# Final Draft BAT Guidance Note on Best Available Techniques for the Production of Paper Pulp, Paper and Board

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# 1. INTRODUCTION

## 1.1 GENERAL

This Guidance Note is one of a series issued by the Environmental Protection Agency (EPA) which provide guidance on the determination of Best Available Techniques (BAT) in relation to:

- applicants seeking Integrated Pollution Prevention and Control (IPPC) licences under Part IV of the Environmental Protection Agency Acts 1992 to 2007,
- existing Integrated Pollution Prevention and Control (IPPC) Licensees, whose licence is to be reviewed under the Environmental Protection Agency Acts 1992 to 2007,
- applicants seeking Waste Licenses under Part V of the Waste Management Acts 1996 to 2008,
- existing Waste Licensees, whose licence is to be reviewed under the Waste Management Acts 1996 to 2008.

This Guidance Note shall not be construed as negating the installation/facility statutory obligations or requirements under any other enactments or regulations.

## 1.2 BAT GUIDANCE NOTE STRUCTURE

This Guidance Note has been structured as follows:

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| 1 | Introduction |
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Where relevant, references are made to other detailed guidance, such as the reference documents (BREF) published by the European Commission, Agency Guidance Notes for *Noise in Relation to Scheduled Activities* and the determination of BAT should be made giving regard to these.

The information contained in this Guidance Note is intended for use as a tool to assist in determining BAT for the activities of the paper pulp, paper and board manufacture.

# 2. INTERPRETATION OF BAT

## 2.1 STATUS OF THIS GUIDANCE NOTE

This Guidance Note will be periodically reviewed and updated as required to reflect any changes in legislation and in order to incorporate technological advances as they arise.

Techniques identified in these Guidance Notes are considered to be current best practice at the time of writing. The EPA encourages the development and introduction of new and innovative technologies and techniques, which meet BAT criteria and look for continuous improvement in the overall environmental performance of the sector's activities as part of sustainable development.

## 2.2 INTERPRETATION OF BAT

BAT was introduced as a key principle in the IPPC Directive, 96/61/EC[1]. This Directive has been incorporated into Irish law by the Protection of the Environment Act 2003. To meet the requirements of this Directive, relevant Sections of the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 have been amended to replace BATNEEC (Best Available Technology Not Entailing Excessive Costs) with BAT. Thus, for activities regulated by these Acts, BAT must be applied.

Best available techniques (BAT) is defined in Section 5 of the Environmental Protection Agency Acts, 1992 to 2007, and Section 5(2) of the Waste Management Acts 1996 to 2008, as the "most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole", where:

- **B** ***'best'*** in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole
- **A** ***'available techniques'*** means those techniques developed on a scale which allows implementation in the relevant class of activity under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity
- **T** ***'techniques'*** includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

The range of BAT associated emission level values specified in Sections 6 and 10 indicate those that are achievable through the use of a combination of the process

[1] Directive 2008/1/EC codified version.

techniques and abatement technologies specified as BAT in Sections 5 and 9. The licensee must demonstrate to the satisfaction of the Agency, during the licensing process, that the installation/facility will be operated in such a way that all the appropriate preventative measures are taken against pollution through the application of BAT and justify the application of other than the most stringent ELV in the range.

At the installation/facility level, the most appropriate techniques will depend on local factors. A local assessment of the costs and benefits of the available options may be needed to establish the best option. The choice may be justified on:

- the technical characteristics of the facility/installation;
- its geographical location;
- local environmental considerations;
- the economic and technical viability of upgrading the existing installation.

The overall objective of ensuring a high level of protection for the environment as a whole will often involve making a judgment between different types of environmental impact, and these judgments will often be influenced by local considerations. On the other hand, the obligation to ensure a high level of environmental protection including the minimisation of long-distance or transboundary pollution implies that the most appropriate techniques cannot be set on the basis of purely local considerations.

The guidance issued in this Note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, technique or standard that may achieve the required emission standards and is demonstrated to the Agency to satisfy the requirement of BAT.

## 2.3 BAT HIERARCHY

In the identification of BAT, emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment.

The IPPC Directive 2008/1/EC and the Environmental Protection Agency Acts 1992 to 2007 (Section 5(3)), require the determination of BAT to consider in particular the following, giving regard to the likely costs and advantages of measures and to the principles of precaution and prevention:

(i) the use of low-waste technology,

(ii) the use of less hazardous substances,

(iii) the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate,

(iv) comparable processes, facilities or methods of operation, which have been tried with success on an industrial scale,

(v) technological advances and changes in scientific knowledge and understanding,

(vi) the nature, effects and volume of the emissions concerned,

(vii) the commissioning dates for new or existing activities,

(viii) the length of time needed to introduce the best available techniques,

(ix) the consumption and nature of raw materials (including water) used in the process and their energy efficiency,

(x) the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it,

(xi) the need to prevent accidents and to minimise the consequences for the environment, and

(xii) the information published by the Commission of the European Communities pursuant to any exchange of information between Member States and the industries concerned on best available techniques, associated monitoring, and developments in them, or by international organisations, and such other matters as may be prescribed.

