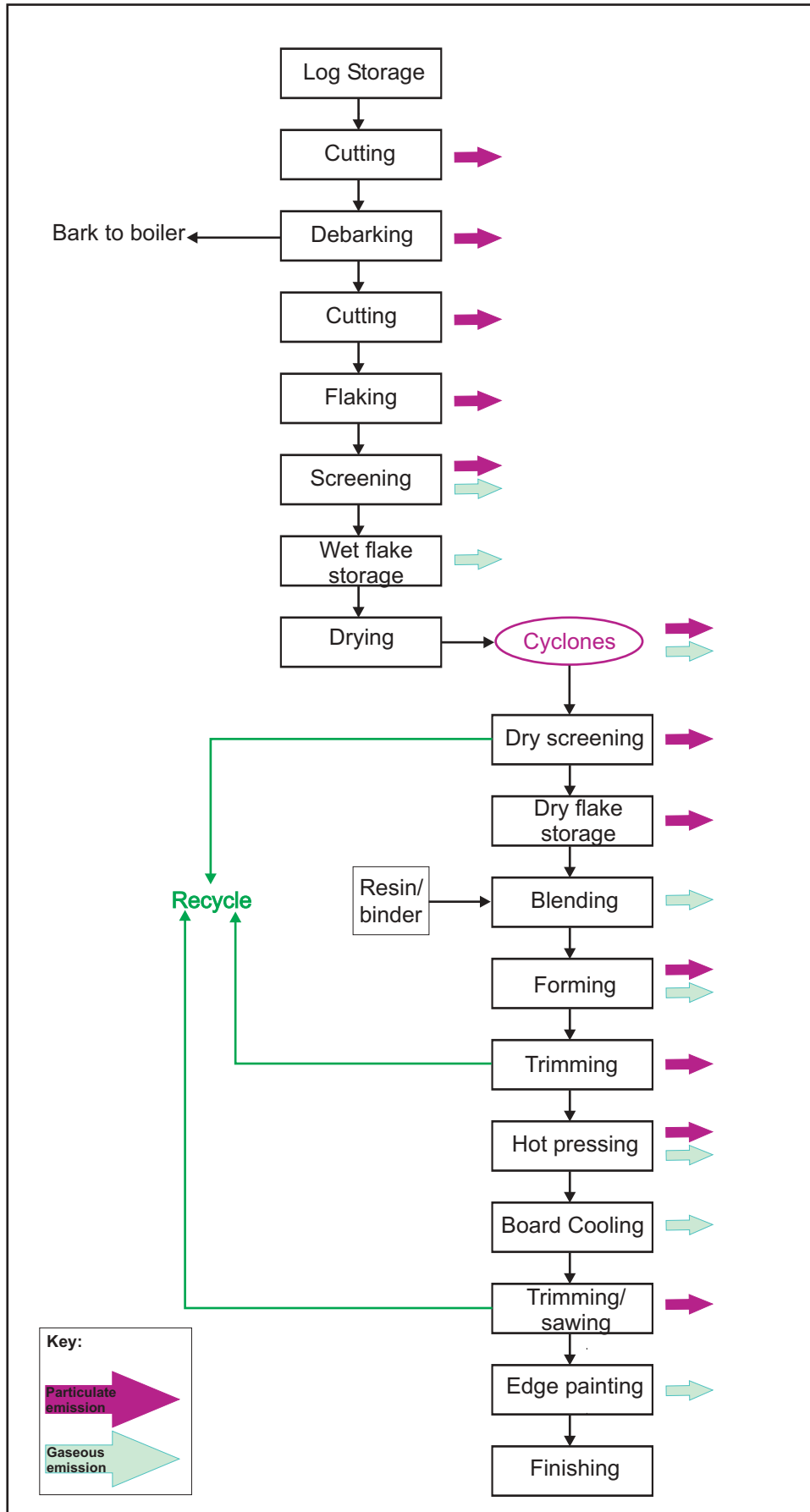


Figure 3.8: OSB process flow diagram





## Key Environmental Impacts

3.38 The following list identifies key environmental impacts.

**Water:** sources of waste water include:

- WESP and wet scrubbers
- plant wash down water
- chip wash / chip steaming effluent (MDF)
- surface water run-off

**Waste/Land:** the range of solid wastes include:

- offcuts, trimmings, sander dust, fines, ash from combustion activities, WESP crumb, MDF fibre, chipwash solid waste, cake from belt presses in effluent treatment plants and off-spec material
- oils and greases and other spent or contaminated lubricants

**Air:** releases from the dryers and presses include:

- formaldehyde and other volatile organic compounds, total aldehydes and particulate matter from dryers
- particulate matter, formaldehyde and other volatile organic compounds from presses. Three factors affect formaldehyde emissions from presses:
  - the press temperature
  - the quantity of excess formaldehyde content in resin, and
  - the amount of resin used

**Other releases include:**

- phenol (from PF) or isocyanate (from pMDI) depending upon the resin used
- water vapour from WESP and wet scrubbers
- particulate matter from debarking, size reduction operations and cyclones
- ammonia from the breakdown of the urea (where UF resin used)
- combustion gases from boiler plant

**Noise:** parts of the manufacturing process are very noisy and require acoustic shelters for worker protection, for example, debarking and wood chipping. Standard noise protection measures should be taken to minimise disturbance in the local neighbourhood.

**Energy:** composite wood based panel manufacture requires significant quantities of both heat and electricity. The largest use of heat is for drying chips, fibre or flake.

**Accidents:** key aspects of the process that could give rise to accidents which may have significant environmental impact are:

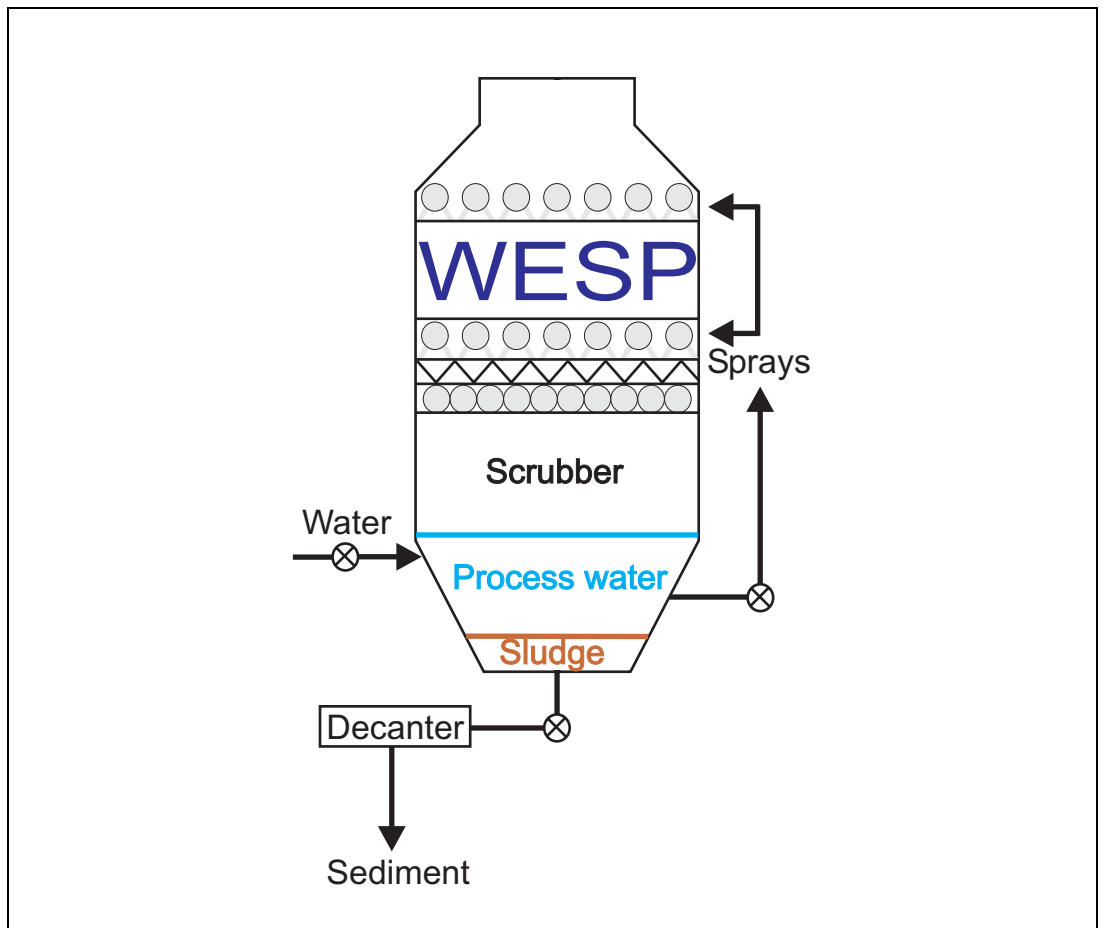
- blockages caused by “choked” woodchips or fibres within the cyclones which could give rise to excessive particulate matter emissions
- leaks from storage tanks
- spillage when filling storage tanks
- failure of abatement systems
- fires, either within the process or in the raw materials storage areas