# 3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers the following activities under the First Schedule to the Environmental Protection Agency Acts 1992 to 2007:

8.1 The production of paper pulp, paper or board (including fibre-board, particle board and plywood) with a production capacity exceeding 20 tonnes per day.

In order to deal with similar industry types, such as the paper and paper pulp sector and the fundamental differences between pulp/paper manufacture and board manufacture the Guidance Note is split into two parts: -

Part A - paper pulp and paper manufacture.
Part B - board manufacture.

# PART A: PAPER PULP AND PAPER MANUFACTURE

# 4. PROCESS DESCRIPTION, RISK TO THE ENVIRONMENT, AND CONTROL TECHNIQUES

Note: Throughout this document the following references apply: -

BREF Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques (BREF) in the Pulp and Paper Industry, published by the European Commission in December 2001.

## 4.1 DESCRIPTION OF PROCESS

The pulp and paper industry can be broadly split into the following process operations:-

- Kraft (Sulphate) Pulping Process.
- Sulphite Pulping Process.
- Mechanical Pulping and Chemi-Mechanical Pulping.
- Recovered Paper Processing.
- Papermaking.

The main unit process and operations are listed below with references to the relevant sections of the BREF documents where available.

### 4.1.1 Pulp and Paper Manufacture

Pulp and Paper manufacturing is comprised of the following distinct processes; each of these processes is outlined in detail in BREF Sections 2 to 6:-

- Kraft (Sulphate) Pulping Process (see BREF Section 2).
- Sulpite Pulping Process (see BREF Section 3).
- Mechanical Pulping and Chemi-Mechanical Pulping (see BREF Section 4).
- Recovered Paper Processing (see BREF Section 5).
- Papermaking (see BREF Section 6).

The main processes and techniques in the pulping and paper manufacturing processes are as follows:-

- Wood Handling (see BREF section 2.1.1-2.1.3, 3.1.1, and 4.1.1.1-4.1.1.2).
- Cooking and Delignification (see BREF sections 2.1.4. and 3.1.2).
- Screening and Washing (see BREF sections 2.1.5, 3.1.3. and 4.1.1.3).
- Oxygen Delignification (see BREF sections 2.1.6, 3.1.4).
- Bleaching (see BREF section 2.1.7, 3.1.5, 4.1.3).
- Bleached Stock Screening (see BREF section 2.1.8).
- Magnefite Process (see BREF section 3.1.7).
- Chemical and Energy Recovery System (see BREF section 2.1.10, 3.1.6).

- Drying (see BREF section 2.1.9).
- Neutral Sulphite Semi-Chemical Pulping (see BREF section 3.1.8).
- Refiner Mechanical Pulp (see BREF section 4.1.2).
- Dissolving Sulphite Pulp (see BREF section 3.1.9).
- Stock Preparation (see BREF section 6.1.1).
- Paper Machine (see BREF section 6.1.2).
- Water Circuits and Fibre Recovery (see BREF section 6.1.3).
- Broke System (see BREF section 6.1.4).
- Sizing (see BREF section 6.1.5).
- Coating (see BREF section 6.1.6).
- Dyeing of Paper (see BREF section 6.1.7)
- Addition of Chemicals (see BREF section 6.1.8).
- Calendering (see BREF section 6.1.9).
- Reeling / Cutting / Dispatch (see BREF section 6.1.10).

## 4.2 Risk To The Environment

The key environmental issues associated with this sector are: -

- Emissions of volatile organic compounds (VOCs).
- Waste waters with potential for high loads of biodegradable organic compounds and suspended solids.
- Noise.
- Nuisance dust emissions.
- Nuisance odour emissions.
- Solid waste generation.
- Energy demand.
- Water usage.

### 4.2.1 Emissions to Atmosphere

Emissions to atmosphere from this sector include VOCs, particulates, combustion and incomplete combustion products and inorganic compounds (see BREF Sections 2.2.2.3, 3.2.2.4, 4.2.2.4, 5.2.2.7 and 6.2.2.7 for details).

### 4.2.2 Emissions to Water

Emissions to water from this sector include soluble and insoluble biodegradable organic compounds. Suspended solids can also be present in significant quantities (see BREF Sections 2.2.2.2, 2.2.2.8, 3.2.2.2, 4.2.2.3, 5.2.2.5, 6.2.2.5 for details).