# Emissions control

## Point source emissions to air

- 3.39 The nature and source of the emissions to air expected from each activity are given in previous sections. In general they comprise:
- SO<sub>x</sub>, NO<sub>x</sub> and CO from the combustion plant
  - particulates from wood comminution, sieving and screening operations and other sources as identified in [Figure 3.4](#), [Figure 3.6](#) and [Figure 3.8](#)
  - formaldehyde and other aldehydes from wood and resins
  - phenols and/or isocyanates from wood and resins (where PF or pMDI is used)
  - other VOC from the timber/wood
  - odorous compounds from both wood and resins
- 3.40 Key control / performance parameters for a WESP include:
- high tension / high voltage at the electrode
  - corona current
  - rinse water quality
  - quench water quality
  - inlet air temperature
  - exit exhaust temperature
  - temperature of circulating liquor
  - washdown period
  - washdown frequency
- 3.41 [Figure 3.9](#) is a schematic representation of a WESP widely used in this sector in the UK to control emissions.

Figure 3.9: Wet Electrostatic Precipitator (WESP)



### Dispersion and dilution of stack emissions

3.42 The basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 (D1) (Ref 3) is that pollutants are dispersed and diluted in the atmosphere to ensure that they ground at concentrations that are harmless under the theoretical conditions of the D1 model. The emission limits in this sector note should be used as the basis for chimney height calculation. The chimney 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 takes into account the relevant air quality standards that apply for the emitted pollutants.

The calculation procedure of D1 is usually used to calculate the required chimney 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 impeters should not be used. A cone may sometimes be useful to increase the efflux velocity and achieve greater dispersion.

An operator may chose to meet a tighter emission limit in order to reduce the required chimney height.

- 3.43 Liquid condensation on internal surfaces of chimney flues and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission.
- adequate insulation should be provided to minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint

- 3.44 Unacceptable emissions of droplets could possibly occur as a result of entrainment from wet abatement plant where the linear velocity within the associated ductwork exceeds 9 m/s. The use of mist eliminators reduces the potential for droplet emissions.
- where a linear velocity of 9 m/s is exceeded in the ductwork of existing wet abatement plant, the linear velocity should be reduced, subject to health and safety considerations, to ensure that droplet fallout does not occur
- 3.45 The dispersion from all emission points to air can be impaired by low exit velocity at the point of discharge, or deflection of the discharge.
- chimney flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme
  - a minimum discharge velocity should be required in order to prevent the discharged plume being affected by aerodynamic down wash
  - emission points to air 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

#### **BAT (Sheet 1 of 2)**

##### **All releases to air**

The operator should:

- 1 Ensure that all operations which generate emissions to air are contained and adequately extracted to suitable abatement plant, where this is necessary to meet specified emission limit values.
- 2 Ensure that emissions from combustion processes in normal operation are free from visible smoke and in any case do not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:1969.
- 3 Ensure that hot emissions take place from the minimum practicable number of stacks, in order to obtain maximum advantage from thermal buoyancy. This is particularly important when new plants are being designed or when changes are being made to existing processes. If practicable a multi-flue stack should be used.
- 4 Ensure that stack heights are sufficient to ensure adequate dispersion under normal conditions.
- 5 Ensure that the minimum stack height is 3 metres above roof ridge height of any building within a distance of 5 times the uncorrected stack height and in no circumstances should it be less than 8 metres above ground level.
- 6 Be able to demonstrate to the regulator that all reasonably practicable steps are taken during start-up and shut down, and changes of fuel or combustion load in order to minimise emissions.
- 7 Ensure that all discharges to air, other than water vapour, are free from persistent visible emissions.
- 8 Ensure that emissions of water vapour are free from droplet fallout.
- 9 Ensure that liquid entrainment in the duct of wet abatement, leading to droplet fallout, does not occur as a result of the linear flow rate within the duct exceeding 9 m/s.
- 10 Ensure that flues and ductwork are cleaned to prevent accumulation of materials, as part of the routine maintenance programme.

## BAT (Sheet 2 of 2)

- 11 Ensure that exhaust gases discharged through a stack achieve an exit velocity greater than 15 m / sec during normal operating conditions to achieve adequate dispersion.
- 12 Ensure that stacks are not 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.

### Process operations

The operator should:

- 13 Ensure that fumes from all pressing, curing, impregnation and coating operations are captured and extracted to suitable abatement plant, where necessary to meet the emission limits in [Table 3](#).
- 14 Ensure that the inlet and outlet temperatures of wood dryers are as low as practicable, whilst achieving the necessary final moisture content of the wood, in order to meet the emission limits in [Table 3](#).
- 15 Certain drying processes use high efficiency cyclones to separate the fibre after drying. In such circumstances where a WESP is not used, the minimum stack height for exhaust gases from the cyclones should be 30 metres unless methods are used for substantially reducing the quantity of water vapour and steam from the final emission.

## Point source emissions to surface water and sewer

- 3.46 The nature and source of the emissions expected from each activity is given in previous sections. In general, wastewater can arise from storm water, from cooling water, from accidental emissions of raw materials, products or waste materials and from fire-fighting. In addition to the techniques below, guidance on cost-effective effluent treatment techniques can be found in ETBPP Guides ([Ref 4](#)).
- 3.47 In addition to the above, wastewater arises from:
  - surface water run-off from log/timber storage areas
  - WESP and wet scrubber effluent
  - effluent from chip washing
  - effluent from chip steaming
  - wash-down water, for example, dryer cleaning effluent
- 3.48 Optimising use of water and minimising pollutants in each water stream are the primary aims, followed by recycling of wastewater streams wherever possible.
- 3.49 Run-off from all open areas, but in particular from raw materials storage areas, will contain suspended solids which will have to be removed by settlement or other techniques. Oil interceptors may be necessary in drainage from storage areas. Drainage sumps should be of sufficient size to handle storm water and should be designed to accommodate storm surge in order to prevent carryover of unsettled material.
- 3.50 WESPs are widely used as an abatement technique for emissions to air within this sector. A WESP contains approximately 15-200 tonnes of circulating water. Around 2 tonnes per hour is bled off in order to achieve the existing emission standards to air. In addition the maintenance and cleaning regime requires that the WESP is totally emptied twice a year. The WESP effluent is contaminated and requires treatment to ensure BOD, COD suspended solids and other contaminants, for example, ammonia (depending on the resin and additives used) are within acceptable limits before discharge.
- 3.51 MDF production generates a contaminated effluent from the chip washing/softening stage in the process. This stage gives an effluent with, in particular, high levels of suspended solids. Approximately 50 tonnes of effluent is generated per 500m<sup>3</sup> of final product.

- 3.52 Transfer of resins and additives for example, formaldehyde solution, within the site is a possible surface water / sewer contaminant if not adequately contained.
- 3.53 Bunding is a sensible precaution in all but the most trivial cases e.g. dilute non-hazardous aqueous solutions. It is essential in many cases where there is a risk to controlled waters, sewers and drains, and on-site effluent treatment plants. Shared bunds are possible in cases where the materials stored are not incompatible. Bund capacities should always exceed the volume of the largest storage by a minimum of 10%.
- 3.54 High level alarms and trips on storage tanks should be designed to an appropriate integrity and tested regularly. The integrity of storage tanks and bunds should also be regularly inspected, particularly where corrosive substances are involved, requiring well managed and documented inspections. Procedures for preventing unauthorised discharges or leakages from bunds should be in place. Where it is considered inappropriate to bund a particular storage tank or process vessel then the applicant must justify this approach.
- 3.55 The following general principles should be applied in sequence to control emissions to water:
- water use should be optimised and wastewater re-used or recycled
  - contamination risk of process or surface water should be minimised
  - wastewater treatment systems can maximise the removal of pollutants, for example metals, using precipitation, sedimentation and filtration. The mix of pollutants will define the methods and reagents used. Concentrated effluents should be pretreated as necessary before discharge into the final effluent treatment system
  - ultimately, surplus water is likely to need treatment to meet the requirements of BAT (and statutory and non-statutory objectives). Generally, effluent streams should be kept separate as treatment will be more efficient. However, the properties of dissimilar waste streams should be used where possible to avoid adding further chemicals, e.g. neutralising waste acid and alkaline streams. Also, biological treatment can occasionally be inhibited by concentrated streams, while dilution, by mixing streams, can assist treatment
  - systems should be engineered to avoid effluent by-passing the treatment plant
- 3.56 The nature of the receiving water should be taken into account, with regard to any pollutant released to this media. Irrespective of the receiving water, the adequacy of the plant to minimise emissions must be considered. Guidance on treatment of persistent substances can be found in [Ref 4](#).