### 4.2.3 Waste

Solid and liquid waste generated by this sector includes waste resins, waste containing resins, ash, reject products, sludge from wastewater treatment, packaging waste and general municipal type waste (see BREF Sections 2.2.2.4, 3.2.2.5, 4.2.2.5, 5.2.2.6 and 6.2.2.5 for details).

### 4.2.4 Water Consumption

Water consumption in this sector is mainly used for washing of raw materials, resin make up, cooling, scrubber make-up, fire suppression, and process operations (see BREF Sections 2.2.2.2, 3.2.2.2, 4.2.2.2, 5.2.2.2 and 6.2.2.2 for details of water consumption).

### 4.2.5 Energy Use

This sector is highly energy intensive, with energy use primarily associated with fibre drying, processing, pollution control and utilities (heating, ventilation, air conditioning and humidity control, etc.) and electrically driven process equipment. Primary heat requirements are often satisfied through the combustion of surplus biomass and energy recovery from process wastes such as trimmings and timber offcuts. See BREF Sections 2.2.2.6, 4.2.2.7, 5.2.2.4 and 6.2.2.4 for details of energy use in the paper and pulp industry.

### 4.2.6 Noise

The main sources of noise associated with the paper and pulp sector are from the log delivery, log loading and debarking processes. In addition the noise from the paper machines can be significant. See BREF Sections 2.2.2.7, 4.2.2.8, 5.2.2.8, and 6.2.2.8 for general description of noise sources from specific unit processes.

## 4.3 CONTROL TECHNIQUES

The existing or possible measures for eliminating, reducing and controlling emissions are described in this Section under the following headings:-

- General Preventative Techniques and Prevention of Environmental Impact.
- Minimisation of Environmental Impact.
- Management and Treatment of Residues.

References are given to relevant sections of the BREF documents, which contain more detailed information.

### 4.3.1 General Preventative Techniques and Prevention of Environmental Impact

- Measures to manage $SO_2$ in normal operation and reduce the consequences of accidents (see BREF Section 3.3.11).
- Measurement and automation of processes to achieve time savings, lower production costs, maximised paper quality (see BREF Section 6.3.8).
- Waste management consisting of waste prevention, reuse, material recycling, composting, energy recovery and final disposal (see BREF Section 6.3.14 and Chapter 2, 3, 4 and 5).

- Water management and minimising water usage for different paper grades to lower costs for raw water, lower losses of fibres and fillers, possibly lower energy consumption and lower volumes of wastewater to be treated (see BREF Section 6.3.1, 6.3.2, 6.3.3, 5.3.4 and 5.3.8).
- Energy savings through energy efficient technologies (see BREF Section 6.3.18).

#### *4.3.1.1 Prevention of Emissions to Water*

- Closed screening to eliminate discharges to water from the screening plant (see BREF Section 2.3.3).
- Chemi-thermomechanical pulp (CTMP) mill effluent treatment – closing up the water circuits by use of evaporation and burning the concentrates to eliminate discharges to water (see BREF Sections 4.3.7, 4.3.13 and 2.3.14).
- Closed Water Loops with In-line Biological Process Water Treatment to produce Zero emissions to water (see BREF Section 5.3.4).

### 4.3.2 Minimisation of Environmental Impact

#### *4.3.2.1 Minimisation of Water Consumption*

- Stripping of the most common concentrated contaminated condensates and re-use of most condensates in the process to reduce freshwater consumption (see BREF Section 2.3.11).
- Separation of less contaminated water from contaminated waters and recycling of process waters to reduce fresh water consumption and discharges (see BREF Section 5.3.1).
- Optimal Water Management (water loop arrangement) and water clarification to minimise fresh water consumption (see BREF Section 5.3.2).
- Control of potential disadvantage of closing up the water systems to achieve low water consumption (see BREF Section 6.3.2, 6.3.1, 6.3.3, 5.3.8 and 5.3.4).

#### *4.3.2.2 Minimisation of Volume of Waste Water*

- Dry debarking to reduce the waste water utilised in wood handling (see BREF Sections 2.1.2, 2.3.1 and 4.3.2).
- Partial Closure of the Bleach Plant to reduce the quantity of waste water discharges (see BREF Section 2.3.8 and 3.3.4).
- Water recirculation in pulp and paper mill reducing effluent discharge and fibre losses to sewers (see BREF Section 4.3.6).

#### *4.3.2.3 Minimisation of Load in Waste Water Stream*

- Dry debarking to decrease TSS (total suspended solids), BOD (biological oxygen demand), COD (chemical oxygen demand), and organic compound loads in the waste water stream (see BREF Sections 2.1.2, 2.3.1 and 4.3.2).
- Extended Modified Cooking techniques by decreasing the lignin content (lowering the kappa number) resulting in reduced discharges of organic substances and nutrients to water from the bleach plant (see BREF Section 2.3.2 and 3.1.2).