## Local Authority Regulation

- 3.57 Regulation 13 of The Pollution Prevention and Control (England and Wales) Regulations 2000 states that:
- "(1) In the case of a Part A installation or Part A mobile plant in relation to which a local authority regulator exercises functions under these Regulations, the Environment Agency may, at any time, give notice to the local authority regulator specifying the emission limit values or conditions which it considers are appropriate in relation to preventing or reducing emissions into water."
  - "(3) Where a notice under paragraph (1) specifies conditions in relation to emissions into water from an installation or mobile plant, the permit authorising the operation of that installation or mobile plant, shall include those conditions or more onerous conditions dealing with the same matters as the local authority regulator considers to be appropriate."

### BAT

#### The operator should ensure that:

- 16 All emissions are controlled, as a minimum, to avoid a breach of water quality standards. (Calculations and/or modelling to demonstrate this may be required to be provided to the regulator.)
- 17 Run-off from raw material storage areas is channelled / transported to a suitable effluent treatment plant or interceptor to meet the discharge requirements of the permit.
- 18 Process effluent is channelled / transported to suitable effluent treatment plant to meet the discharge requirements of the permit.
- 19 All interceptors:
  - are impermeable
  - are subject to at least weekly visual inspection and, where necessary to ensure the continuous function, contamination removed
  - have an annual maintenance inspection; prior to inspection all contents should be removed

#### Off site effluent treatment

- 20 Where effluent is treated off-site at a sewage treatment works, the operator should demonstrate that:
  - all appropriate measures have been taken to reduce effluent volume and strength, for example through optimisation of water use
  - the treatment provided at the sewage treatment works is as good as would be achieved if the emission was treated on-site, based on reduction of load (not concentration) of each substance to the receiving water
  - a suitable monitoring programme is in place for emissions to sewer, taking into consideration the potential inhibition of any downstream biological processes

## Point source emissions to groundwater

### Groundwater protection legislation

- 3.58 The Groundwater Regulations for the UK came into force on 1 April 1999. If List I or List II substances are discharged to groundwater or may be discharged to groundwater then the Environment Agency will provide advice as part of their statutory consultation duties. For further guidance see chapter 31 in the General Guidance Manual.

## Fugitive emissions to air

### Sources

- 3.59 Common sources of fugitive emissions are:
- poor extraction and building containment
  - accidental loss of containment from failed plant and equipment (e.g. bag filter failure, cyclone clogging and consequent over-pressurisation)
  - the potential for bypass of abatement equipment
  - conveyor systems (e.g. woodchip conveyors)
  - open vessels (e.g. the effluent treatment plant, lagoons)
  - storage areas (e.g. log storage, woodchip stockpiles)
  - the loading and unloading of transport vehicles
  - transferring material from one vessel to another (e.g. resin storage tanks and mixing vessels)
  - pipework and ductwork systems (e.g. pumps, valves, flanges, catchpots, drains, inspection hatches etc.)
- 3.60 Internal transport of dusty materials can generate fugitive emissions. Attention to preventing fugitive emissions and, if prevention has failed, cleaning up deposits of dust on external support structures and roofs will minimise wind entrainment of deposited dust.
- 3.61 Pneumatic or enclosed handling systems are preferred to open conveyors or bulk transfer by site transport. The transportation and handling of dust and wood particles can give rise to fire and explosion. Attention is drawn to health and safety legislation in this regard.

### BAT (Sheet 1 of 2)

- 21 Operations should be controlled to minimise fugitive emissions.
- 22 Fugitive emissions should specifically be controlled from:
- woodyards, log storage and chipping operations (dust)
  - process buildings (VOC, dust)
  - finishing (dust)
  - wastewater treatment (odour)
  - fuel and ash handling (dust)
  - waste wood handling and stores (dust)
  - coating (VOCs)
  - resin breakdown products e.g. ammonia - depending on the resin composition
- 23 The operator should update a record of fugitive emissions on an annual basis and submit to the regulator to demonstrate progress in reducing emissions.



- 24 A high standard of house keeping should be maintained. The operator should, in particular:
- ensure that all skips and vessels containing dusty or volatile materials are adequately covered to minimise emissions
  - avoid outdoor or uncovered stockpiles of dusty materials
  - (where outdoor stocking is unavoidable) use sprays, binders, stockpile management techniques and windbreaks (as appropriate) to minimise emissions
  - maintain wheel and road cleaning facilities and ensure that vehicles are adequately cleaned to avoid transfer of material to the public highway
  - ensure that dusty materials such as collected material from cyclones are transferred by methods which do not give rise to particulate emissions
  - ensure that conveyors are fully enclosed and maintained in order to prevent emissions of dust
  - prevent or minimise the release of VOCs during the transfer of fuel or other volatile liquids by the use of one or more of the following techniques:
    - subsurface filling via filling pipes extended to the bottom of the container
    - the use of vapour balance lines that transfer the vapour from the container being filled to the one being emptied
    - an enclosed system with extraction to suitable abatement plant
  - prevent or minimise the release of VOCs from breathing emissions on vent systems. Knock-out pots and appropriate abatement equipment should be employed unless it can be demonstrated that emissions are minimal
- 25 Bunds and storage areas for wood chips should be clearly marked on the site plan and should be fitted with a suitable control technique to minimise wind whipping and prevent the transfer of material across the site boundary. Suitable control techniques include:
- full or partial enclosure of stockpiles
  - covering of stockpile, using, for example, tarpaulins or sheeting
  - strategic positioning of wind breaks
  - use of water sprays for dampening of stockpiles
- 26 Loading to and from stockpiles should be carried out so as to minimise emissions to air.
- 27 Transportation of materials on site should be carried out in such a manner so as to prevent fugitive releases of particulates. Control techniques to be used in this instance include:
- purpose built , fully enclosed transportation methods, such as, enclosed conveyors / vehicles
  - sheeting or covering of transported materials
  - use of sprays for dampening
- 28 Collection of product or waste from dry arrestment plant should be contained and kept enclosed to ensure that fugitive emissions are prevented.
- 29 Tankers delivering resins and other additives, for example, formaldehyde solution to a storage tank, should be back vented, or a closed-loop tank ventilation system should be provided.

## Fugitive emissions to surface water, sewer and groundwater

3.62 Operations should be controlled so as to minimise fugitive emissions. A record of fugitive emissions should be submitted on a regular basis, and normally at least once a year.

### BAT (Sheet 1 of 2)

- 30 With regard to **subsurface structure**, the operator should:
- establish and record the routing of all installation drains and subsurface pipework
  - identify all subsurface sumps and storage vessels
  - engineer systems to minimise leakages from pipes and ensure swift detection if they do occur, particularly where hazardous (i.e. listed) substances are involved
  - provide, in particular, secondary containment and/or leakage detection for such subsurface pipework, sumps and storage vessels
  - establish an inspection and maintenance programme for all subsurface structures, e.g. pressure tests, leak tests, material thickness checks or CCTV
- 31 For **surfacing**, the operator should:
- ensure that all operational areas are equipped with an impervious surface, spill containment kerbs, sealed construction joints, and connection to a sealed drainage system unless the operator justifies that this is not necessary to the satisfaction of the regulator.
  - keep records of the design and condition of the surfacing of all operational areas - relevant information may include, as appropriate, capacities, thicknesses, falls, material, permeability, strength/reinforcement, and resistance to chemical attack
  - have an inspection and maintenance programme of impervious surfaces and containment kerbs
  - justify where operational areas have not been equipped with:
    - an impervious surface
    - spill containment kerbs
    - sealed construction joints
    - connection to a sealed drainage system
- 32 The operator should ensure that all tanks containing liquids whose spillage could be harmful to the environment are contained. The operator should ensure that all bunds:
- are impermeable and resistant to the stored materials
  - have no outlet (that is, no drains or taps) and drain to a blind collection point
  - have pipework routed within bunded areas with no penetration of contained surfaces
  - are designed to catch leaks from tanks or fittings
  - have a capacity of at least 110% of the largest tank \*
  - are visually inspected weekly and any contents pumped out or otherwise removed under manual control after checking for contamination
  - where not frequently inspected, are fitted with a high-level probe and an alarm as appropriate
  - have an annual maintenance inspection (normally visual but extending to water testing where structural integrity is in doubt)

\* A Code of Practice on the use and storage of solvents is currently being drawn up and will be published on the Defra website. [www.defra.gov.uk/environment/water/ground/solvents/index](http://www.defra.gov.uk/environment/water/ground/solvents/index)  
Where the Code, when published, contains anything more stringent as regards bunding, account should be taken of it.

## BAT (Sheet 2 of 2)

- 33 All sumps should:
- be impermeable and resistant to stored materials
  - be subject to regular visual inspection agreed with the regulator and any contents pumped out or otherwise removed after checking for contamination
- 34 All storage tanks should:
- be fitted with high-level alarms or volume indicators to warn of overfilling. Where practicable the filling system should be interlocked to the alarm system of prevent overfilling
  - have delivery connections located within a bunded area, fixed and locked when not in use
  - have their integrity inspected, recorded and documented, particularly where corrosive substances are involved. These inspections should be included in the maintenance schedule
- 35 Storage areas and containers should be designed and operated to minimise the risk of fugitive releases to surface water, sewer and groundwater, in particular:
- storage areas should be located away from watercourses and should be protected against vandalism
  - the maximum storage capacity of storage areas should be stated and not exceeded
  - the maximum storage period for containers should be specified
  - storage areas and silos should be inspected at least once a week to check for signs of leakage or potential leakage

## Odour

- 3.63 Chapter 17 of the General Guidance Manual provides guidance on controlling odour from installations and the information required in an application.
- 3.64 The following parts of the installation may give rise to offensive odorous emissions:
- storage and handling of raw wood
  - drying and pressing of wood particles / fibres
  - storage and handling of resins
- Abatement measures (including the location of stockpiles) should be used to prevent odorous emissions where practicable. Stacks should be designed to disperse and dilute odorous emissions.
- 3.65 The aim should be that there are adequate controls in place to prevent emissions of odour where practicable and otherwise to ensure that they are not offensive to human senses in accordance with BAT.
- 3.66 Implementation of the best available techniques and the emission limit values and provisions of this note should ensure that offensive odours are not perceived beyond the site boundary, other than where unavoidable plume grounding occurs. It may be necessary to include additional controls to avoid offensive odours, for example where local meteorological conditions frequently lead to poor dispersion conditions.
- 3.67 The locality will influence the assessment of the potential for odour impact, for example, where the site has a low odour impact due to its remoteness from sensitive receptors, the escape of offensive odour beyond the installation would be unlikely to cause harm. In these circumstances it is expected that the operations should be optimised to minimise odour emissions and also that effective process management is applied. Assessment of the potential for offensive odour beyond the site boundary should take account of all predicted wind directions and weather conditions, which are typical of the location in question.

## BAT

- 36 Stockpiles of wood should be suitably contained and located so as to minimise the potential for offensive odours beyond the site boundary.
- 37 Emissions from dryers and presses should, where practicable, be passed through suitable abatement equipment, such as a WESP, in order to minimise the potential for offensive odours beyond the site boundary.
- 38 Where it is not practicable for emissions from dryers and presses to be passed through suitable abatement equipment, these emissions require to be vented through stacks of suitable height to prevent or minimise plume grounding under normal local meteorological conditions.
- 39 Resins should be stored, handled and used in such a manner so as to minimise the potential for odour to cause offence beyond the site boundary. For example, spillages should be cleaned up as soon as possible, and all cleaning materials disposed of and sealed, in suitable containers.

## Management

- 3.68 Within IPPC, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis.
- 3.69 An effective Environmental Management System (EMS) will help the operator to maintain compliance with regulatory requirements and to manage other significant environmental impacts.
- 3.70 **Maintenance** - It is good practice to ensure:
  - effective preventative maintenance on all aspects of the process the failure of which could impact on the environment
  - clear written maintenance instructions for all relevant items are developed and maintained
  - a method of reviewing maintenance needs, with demonstrable evidence that this process takes place
- 3.71 **Responding to problems** - The regulator needs to be notified about certain events and expects the operator to respond to problems which may have an effect on emissions to the environment. Such problems may arise within the process itself or, for example, with the abatement plant.
- 3.72 **Contractors on site** - It is important to be aware that in complying with their permit, operators will be responsible for work undertaken by contractors. Operators are advised to provide instructions to contractors regarding protecting the environment whilst working on site.

## Operations and maintenance

**Operations and maintenance**

- 40 Effective operational and maintenance systems should be employed on all aspects of the installation whose failure could impact on the environment, in particular there should be:
- documented operational control procedures
  - a documented preventative maintenance schedule, covering all plant whose failure could lead to impact on the environment, including major 'non productive' items such as tanks, pipework, retaining walls, bunds, ducts and filters; this should be reviewed and updated annually
  - documented procedures for monitoring emissions
- 41 The regulator should be provided with a list of key process equipment and abatement equipment. Such equipment should be provided with alarms or other warning systems which indicate equipment malfunction or breakdown. Such warning systems should be maintained and checked to ensure continued correct operation, in accordance with the manufacturer's recommendations.
- 42 Essential spares and consumables should be held on site or be available at short notice from suppliers, so that plant breakdown can be rectified rapidly.
- 43 Records of breakdowns should be kept and analysed by the operator in order to eliminate common failure modes.
- 44 A competent person should be appointed to liaise with the regulator and the public with regard to complaints. The regulator should be informed of the designated individual.

**Competence and training**

- 45 Training systems, covering the following items, should be in place for all relevant staff:
- awareness of the regulatory implications of the permit
  - awareness of all potential environmental impacts under normal and abnormal circumstances
  - awareness of the procedures for dealing with a breach of the permit conditions
  - prevention of accidental emissions and action to be taken when accidental emissions occur
  - awareness of all operating procedures
- 46 The skills and competencies necessary for key posts (which may include contractors and those purchasing equipment and materials) should be documented and records of training needs and training received for these posts maintained.
- 47 The potential environmental risks posed by the work of contractors should be assessed and instructions provided to contractors about protecting the environment while working on site.
- 48 Where industry standards or codes of practice for training exist they should be complied with.

## Raw Materials

- 3.73 This section covers the use of raw materials and water and the techniques for both optimising their use and minimising their impact by selection (Energy and fuels are covered under [Energy](#)).
- 3.74 As a general principal, the operator will need to demonstrate the measures taken to:
- **reduce** the use of chemicals and other materials ([Waste minimisation \(optimising the use of raw materials\)](#))
  - **substitute** with materials presenting lower risks to the environment
  - **understand** the fate of by-products and contaminants and their environmental impact

### Raw materials selection

- 3.75 This section looks at the selection and substitution of raw materials used, while [Waste minimisation \(optimising the use of raw materials\)](#) describes the techniques to optimise their use.
- 3.76 Raw materials in this sector include:
- roundwood logs
  - woodchips
  - recycled woodchips
  - slabwood
  - sawdust/shavings/fines
  - resins e.g. urea-formaldehyde resin (UF), phenol-formaldehyde (PF), polymeric di-phenyl-methane di-isocyanate resin (pMDI)
  - other additives e.g. waxes
- 3.77 Examples of good practice in materials selection is:
- use of recycled timber
  - re-use of water within the process
  - minimising the use of resins
  - use of biodegradable hydraulic oils
- 3.78 The key factor that can differentiate one product from another is the resin (and any additives) used in its manufacture. Different resins are used to impart different qualities into the end product and developments in resin technology are very competitive.
- 3.79 Different resins are used depending on the required product. Urea-formaldehyde resins tend to be used in panels intended for interior applications. Phenol-formaldehyde resins are generally used in particleboard for exterior applications. Other additives may be used, for example, melamine as a waterproofing agent, waxes to impart water resistance and increase the stability of the finished product under wet conditions and to reduce the tendency for equipment plugging. Ammonium salts may be used as an additive to impart fire retardant qualities. Catalysts may be mixed with resin and particles during blending to accelerate the time taken for the resin to cure and to reduce the time required in the press. Formaldehyde scavengers may also be added to the product at the blending step to reduce formaldehyde emissions from the process.

Operators should use resins which minimise emissions of formaldehyde wherever possible. The choice of resins used, should be continually reviewed to ensure minimum emissions occur. This note will be reviewed in 2 years from date of publishing to keep abreast of resin development.