- Closed screening to reduce emissions of organic compounds in effluent (see BREF Section 2.3.3).
- Ozone bleaching to reduce discharges of adsorbable organically bound halogens (AOX) to waste water. (See BREF Section 2.3.5).
- ECF (elemental chlorine free) bleaching to reduce AOX emissions to water (see BREF Section 2.3.6).
- TCF (totally chlorine free) bleaching to reduce AOX and chloro-organic compounds are not formed (see BREF Sections 2.3.7 and 3.3.3).
- Partial Closure of the Bleach Plant to reduce the COD load in the waste water (see BREF Section 2.3.8, 3.1.4 and 3.3.4).
- Collection of almost all spillages and use of sufficiently large buffer tanks for storage of concentrated/ hot liquids to reduce discharges of BOD and COD to waste water. (See BREF Section 2.3.9, 2.3.12 and 4.3.12).
- Efficient Washing and Process Control to reduce AOX, BOD and COD discharges to mill sewer (see BREF Section 2.3.10 and 4.3.5).
- Stripping of the most common concentrated contaminated condensates and re-use of most condensates in the process to reduce the organic pollution load to the waste water (see BREF Section 2.3.11).
- Anaerobic pre-treatment of the condensate followed by aerobic treatment of the total effluent to reduce the concentrations of organic substances in wastewater stream (see BREF Section 3.3.6 and 3.3.7).
- Water recirculation in pulp and paper mill to reduce suspended solid load (see BREF Section 4.3.6).
- Reduction of fresh water consumption by strict separation of water loops together with counter-current flows (water loop closure) to decrease the wastewater load from integrated recycled fibre (RCF) mills with a possible reduction in ground water abstraction (where applicable) (see BREF Section 5.3.3).

#### *4.3.2.4 Minimisation of Emissions to Air*

- Use of combined heat and power generation to decrease the overall emissions from power generation (see BREF section 6.3.16 and section 5.3.9)
- Installation of low NOx technology in auxiliary boilers (oil, gas, coal) to reduce NOx emissions (see BREF Section 6.3.15 and 2.3.20).

#### *4.3.2.5 Minimisation of Energy Consumption*

- Upgrading of stock preparation plants to achieve decreased electricity consumption and improved paper machine runnability (see BREF Section 5.3.7).
- Optimisation of de-watering in the press section of the paper machine (Wide nip press) provides improved strength characteristics of the paper and increased energy savings (see BREF Section 6.3.17).

#### *4.3.2.6 Minimisation of Waste*

- Minimisation of reject losses by using efficient reject handling stages (see BREF Section 4.3.3).
- Minimisation of disposal of rejects to landfill by incineration with energy recovery (see BREF Section 4.3.4).

- Emission optimised incineration of solid waste and energy recovery for reduction of organic waste disposed to landfill (see BREF Section 4.3.11).
- Waste management to reduce fibre and filler losses resulting in better raw material efficiency and less waste to be disposed of (see BREF Section 6.3.4 and 6.3.5).

#### *4.3.2.7 Minimisation of Noise*

- Measures for noise reduction (see BREF Section 6.3.19).

### 4.3.3 Management and Treatment of Residues

#### *4.3.3.1 Treatment of Waste Water*

- Secondary or Biological Treatment (aerobic) to remove organic matter from waste water (see BREF Section 2.3.13, 4.3.13, 5.3.6, 6.3.9 and 6.3.10).
- Tertiary Treatment of Wastewater with Chemical Precipitation to reduce the nutrient content of the treated effluent (see BREF Section 2.3.14)
- Generation of clarified water from recovered paper processing with de-inking for optimal water management (see BREF Section 5.3.8).
- Anaerobic techniques as first stage of biological wastewater treatment improving stability of COD-loading, producing biogas and smaller volumes of excess sludge (see BREF Section 5.3.5).
- Internal treatment of white water by use of membrane filtration and recycling of treated process water to minimise water emissions (see BREF Section 6.3.3, 6.3.5, 5.3.4 and 5.5.2).
- Recovery and recycling of coating-colour-containing effluent to cut the mill suspended solids discharges and improve the operability of the external effluent treatment (see BREF Section 6.3.5 and 6.3.6).
- Separate Pre-treatment of Coating Wastewaters to cut the mill suspended solids discharges and improve the operability of the external effluent treatment (See BREF Section 6.3.6 and 6.3.5).
- Installation of an equalisation basin and primary treatment of wastewater to reduce TSS load to the recipient or biological treatment (See BREF Section 6.3.9).
- Chemical precipitation of wastewater from paper mills to remove the nutrients, TSS and non-soluble parts of the organic matter in the effluent (see BREF Section 6.3.11 and 6.3.10).

#### *4.3.3.2 Treatment of Emissions to Air*

- Increase the dry solids content of black liquor to reduce the sulphur emissions from the recovery boiler (see BREF Section 2.3.15).
- Installation of scrubbers on the recovery boiler to reduce $SO_2$ emissions and obtain heat recovery (see BREF Section 2.3.16 and 3.3.8).
- Collection of weak gases for incineration in the recovery boiler, collection and incineration of odorous gases in the lime kiln and use of a separate furnace equipped with scrubbers to reduce or eliminate of TRS (total reduced sulphur) emissions (see BREF Sections 2.3.17, 2.3.18 and 2.3.19).

- Installation of low $NO_X$ technology to reduce the $NO_X$ emissions from auxiliary boilers (see BREF Section 2.3.20).
- Implement of SNCR (selective non-catalytic reductions) on bark boilers and OFA (over fire air technique) on recovery boilers to reduce NOx boiler emissions (see BREF Section 2.3.21 and 2.3.22).
- Installation of improved washing of lime mud in re-causticizing to reduce of $H_2S$ (TRS) from the flue gases of the lime kiln (see BREF Section 2.3.23).
- Installation of an electrostatic precipitator for dust reduction to reduce particulate matter (dust) emissions to air from the bark boiler and the lime kiln (see BREF Section 2.3.24).

#### *4.3.3.3 Treatment of Odour Emissions*

- Collection and incineration of odorous gases to reduce odorous components released in the waste water treatment process (See BREF Sections 2.3.18 and 3.2.2.4).
- Installation of improved washing of lime mud in recausticizing to reduce odours from the flue gases of the lime kiln (see BREF Section 2.3.23).

#### *4.3.3.4 Treatment of waste*

- Reject and sludge handling and processing (de-watering) on-site to reduce the waste volume to be disposed of by landfilling (see BREF Section 5.3.10).

# 5. BAT FOR THE MANUFACTURE OF PAPER PULP AND PAPER

## 5.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BAT but obviously does so in the absence of site-specific information. Accordingly, it represents the requirements expected of any new activity covered by the Note, and ultimately the requirement expected of existing installations, but exclude additional requirements, which may form part of the granting of a licence for a specific site.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly, or in combination, the measures represent BAT solutions when implemented in the appropriate circumstances. The circumstances depend on the nature of process, plant scale, fuels used, etc.

## 5.2 BAT – GENERAL PREVENTATIVE MEASURES

General BAT for all paper pulp and paper processes are as follows:-

- Training and education of staff and operators.
- Process control optimisation.
- Sufficient maintenance of the technical units and the associated abatement techniques.
- Operate an environmental management system which optimises management, increases awareness and includes goals and measures, process and job instructions, etc.

## 5.3 BAT – PREVENTATIVE MEASURES FOR SPECIFIC UNIT OPERATIONS

### 5.3.1 Prevention and Minimisation of Environmental Impact for Kraft Pulp Processing

BAT for the kraft pulp mills are considered to be:-

- Dry debarking of wood.
- Increased delignification before the bleach plant by extended or modified cooking and additional oxygen stages.
- Highly efficient brown stock washing and closed cycle brown stock screening.
- Elemental chlorine free (ECF) bleaching with low AOX or totally chlorine free (TCF) bleaching.
- Recycling of some, mainly alkaline process water from the bleach plant.
- Effective spill monitoring, containment and recovery system.
- Stripping and reuse of the condensates from the evaporation plant.

- Sufficient capacity of the black liquor evaporation plant and the recovery boiler to cope with the additional liquor and dry solids load.
- Collection and reuse of clean cooling waters.
- Provision of sufficiently large buffer tanks for storage of spilled cooking and recovery liquors and dirty condensates to prevent sudden peaks of loading and occasional upsets in the external effluent treatment plant.
- In addition to process-integrated measures, primary treatment and biological treatment are considered BAT for kraft pulp mills.

BAT for reducing emissions to air are considered to be: -

- Collection and incineration of concentrated malodorous gases and control the resulting $SO_2$ emissions. The strong gases can be burnt in the recovery boiler, in the lime kiln or a separate, low NOx furnace. The flue gases of the latter have a high concentration of $SO_2$ that is recovered in a scrubber.
- Diluted malodorous gases from various sources are also collected and incinerated and the resulting $SO_2$ controlled.
- Total reduced sulphur (TRS) emissions of the recovery boiler are mitigated by efficient combustion control and carbon monoxide (CO) measurement.
- TRS emissions of the lime kiln are mitigated by controlling the excess oxygen, by using low-S fuel, and by controlling the residual soluble sodium in the lime mud fed to the kiln.
- The $SO_2$ emissions from the recovery boilers are controlled by firing high dry solids concentration black liquor in the recovery boiler and/or by using a flue gas scrubber.
- BAT are to further the control of NOx emissions from the recovery boiler (i.e. ensuring proper mixing and division of air in the boiler), lime kiln and from auxiliary boilers by controlling the firing conditions, and for new or altered installations also by appropriate design.
- $SO_2$ emissions from auxiliary boilers are reduced by using bark, gas, low sulphur oil and coal or controlling sulphur emissions with a scrubber.
- Flue gases from recovery boilers, auxiliary boilers (in which other biofuels and/or fossil fuels are incinerated) and lime kiln are cleaned with efficient electrostatic precipitators to mitigate dust emissions.