- 3.80 Increasingly, recycled wood is used in wood panelboard plants in the UK. From information gathered from the UK wood chipboard industry, in 2002 between 50% and 75% recycled material is used. Such recycled material originates from, for example, wood pallets. The use of recycled material adds a washing/classification step at the front end of the process. A key process parameter here is the quality of the recycled material. Possible contaminants are metal (from nails or brackets), paint or preservative. Such contamination affects the quality of the finished product. Strenuous efforts are taken to remove any contamination before the chipped wood enters the process. This is usually achieved by the recycled material supplier having in place effective quality control systems, although the final cleaning of the recycled material is carried out on the board manufacturers site to make it fit for purpose. Spot samples may be taken from the recycled material for laboratory analysis, however, this is seen as having less value than effective quality management systems.
- 3.81 The boilers provide heat to the dryers and provide heat for other process requirements for example, oil for pressing operations. Boiler feedstock may be gas, oil, wood materials or wood waste. Wood waste is generated on site from trimming the boards once they are set and dry. This trimming process produces a waste which can be burned in the boilers or disposed of off site, for example, landfill. Where wood waste is burned which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, the provisions of the EU Waste Incineration Directive will apply. See [Ref 5](#).<sup>1</sup>
- 3.82 Where dryers and boilers use wood waste as a fuel which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, the provisions of the EU Waste Incineration Directive will apply. ([Ref 5](#)) (See footnote 1 to paragraph 3.81)

#### BAT

49 The operator should:

- maintain an inventory covering the principal types of raw materials used
- annually review alternatives for the principal types of raw materials used with regard to their environmental impact
- have quality procedures to control the specification of raw materials used, in order to minimise any potential environmental impact
- complete any long term studies needed into the less polluting options and make any material substitutions identified within the review period

1. At the time of publication of this note, the Wood Panel Industries Federation has submitted to Defra a case that the Waste Incineration Directive does not apply in any case. This is being considered by Defra, and the outcome of this will be reflected in the final published version of the Defra guidance on WID.

## Waste minimisation (optimising the use of raw materials)

- 3.83 Waste minimisation can be defined simply as: *“a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste”*.
- 3.84 A variety of techniques can be classified under the term waste minimisation and they range from basic housekeeping techniques through statistical measurement techniques, to the application of clean technologies.
- 3.85 Key operational features of waste minimisation will be:
- the ongoing identification and implementation of waste prevention opportunities
  - the active participation and commitment of staff at all levels including, for example, staff suggestion schemes
  - monitoring of materials' usage and reporting against key performance measures
- 3.86 Using this information, opportunities for waste reduction, changes in process and improved efficiency should be generated and assessed, and an action plan prepared for the implementation of improvements.
- 3.87 The use and fate of all materials should be mapped onto a process flow diagram using data from the raw materials inventory and other company data as appropriate. Data should be incorporated for each principal stage of the operation in order to construct a mass balance for the installation. The mass balance can then be used to identify opportunities for improvements.

### BAT

- 50 The operator should carry out a waste minimisation audit at least as frequently as the review period of the permit. The methodology used and an action plan for optimising the use of raw materials should be submitted to the regulator within 2 months of completion of the audit.
- 51 If an audit has not been carried out in the 2 years prior to submission of the application then the first audit should take place within 18 months of the issue of the permit.
- 52 Specific improvements resulting from the recommendations of audits should be carried out within a timescale approved by the regulator.

## Water use

- 3.88 Water use should be minimised within the BAT criteria for the prevention or reduction of emissions and be commensurate with the prudent use of water as a natural resource.
- 3.89 Reducing water use may be a valid environmental and/or economic aim in itself, perhaps because of local supply constraints. Also, from the point of view of reducing polluting emissions, any water passing through an industrial process is degraded by the addition of pollutants, and there are distinct benefits to be gained from reducing the water used. These include:
- reducing the size of (a new) treatment plant, thereby supporting the cost benefit BAT justification of better treatment
  - cost savings where water is purchased or disposed of to another party
  - associated benefits within the process such as reduced energy requirements for heating and pumping, and reduced dissolution of pollutants into the water leading to reduced sludge generation in the effluent treatment plant

The use of a simple mass balance for water use may help to reveal where reductions can be made.

Advice on cost-effective measures for minimising water use can be found in [Ref 4](#).



- 3.90 Water is used within the process for:
- washing woodchips (MDF)
  - steam cooking of wood chips (MDF)
  - soaking logs (OSB)
  - diluting resins and other additives
  - wet scrubbers
  - WESP (wet electrostatic precipitator)
  - general plant wash-down
  - cooling activities
- 3.91 The following general principals should be applied in sequence to reduce emissions to water:
- water-efficient techniques should be used where possible
  - water should be recycled within the process from which it issues, treating it first if necessary. Where this is not practicable, it should be recycled to another part of the process which has a lower water quality requirement

#### BAT

- 53 The operator should carry out a regular review of water use (water efficiency audit). Where one has not been carried out recently, an initial comprehensive audit should be carried out at the earliest opportunity. Audits should be at least as frequent as the IPPC permit reviews.
- 54 Using this information, opportunities for reduction in water use should be assessed and, where appropriate should be carried out, in accordance with a timescale approved by the regulator.
- 55 The volume of mains and abstracted water used in the activities should be directly measured when the installation is operating once a day for at least a fortnight and there after, once a week with an annual exercise taking daily measurements for at least a fortnight. All measurements should be recorded and the records held on site.
- 56 Roof and surface water drains should be kept separate from process water and systems designed to avoid contamination. Where roof and surface water cannot be used in the process it should be discharged separately.
- 57 Hosing down should not be used where vacuuming, scraping or mopping could be employed.
- 58 Trigger controls should be employed on all hoses, hand lances and washing equipment.

## Waste handling

- 3.92 Good segregation of materials is essential to facilitate opportunities for recovery, recycling and re-use.
- 3.93 In general, the waste streams comprise:
- bark and other wood residue
  - stones, grit and metal fragments from cleaning recycled material
  - production residue (off spec. material)
  - packaging e.g. metal banding, cardboard
  - plastics (polythene, polystyrene)
  - boiler plant ash
  - filter cake from effluent treatment plant
  - waste oil
  - chemical waste (some of which may be special waste)
  - chemical containers
  - general inert industrial waste

## BAT

- 59 The operator should:
- record the quantity, nature, origin and where relevant, the destination, frequency of collection, mode of transport and treatment method of any waste which is disposed of or recovered
  - ensure that waste storage areas are clearly marked and signed, and that containers are clearly labelled
  - ensure that appropriate storage facilities are provided for substances that are flammable, sensitive to heat or light etc, and that incompatible waste types are kept separate
  - ensure that containers are stored with lids, caps and valves secured and in place (this also applies to emptied containers)
  - ensure that procedures are in place to deal with damaged or leaking containers.
  - segregate waste wherever practicable
  - identify the disposal route for all waste, which should be as close to the point of production as possible

## Waste re-use, recovery, recycling or disposal

- 3.94 Waste should be re-used, recovered or recycled unless the regulator has accepted a satisfactory BAT justification.
- 3.95 Bark and sawdust recovery (if applicable) may include the following uses:
- compost
  - mulch
  - animal bedding
- 3.96 Where energy recovery is the chosen option for bark or other wood residues:
- the impact of burning production residue on the boiler's energy balance should be assessed
  - new plant should be demonstrably as good as a modern, well run fluidised bed combustor in terms of flexibility in handling a variable feedstock, efficiency and emissions to atmosphere
  - residual ash from the energy recovery boiler should also be re-used
  - the plant should meet the appropriate standards in the combustion guidance
- 3.97 Where dryers or boilers use wood waste as a fuel which contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, the provisions of the EU Waste Incineration Directive will apply. (Ref 5) (See footnote 1 to paragraph 3.81)

## BAT

- 60 The operator should carry out an annual review to demonstrate that the best environmental options are being used for dealing with all waste from the installation.
- 61 Where wood material or wood waste is burnt on site the burners should be capable of and operated such that chemicals are incinerated and emission limit values as specified in [Table 3](#) are not exceeded. Where wood waste is burnt on site to which the Waste Incineration Directive applies, the requirements of this Directive must be applied. (Ref 5) (See footnote 1 to paragraph 3.81)

## Energy

3.98 BAT for energy efficiency under the PPC Regulations will be satisfied provided the operator meets the following conditions:

**either**

- the operator meets the basic energy efficiency requirements below and is a participant to a Climate Change Agreement (CCA) or a Direct Participation Agreement (DPA) with the Government.

**or**

- the operator meets the basic energy efficiency requirements below and the additional energy efficiency requirements.

### Basic energy efficiency requirements

3.99 **The requirements of this section are basic, low cost, energy standards that apply whether or not a CCA or DPA is in force for the installation.**

BAT	
62	The operator should produce a report annually on the energy consumption of the installation.
63	The operator should monitor energy flows and target areas for reduction which should be updated annually. ("Sankey" diagrams and energy balances would be useful as aids.)
64	In order to optimise combustion, the operator should, where practicable, monitor carbon monoxide and oxygen in waste gases.
65	The operator should ensure that all plant is operated and maintained to optimise the use and minimise the loss of energy.
66	The operator should ensure that all appropriate containment methods, (e.g. seals and self-closing doors) are employed and maintained to minimise energy loss.

## Additional energy efficiency requirements

3.100 Within IPPC it is valid to consider both the emission of direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) pollution when considering options for energy efficiency.