### 5.3.2 Prevention and Minimisation of Environmental Impact for Sulphite Pulp Processing

BAT for the sulphite pulp mills are considered to be:-

- Dry debarking of wood.
- Increased delignification before the bleach plant by extended or modified cooking.
- Highly efficient brown stock washing and closed cycle brown stock screening.
- Effective spill monitoring containment and recovery system.
- Closure of the bleach plant when sodium based cooking process is being used.
- TCF bleaching.
- Neutralising of weak liquor before evaporation followed by re-use of most condensate in the process or anaerobic treatment.

- For prevention of unnecessary loading and occasionally upsets in the external effluent treatment due to process cooking, recovery liquors and dirty condensates, install sufficiently large buffer tanks for storage where necessary.
- In addition to process-integrated measures, primary and biological treatments are considered BAT for sulphite pulp mills.

BAT for reducing emissions to air are:-

- Collection of concentrated $SO_2$ releases and recovery in tanks with different pressure levels, where practicable;
- Collection of diffuse $SO_2$ releases from various sources and introducing them in the recovery boiler as combustion air, where practicable;
- Control of $SO_2$ emissions from the recovery boiler(s) by use of electrostatic precipitators and multi-stage flue gas scrubbers and collection and scrubbing of various vents;
- Reduction of $SO_2$ emissions from auxiliary boilers by using bark, gas, low sulphur oil and coal or controlling sulphur emissions;
- Reduction of odorous gases by efficient collection systems;
- Reduction of NOx emissions from the recovery boiler and from auxiliary boilers by controlling the firing conditions;
- Cleaning of the auxiliary boilers flue gases with efficient electrostatic precipitators to mitigate dust emissions;
- Emission optimised incineration of uncontaminated residues with energy recovery, where applicable.

### 5.3.3 Prevention and Minimisation of Environmental Impact for Mechanical Pulping and Chemi-Mechanical Pulping

BAT for mechanical pulping and chemi-mechanical pulping are considered to be:-

- Dry debarking of wood.
- Minimisation of reject losses by using efficient reject handling stages.
- Water recirculation in the mechanical pulping department.
- Effective separation of the water systems of the pulp and paper mill by use of thickeners.
- Counter-current white water system from paper mill to pulp mill depending on the degree of integration.
- Use of sufficiently large buffer tanks for storage of concentrated wastewater streams from the process (mainly for CTMP).
- Primary and biological treatment of the effluents, and in some cases also flocculation or chemical precipitation.

### 5.3.4 Prevention and Minimisation of Environmental Impact for Recycled Fibre Processing

BAT for recycled fibre processing are considered to be:-

- Separation of less contaminated water from contaminated water and recycling of process water.

- Optimal water management (water loop arrangement), water clarification by sedimentation, flotation or filtration techniques and recycling of process water for different purposes.
- Strict separation of water loops and counter-currents flow of process water.
- Generation of clarified water for de-inking plants (flotation).
- Installation of an equalisation basin and primary treatment.
- Biological effluent treatment. An effective option for de-inked grades, and depending on the conditions also for non-de-inked grades, is aerobic biological treatment and in some cases also flocculation and chemical precipitation. Mechanical treatment with subsequent anaerobic-aerobic biological treatment is the preferable option for non-deinked grades. These mills usually have to treat more concentrated wastewater because of higher degree of water circuit closure.
- Partial recycling of treated water after biological treatment. The possible degree of water recycling is depending on the specific paper grades produced. For non-de-inked paper grades this technique is BAT. However, the advantages and drawbacks need to be carefully investigated and will usually require additional polishing (tertiary treatment).
- Treating internal water circuits.

### 5.3.5 Prevention and Minimisation of Environmental Impact for Papermaking and Related Processes

BAT for paper-making and related processes are considered to be:-

- Minimising water usage for different paper grades by increased recycling of process waters and water management.
- Control of potential disadvantages of closing up the water systems.
- Construction of a balanced white water, (clear) filtrate and broke storage system and use of constructions, design and machinery with reduced water consumption when practicable. This is normally when machinery or components are replaced or at rebuilds.
- Application of measures to reduce frequency and effects of accidental discharge.
- Collection and reuse of clean cooling and sealing waters or separate discharge.
- Separate pre-treatment of coating wastewaters.
- Substitution of potentially harmful substances by use of less harmful alternatives.
- Effluent treatment of wastewater by installation of an equalisation basin.
- Primary treatment, secondary biological, and/or in some cases, secondary chemical precipitation or flocculation of wastewater. When only chemical treatment is applied the discharges of COD will be somewhat higher but mainly made up of easily degradable matter.

# 6. BAT ASSOCIATED EMISSION LEVELS

## 6.1 EMISSION LEVELS FOR DISCHARGES TO AIR

Achievable emission levels for discharges to air based on BAT are given in Table 6.1 below.

**Table 6.1 BAT Associated Emission Levels for Discharges to Air**

| Constituent Group or Parameter | Emission Level (mg/m$^3$ unless otherwise specified) |
|---|---|
| Total Particulates | 20 |
| Volatile Organic Compounds (VOCs) as C | 20 |
| $H_2S$ | 3 |
| Methyl Mercaptan ($CH_3SH$) | 2 |
| Chlorine Oxide | 1 |
| Chlorine ($Cl_2$) | 3 |
| PCDDs and PCDFs | 0.1 ng/m$^3$ |
| Other [Note 1] | - |

Note 1: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

## 6.2 EMISSION LEVELS FOR DISCHARGE TO WATER

The following table sets out emission levels that are achievable using BAT for wastewater treatment. However establishing emission limit values within a licence for direct discharges to surface water from wastewater treatment plant and stormwater discharges must ensure that the quality of the receiving water is not impaired or that the current Environmental Quality Standards (EQSs) are not exceeded.

All discharges to sewer are subject to approval from the Water Services Authority.

Compliance with the Water Framework Directive (2000/60/EC) is required where relevant, in particular Article 16.

**Table 6.2 BAT Associated Emission Levels for Discharges to Water ***

| Constituent Group or Parameter | Emission Levels (mg/l unless otherwise stated) | Percentage Reduction [3] | Notes |
|---|---|---|---|
| pH | 6 - 9 pH Units | - | |
| Toxicity | 5 - 10 TU | | 1 |
| $BOD_5$ | 50 | >90% | |
| COD | 30 - 250 | >75% | |
| Suspended Solids | 10 - 35 | | |
| Total Ammonia (as N) | 10 | | |
| Total Nitrogen (as N) | 15 | >80% | 2, 4 |
| Total Phosphorus (as P) | 2 | >80% | 4 |
| Oils Fats and Greases | 10 | | |
| Mineral Oil (from interceptor) | 20 | | |
| Mineral Oil (from biological treatment) | 1.0 | | |
| Phenols | 1.0 | | 5 |
| Metals | | | 5 |
| Organohalogens | | | 5 |
| Priority Substances (as per Water Framework Directive) | | | 5 |
| Cyanides | | | 5 |
| Other | | | 5, 6 |

* All values refer to daily averages based on a 24-hour flow proportional composite sample, except where stated to the contrary and for pH, which refers to continuous values. Levels apply to effluent prior to dilution by uncontaminated streams e.g. storm water, cooling water, etc.

* Temperature measured downstream of a point of thermal discharge must not exceed the unaffected temperature by more than 1.5°C in salmonid waters and 3°C in cyprinid waters (Freshwater Fish Directive 79/659/EEC).

Note 1: The number of toxic units (TU) = 100/x hour EC/LC50 in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

Note 2: Total Nitrogen means the sum of Kjeldahl Nitrogen, Nitrate N and Nitrite N.

Note 3: Reduction in relation to influent load.

Note 4: Limits will depend on the sensitivity of the receiving waterbody.

Note 5: BAT associated emissions levels are highly dependent on production process, wastewater matrix and treatment. These parameters shall be considered on a site-specific basis when setting emission limit values.

Note 6: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

# 7. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from the sector are set out below. Licence requirements may vary from those stated below due to site-specific considerations, sensitivity of receiving media, and scale of the operations.

## 7.1 MONITORING OF EMISSIONS TO AIR

- Monitoring of boiler stack emissions for SOx, NOx, CO and particulates, as required by the licence, taking account of the nature, magnitude and variability of the emission and the reliability of the controls.
- Monitoring of boiler combustion efficiency in accordance with the manufacturer's instructions at a frequency determined by the Agency.
- Continuous monitoring on main emissions where technically feasible (e.g. TOC, HCl, Particulates, CO, $SO_2$, NOx,).
- Periodic monitoring of stacks for other parameters (e.g. TRS, $H_2S$, PCDD/PCDF and Cl) as determined by the Agency.
- Monitor solvent / VOC usage by annual mass balance reports and use to determine fugitive emissions.
- Olfactory (sniff) assessment for odours should be carried out daily or as directed by the Agency at a minimum at four boundary locations and at the nearest odour sensitive locations to be agreed with the Agency.