### BAT

#### Energy efficiency techniques

67 The following techniques should be considered:

- heat recovery from different parts of the processes
- minimisation of water use and closed circulating water systems
- good insulation
- plant layout to reduce pumping distances
- phase optimisation of electronic control motors
- optimised efficiency measures for combustion plant e.g. air/feedwater preheating, excess air etc.

#### Energy supply techniques

68 The following techniques should be considered:

- use of Combined Heat and Power (CHP)
- generation of energy from waste
- use of less polluting fuels

## Accidents

3.101 For accident management, there are three particular components:

- **identification of the hazards** to the environment posed by the installation/activity
- **assessment of the risks** (hazard x probability) of accidents and their possible consequences
- implementation of **measures to reduce the risks** of accidents, and contingency plans for any accidents that occur

3.102 Further guidance can be found in chapter 20 of the General Guidance Manual.

3.103 The manufacture of particleboard produces large quantities of dusty material. Failure to capture and handle such material safely, may result in a fire or risk of explosion. There is also a risk of spontaneous combustion from stockpiles. Techniques to minimise this include fire breaks between stockpiles and limiting the height / angle of repose. [Ref 5](#) and [Ref 6](#) provide guidance that may be relevant in the event of fire.

### Identification of the hazards

- 3.104 In identifying the hazards particular areas to consider may include, but should not be limited to, the following:
- transfer of substances (e.g. loading or unloading from or to silos or storage tanks)
  - overfilling of silos or tanks
  - failure of plant and/or equipment (e.g. extraction fans or pumps, over-pressure of storage silos and pipework, blocked drains)
  - failure of containment (e.g. bund and/or overfilling of drainage sumps)
  - fires and problems arising from fighting fires such as failure to contain firewaters
  - making the wrong connections in drains or other systems
  - preventing incompatible substances coming into contact
  - unwanted reactions and/or runaway reactions
  - emission of an effluent before adequate checking of its composition has taken place
  - steam main issues
  - vandalism
  - vehicle movements

### Measures to reduce the risks (identified by risk assessment)

- 3.105 Risk reduction can be achieved by process management controls and preventative measures. The following techniques will be relevant to most installations, although this is not an exhaustive list.

#### Process management controls

- process design, alarms, trips and other failsafe control techniques to ensure the safe operation of the plant
- security systems to prevent unauthorised access
- records of all incidents, near-misses, changes to procedures, abnormal events and findings of maintenance inspections and procedures to learn from such incidents
- personnel suitably trained in accident management
- guidance for specific accident scenarios
- procedures to ensure good communication among operations staff during shift changes and maintenance or other engineering work
- safe shutdown procedures
- established communication routes with relevant authorities and emergency services

### Preventative Measures

- procedures to ensure that the composition of the contents of a bund /sump is checked before treatment or disposal
- drainage sumps equipped with a high-level alarm with automatic pump to storage (not to discharge)
- high-level alarms etc. (which should not be routinely used as the primary method of level control)
- adequate redundancy or standby plant with maintenance and testing to the same standards as the main plant
- sufficient storage to contain process waters, site drainage waters, emergency firewater, chemically contaminated waters and spillages of chemicals, which should be routed where necessary, having regard to a site-specific assessment of risks, to the effluent system
- provision to contain surges and storm-water flows, which should be treated where necessary, having regard to a site-specific assessment of risks, before emission to controlled waters or sewer
- spill contingency procedures to minimise the risk of accidental emission of raw materials, products and waste materials and to prevent their entry into water
- suitable barriers to prevent damage to equipment from the movement of vehicles, as appropriate, having regard to a site-specific assessment of risks
- where indicated by the site-specific assessment of risks, containment or abatement for accidental emissions from vents and safety relief valves/bursting discs should be provided. Where this may be inadvisable on safety grounds, attention should be focused on reducing the probability of the emission

### BAT

#### Accidents/incidents/non conformance

- 69 There should be written procedures for investigating incidents and near misses, including identifying suitable corrective action and following up.
- 70 The operator should maintain an accident management plan which identifies the hazards, assesses the risks and identifies the measures required to reduce the risk of potential events or failures that might lead to an environmental impact. The plan should identify:
- the actions to be taken to minimise these potential occurrences; and
  - an action plan to deal with such occurrences so as to limit their consequences
- 71 In the case of abnormal emissions arising from an accident, such as a spillage for example, the operator should:
- investigate immediately and undertake remedial action as soon as practicable
  - promptly record the events and actions taken
  - ensure the regulator is made aware, as soon as practicable
- 72 Suitable equipment should be readily available to handle dusty spillages or adequate provision should be made for containment of the spillage.
- 73 Stockpiles should be managed such that the risk of spontaneous combustion is minimised.

## Noise and Vibration

- 3.106 Within this section, “noise” should be taken to refer to noise and/or vibration as appropriate, detectable beyond the site boundary.
- 3.107 Further guidance can be found in chapter 16 of the General Guidance Manual.
- 3.108 Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing installations depending upon the potential for noise problems. Operators may have a noise management plan as part of their management system. Where an installation poses no risk of noise related environmental impact because the activities undertaken are inherently quiet or remote from receptors, these measures would not normally be required.

BAT	
74	The operator should employ basic good practice measures for the control of noise, in particular: <ul style="list-style-type: none"><li>• identification of key plant and equipment with the potential to give rise to noise nuisance</li><li>• documented maintenance systems for the identified key plant and equipment</li></ul>
75	Log handling should, where practicable, be located in order to minimise noise.
76	Debarking and wood chipping operations should be carried out in enclosed buildings.
77	Drying and cyclone systems may give rise to duct and fan noise. Housing and / or suitable silencers should be used on relevant ducts and fans where necessary to minimise noise emissions.

## Monitoring

- 3.109 This section describes general monitoring and reporting requirements for emissions to all environmental media. Guidance is provided for the selection of the appropriate monitoring methodologies, frequency of monitoring, compliance assessment criteria and environmental monitoring. The specific monitoring requirements with respect to emissions to air are described in [Table 3](#).

### Standards for monitoring equipment and procedures

- 3.110 The Environment Agency has introduced its Monitoring Certification Scheme (MCERTS) to improve the quality of monitoring data and to ensure that the instrumentation and methodologies employed for monitoring are fit for purpose.
- operators should ensure their monitoring arrangements comply with the requirements of MCERTS where available, e.g. using certified instruments and equipment, and using a registered stack testing organisation etc.

See <http://www.environment-agency.gov.uk> for listing of MCERTS equipment.

### Sampling and analysis standards

- 3.111 The analytical methods given in **Table 3** and **Appendix 1** should normally be used. In the event of other substances needing to be monitored, standards should normally be used in the following order of priority:
- Comité Européen de Normalisation (CEN)
  - International Standardisation Organisation (ISO)
  - British Standards Institution (BSI)
  - United States Environmental Protection Agency (US EPA)
  - American Society for Testing and Materials (ASTM)
  - Deutsches Institut für Normung (DIN)
  - Verein Deutscher Ingenieure (VDI)
  - Association Française de Normalisation (AFNOR)
- 3.112 Further guidance on standards for monitoring gaseous releases relevant to IPPC is given in the Technical Guidance Note M4 (Monitoring) (see **Ref 8**). A series of updated Guidance Notes covering this subject is currently in preparation. This guidance specifies manual methods of sampling and analysis, which will also be suitable for calibration of continuous emission monitoring instruments. Further guidance relevant to water and waste is available from the publications of the Standing Committee of Analysts. See <http://dwi.gov.uk/regs/pdf/scabb202.pdf>
- 3.113 If in doubt the operator should consult the regulator.

### Monitoring and sampling protocols

- 3.114 Where monitoring is needed the operator should address the following:
- determinands to be monitored
  - monitoring strategy and selection of monitoring points
  - monitoring methods and procedures (selection of Standard Reference Methods)
  - reference conditions and averaging periods
  - measurement uncertainty of the proposed methods and the resultant overall uncertainty
  - drift correction
  - quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail
  - reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information to the Regulator
  - the accreditation held by samplers and laboratories or details of the people used and the training/competencies



### Monitoring frequency

- 3.115 The frequency of testing should be increased, for example, as part of the commissioning of new or substantially changed activities, or where the emission levels are near to or approach the emission limit.
- 3.116 Emission flow rates must be consistent with good operating practice and meeting the requirements of the legislation relating to workplace safety.
- 3.117 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:
- the variability of monitoring results, for example, results which range from 15 - 45 mg/m<sup>3</sup>, against an emission limit of 50 mg/m<sup>3</sup> might not qualify for a reduction in monitoring
  - the margin between the results and the emission limit, for example, results which range from 45 - 50 mg/m<sup>3</sup> when the limit is 50 mg/m<sup>3</sup> might not qualify for a reduction in monitoring
- 3.118 Consistent compliance should be demonstrated using the results from at least three or more monitoring exercises within two years, or two or more monitoring exercises in one year supported by continuous monitoring. Any significant process changes which might have affected the results should be taken into account.
- 3.119 Where effective surrogates are available they may be used to minimise monitoring costs.
- 3.120 Where monitoring shows that substances are not emitted in significant quantities, consideration can be given to a reduced monitoring frequency.

### Monitoring emissions to air

- 3.121 The reference conditions of substances in releases to air from point sources are: temperature 273.15 K (0°C), pressure 101.3 kPa (1 atmosphere), measured wet i.e. no correction for water vapour. The concentrations of pollutants in emissions from dryers should be normalised to 17% O<sub>2</sub>, whereas for press and WESP emissions O<sub>2</sub> reference should be as measured. To convert measured values to reference conditions, see Technical Guidance Note M2 ([Ref 8](#)) for more information.

### Environmental monitoring (beyond installation)

- 3.122 Environmental monitoring may be required, for example, when:
- there are vulnerable receptors
  - the emissions are a significant contributor to an Environmental Quality Standard (EQS) which may be at risk
  - the operator is looking for departures from standards based on lack of effect on the environment
  - the operator is required to validate modelling work
- 3.123 Further guidance is given in chapter 15 of the General Guidance Manual.

## Monitoring of process variables

- 3.124 Some process variables will have potential environmental impact and these should be identified and monitored where they have an environmental relevance. Examples of monitoring these variables include:
- keeping inventories of materials used and disposed of
  - monitoring for contaminants in raw materials where scrap is used or where there is inadequate supplier information (see [Raw materials selection](#))
  - monitoring temperature or pressure where relevant, for example pressure drop across bag filters
  - plant efficiency monitoring

### BAT (Sheet 1 of 3)

#### Monitoring and reporting

- 78 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 should monitor emissions, make tests and inspections of the process and keep records, in particular the operator should keep records of audits, inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. Monitoring may include process variables and operating conditions where relevant to emissions. In such cases:
- current records should be kept on site and be made available for the regulator to examine
  - records should be kept by the operator for at least two years
- 79 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.
- 80 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
- 81 The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of the completion of the sampling.
- 82 Adverse results from **any** monitoring activity (both continuous and non-continuous) should be investigated immediately. The operator should ensure that:
- the cause has been identified and corrective action taken
  - as much detail as possible is recorded regarding the cause and extent of the problem and the action taken to rectify the situation
  - re-testing to demonstrate compliance is carried out as soon as possible, and
  - the regulator is notified
- 83 The regulator needs to be notified about certain events and expects the operator to respond to problems which may have an effect on emissions to air. Such problems may arise within the process itself or with the abatement plant, for example.

- 84 In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions:
- investigation and remedial action should be undertaken immediately
  - the process or activity should be adjusted to minimise those emissions; and
  - the events and actions taken should be promptly recorded
  - In the case of non-compliance causing immediate danger to human health operation of the activity should be suspended
- 85 The regulator should be informed without delay:
- if there is an emission that is likely to have an effect on the local community or
  - in the event of the failure of key abatement plant, for example, bag filtration plant or scrubber units
  - if continuous monitoring shows an emission concentration exceeding double the limit value
- 86 Care is needed in the design and location of sampling systems in order to obtain representative samples for all release points.
- sampling points on new plant should be designed to comply with the British or equivalent standards. e.g. BS ISO 9096: 2003 or BS EN 13284-1 for sampling particulate matter in stacks
  - the operator should ensure that adequate facilities for sampling are provided on stacks or ducts
  - 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
- 87 Continuous monitoring is normally expected for the main abated releases identified in Section 3. Where continuous monitoring is required by the permit it should be carried out as follows:
- all continuous monitoring readings should be on display to appropriately trained operating staff
  - instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of abatement plant failure or malfunction
  - 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 new continuous monitoring equipment should be designed for less than 5% downtime over any 3-month period

**Monitoring and reporting of emissions to air**

- 88 Exhaust flow rates of waste gases should be consistent with the efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the work-place environment.
- 89 The introduction of dilution air to achieve emission concentration limits should not be permitted.
- 90 Dilution air may be added for waste gas cooling or improved dispersion where justified, but this should not be considered when determining the mass or concentration of the pollutant in the waste gases.
- 91 Periodic visual assessment of releases should be undertaken as required by the regulator to ensure that all final releases are colourless, free from persistent visible emissions and free from droplets.
- 92 Calibration and compliance monitoring should meet the following requirements as appropriate. No result should exceed the emission concentration limits specified, except where either:
- (a) data is obtained over at least 5 sampling hours in increments of 15 minutes or less; or
  - (b) at least 20 results are obtained where sampling time increments of more than 15 minute are involved; AND in the case of (a) or (b)
  - (c) no daily mean of all 15-minute mean emission concentrations should exceed the specified emission concentration limits during normal operation (excluding start-up and shut-down); and
  - (d) no 15-minute mean emission concentration should exceed twice the specified emission concentration limits during normal operation (excluding start-up and shut-down)
- 93 Where continuous quantitative monitoring is undertaken, compliance with (c) and (d) above should be demonstrated on a daily basis.
- 94 The dryer inlet and outlet temperatures and stack draught should be monitored and recorded continuously.
- 95 Gas flow should be measured, or otherwise determined, to relate concentrations to mass releases.

**Monitoring and reporting emissions to water and sewer**

- 96 The appropriateness of the monitoring requirements will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required:
- the specific volume flow from the process to sewer/controlled water
  - the quality of the receiving water
  - the volume of discharge compared to the percentage dry river flow of the receiving water
- 97 Increased monitoring should be carried out where substances to which the local environment may be susceptible could be released from the installation, e.g. where releases of common pesticides or heavy metals may occur.
- 98 A full analysis, to include the substances listed in Schedule 5 of the Regulations, should be carried out annually on a representative sample from each release point, unless it is agreed with the regulator that this is inappropriate.

**Monitoring and reporting of waste**

- 99 The following should be monitored and recorded:
- the physical and chemical composition of the waste
  - its hazard characteristics
  - handling precautions and substances with which it cannot be mixed

## References

Environment Agency documents referred to below are available from the Environment Agency website <http://www.environment-agency.gov.uk>. Many of the references below are being made available free of charge for viewing or download on the website. The same information can also be accessed via the SEPA website <http://www.sepa.org.uk>, or the NIEHS website [www.ehsni.gov.uk](http://www.ehsni.gov.uk)

- Ref 1 *The Pollution Prevention and Control(England and Wales) Regulations (SI 1973 2000) as amended* ([www.legislation.hmso.gov.uk](http://www.legislation.hmso.gov.uk)) or the Scottish equivalent SSI 323 2000
- Ref 2 *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 [www.defra.gov.uk/environment/ppc/index.htm](http://www.defra.gov.uk/environment/ppc/index.htm) and, in hard copy, from the Defra Publications line 08459 556000
- Ref 3 *HMIP Technical Guidance Note (Dispersion) D1*, 1993 The Stationery Office ISBN 0 11 752794 7([Environment Agency website](http://www.environment-agency.gov.uk) - summary only)
- Ref 4 Water efficiency references:
- ETBPP, Simple measures restrict water costs, GC22
  - ETBPP, Effluent costs eliminated by water treatment, GC24
  - ETBPP, Saving money through waste minimisation: Reducing water use, GG26
  - ETBPP (is now Envirowise) Helpline 0800 585794
- Ref 5 *Defra Draft Guidance, Guide to Directive 2000/76/EC on the Incineration of Waste* <http://www.defra.gov.uk>
- Ref 6 *BS 5908: Code of Practice for Fire Precautions in the Chemical and Allied Industries*
- Ref 7 *Environment Agency, Pollution Prevention Guidance Note - Pollution prevention measures for the control of spillages and fire-fighting run-off, PPG 18*, gives information on sizing firewater containment systems ([Environment Agency website](http://www.environment-agency.gov.uk))
- Ref 8 Monitoring Guidance ([Environment Agency website](http://www.environment-agency.gov.uk))
- *M1 Sampling requirements for monitoring stack emissions to air from industrial installations*, Environment Agency July 2002
  - *M2 Monitoring of stack emissions to air*. Environment Agency November 2002
  - *M3 Standards for IPC Monitoring Part 1: Standards, organisations and the measurement infrastructure*, HMIP, August 1995, ISBN 0-11-753133-2
  - *M4 Standards for IPC Monitoring Part 2 : Standards in support of IPC Monitoring*, HMIP Revised 1998
  - *M9 Monitoring Methods for Ambient Air Quality*: Environment Agency 2000
  - *MCERTS approved equipment link via <http://www.environment-agency.gov.uk/mcerts> "Guidance for Business and Industry"*
  - *Direct Toxicity Assessment for Effluent Control: Technical Guidance (2000)*, UKWIR 00/TX/02/07.

## Abbreviations

<b>BAT</b>	Best Available Techniques
<b>BOD</b>	Biochemical Oxygen Demand
<b>BREF</b>	BAT Reference Document
<b>CCA</b>	Climate Change Agreement
<b>CEM</b>	Continuous Emissions Monitoring
<b>CHP</b>	Combined Heat and Power plant
<b>COD</b>	Chemical Oxygen Demand
<b>DPA</b>	Direct Participation Agreement
<b>ELV</b>	Emission Limit Value
<b>EMS</b>	Environmental Management System
<b>ETP</b>	Effluent Treatment Plant
<b>EU</b>	European Union
<b>EQS</b>	Environmental Quality Standard
<b>ITEQ</b>	International Toxicity Equivalents
<b>MCERTS</b>	Monitoring Certification Scheme
<b>MDF</b>	Medium Density Fibreboard
<b>MUF</b>	Melamine Urea Formaldehyde
<b>NIEHS</b>	Northern Ireland Environment and Heritage Service
<b>OSB</b>	Oriented Strand Board
<b>PF</b>	Phenol Formaldehyde
<b>pMDI</b>	Polymeric di-phenolmethane di-isocyanate
<b>SAC</b>	Special Areas of Conservation
<b>SECp</b>	Specific Energy Consumption
<b>SEPA</b>	Scottish Environment Protection Agency
<b>SPA</b>	Special Protection Area
<b>TSS</b>	Total Suspended Solids
<b>TOC</b>	Total Organic Carbon
<b>UF</b>	Urea Formaldehyde
<b>VOC</b>	Volatile Organic Compounds
<b>WAG</b>	Welsh Assembly Government
<b>WESP</b>	Wet Electrostatic Precipitator

## Definitions

### **Wood Particleboards are defined by BS EN 309;**

"Panel material manufactured under pressure and heat from particles of wood (wood flakes, chips, shavings, sawdust, wafers, strands and similar) and/or other lignocellulosic material in particle form (flax shives, hemp shives, bagasse fragments and similar) with the addition of an adhesive."

### **Oriented Strand Board is defined in BS EN 300;**

"Multi-layers board made from strands of wood of a pre-determined shape and thickness together with a binder. The strands in the external layers are aligned and parallel to the board length or width; the strands in the centre layer or layers can be randomly oriented or aligned generally at right angles to the strands of the external layers."

### **Wood Fibreboards are defined in BS EN 316;**

"Panel material with a nominal thickness of 1.5mm or greater, manufactured from lignocellulosic fibres with application of heat and/or pressure."

The board is derived from :

- the felting of fibres and their inherent adhesive properties; or
- from a synthetic adhesive added to the fibres

other additives can be included.

Fibreboards are further classified by their production process as either "wet process" for example hardboard or, "dry process" for example Medium Density Fibreboard (MDF)"

### **Dry Process Boards (MDF) are defined as:**

"Fibreboards having a fibre moisture content of less than 20% at the forming stage, and having a density of  $>450\text{kg/m}^3$ . These boards are essentially produced under heat and pressure with the addition of a synthetic adhesive."

# Appendix 1: Some common monitoring and sampling methods

Table 6: Measurement methods for common substances to water

Determinand	Method	Detection limit Uncertainty	Valid for range mg/l	Standard
Suspended solids	Filtration through glass fibre filters	1 mg/l 20%	10-40	ISO 11929:1997 EN872 - Determination of suspended solids
COD	Oxidation with di-chromate	12 mg/l 20%	50-400	ISO 6060: 1989, Water Quality - Determination of chemical oxygen demand
BOD5	Seeding with micro-organisms and measurement of oxygen content	2 mg/l 20%	5-30	ISO 5815: 1989, Water Quality Determination of BOD after 5 days, dilution and seeding method EN 1899 (BOD 2 Parts)
AOX	Adsorption on activated carbon and combustion	-- 20%	0.4 - 1.0	ISO 9562: 1998 EN1485 - Determination of adsorbable organically bound halogens
Tot P				BS 6068: Section 2.28 1997, Determination of phosphorus – ammonium molybdate spectrometric method
Tot N				BS 6068: Section 2.62 1998, Determination of nitrogen Part 1 Method using oxidative digestion with peroxydisulphate BS EN ISO 11905
pH				SCA The measurement of electric conductivity and the determination of pH, ISBN 0117514284
Turbidity				SCA Colour and turbidity of waters 1981, ISBN 0117519553 EN 27027:1999
Flow rate	Mechanical ultrasonic or electromagnetic gauges			SCA Estimation of Flow and Load ISBN 011752364X
Temperature				SCA temperature measurement for Natural, Waste and Potable Waters and other items of interest in the Water and Sewage Disposal Industry ISBN 01175 20179
TOC				SCA The Instrumental Determination of Total Organic Carbon and Related Determinands 1995, ISBN 0117529796 EN 1484:1997
Fatty acids				Determination of Volatile Fatty Acids in Sewage Sludge 1979 ISBN 0117514624



**Table 6: Measurement methods for common substances to water**

Determinand	Method	Detection limit Uncertainty	Valid for range mg/l	Standard
Metals				BS 6068: Section 2.60 1998 Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
Chlorine				BS6068: Section 2.27 1990, Method for the determination of total chlorine: iodometric titration method
Trichloromethane (Chloroform) Bromoform				BS6068: Section 2.58, Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods
Dispersants Surfactants: Anionic Cationic Non-ionic				SCA Analysis of Surfactants in Waters, Wastewaters and Sludges ISBN 0117516058 EN 903:1993 (Used for anionic surfactants)
Pentachlorophenol				BS5666 Part 6 1983, Wood preservative and treated timber quantitative analysis of wood preservatives containing pentachlorophenol EN 12673:1997 (used for chlorophenol and polychlorinated phenols)
Formaldehyde				SCA The determination of formaldehyde, other volatile aldehydes, ketones and alcohols in water
Phosphates and nitrates				BS 6068: Section 2.53 1997, Determination of dissolved ions by liquid chromatography
Sulphites and sulphates				BS 6068: Section 2.53 1997, Determination of dissolved ions by liquid chromatography
Ammonia				BS 6068: Section 2.11 1987, Method for the determination of ammonium: automated spectrometric method
Grease and oils	IR absorption	0.06 mg/kg		SCA The determination of hydrocarbon oils in waters by solvent extraction IR absorption and gravimetry ISBN 0117517283

**Table 7: Measurement methods for common substances to air**

Determinand	Method	Standard
Particulate matter	Weighed filter	BS EN 13284-1: 2002 BS ISO 12141: 2002 BS ISO 9096: 2003
Condensable VOC	Extractive sampling and FID analyser	US EPA Method 25A
	As beneath table	
Formaldehyde	Extractive sample and portable GC	US EPA Method 18
Offsite formaldehyde		NIOSH 2541
Total aldehydes	MBTH method for water soluble aliphatic aldehydes	Range 0.1 - 2.0 ug m <sup>3</sup> HCOH for a 40 litre air sample. Sensitivity can be increased tenfold by sampling directly into chromotropic acid - sulphuric acid solution
	Extractive sample and portable GC	US EPA Method 18
Phenol	Sorbent (XAD-7) methanol desorption HPLC-UV analysis	BS EN 13649:2002 sample Analysis OSHA 32 or NIOSH 2546
Isocyanate	Isokinetic sample Impinge in 1-2-pyridyl piperazine HPLC analysis	Draft US EPA Method 207-1
	Isokinetic sample Impinge in 1-(2-methoxyphenyl) piperazine	As US EPA Method 207-1 amended by Environment Agency method implementation document (MID)
<p><b>Condensable VOC</b></p> <p>The test method for VOCs should include a heated sample probe, a heated filter to remove particulate matter and avoid condensation, followed by a suitable absorption system, for example, a condensate trap and 2 midjet impingers containing ultra pure water, connected in series and placed in an ice bath, followed by an absorber column of purified silica and a fine quartz filter. After sampling the condensate trap should be rinsed with the contents of the 2 impingers and an aliquot of the sample analysed for total organic carbon, for example, by oxidation with persulphate and ultra violet light and detection of the resultant CO<sub>2</sub>. The silica should be analysed for total organic carbon, for example, by oxidation with dichromate and back titration of the excess dichromate. The quartz filters should be weighed and the total organic carbon determined if any change in the mass is detected. The total organic carbon content of the sample may then be calculated by summation of the results obtained for the condenser and impingers with the results obtained with the silica gel and quartz filter.</p> <p>This test can be performed concurrently with the monitoring for particulate matter.</p>		