## 7.2 MONITORING OF AQUEOUS EMISSIONS

- For uncontaminated cooling waters, continuous monitoring of temperature and flow.
- Continuous monitoring of flow, volume, pH, temperature and any other relevant parameters deemed necessary by the Agency, taking account of the nature, magnitude and variability of the emissions and the reliability of the control technique.
- Establish existing conditions prior to start-up of key emission constituents and salient flora and fauna.
- Monitoring of influent and effluent for the wastewater treatment plant to establish % BOD and COD reduction and early warning of any difficulties in waste water treatment, or unusual loads.
- The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.
- Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter.
- BAT is to carry out regular biomonitoring of the total effluent after the biological WWTP where substances with ecotoxicological potential are handled or produced with or without intention. BAT is also to apply online toxicity monitoring in combination with online TOC measurement if residual acute toxicity is identified as a concern.

- Monitor regularly the total effluent from and to the biological WWTP for appropriate parameters. The monitoring frequencies should reflect the operational mode of the production and the frequency of product changes as well as the ratio of buffer volume and residence time in the biological WWTP.

## 7.3 MONITORING OF EMISSIONS TO GROUNDWATER

- There should be no direct emissions to groundwater, including during extraction and treatment of groundwater.

## 7.4 MONITORING OF SOLID WASTE

- The recording in a register of the types, quantities, date and manner of disposal/recovery of all wastes.
- Leachate testing of sludges and other material as appropriate being sent for landfilling.
- Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials.

# PART B: BOARD MANUFACTURE

# 8. PROCESS DESCRIPTION, RISK TO THE ENVIRONMENT, AND CONTROL TECHNIQUES

## 8.1 DESCRIPTION OF PROCESS

The panel board manufacturing industry can be broadly split into three distinct manufacturing operations, which manufacture the following products: -

- Fibreboard
  - MDF and hardboard.
- Particleboard
  - Orientated Strand Board (OSB), chipboard, waferboard.
- Plywood.

The panel board sector in Ireland is comprised of the manufacture of fibreboard, particleboard, and OSB. The manufacturing processes are broadly similar with the main differences between fibre and particleboard being the particle size and nature of wood used in the manufacturing process. Fibreboard such as hardboard or MDF is comprised of wood fibres, chipboard is comprised of wood chips and OSB is comprised of wood flakes known as wafers. In each case dried wood particulates are mixed with resins, formed into mats and pressed with temperature and pressure addition.

Plywood, which is not manufactured in Ireland, differs from fibreboard and particleboard manufacture in that plywood panels are produced from veneers that are "peeled" from large diameter logs. These veneers are dried, resins are applied and the veneers are laid out in three or more layers and cemented together with the grain of the adjoining veneers usually laid out at 90 degrees to each other. The veneers are then pressed into a solid board.

The main unit operations in the manufacturing process for particle and fibreboards are as follows: -

- Raw Material Reception.
- Pre-treatment
  - debarking,
  - comminution
  - woodchips produced may be washed or cleaned using screening and density separation devices,
  - steaming (fibreboard only).
- Fiberisation (fibreboard only).
- Size screening (particle board and OSB).
- Drying.
- Blending with Resins.
- Forming.

- Pressing with heat and pressure addition.
- Cooling.
- Finishing.

## 8.1.1 Raw Material Reception

Wood may be received as logs directly from the forest or as by-product chips/sawdust from other wood working industries. Logs are mainly delivered with the bark on and must be debarked before further processing. Wood chip/sawdust imported directly to the sites are normally free of bark and can be used after screening and possibly washing. The wood is transported to the mills by road.

## 8.1.2 Pre-treatment

Pre-treatment typically consists of de-barking, screening, chipping, washing, steaming, milling/shredding.

### *8.1.2.1 Debarking*

The most common method for debarking is drum debarking. Bark is removed as the logs rub against each other when made to tumble by the rotating action of the debarking drum. Loose bark and wood sticks fall from the drum through special chutes. An alternative debarking process is the ring debarking system, where logs are spun through pneumatically held paring blades. Debarked logs are typically washed with water in order to remove grit and loose bark prior to being delivered to the next stage of processing within the mill. Collected bark is typically shredded and utilised as a fuel for thermal requirements within the mill, and where a surplus occurs this is normally sold on for use in horticultural processes.

### *8.1.2.2 Comminution*

In the production of MDF and chipboard the imported logs and woodchips are reduced to a standard size in a chipper. A uniform chip-size distribution is necessary for the efficiency of further processes and for the quality of the end product.
In OSB manufacture logs are pressed against a spinning disk known as a waferiser. The waferiser contains a large amount of cutting knives which produce wafers of uniform shape and thickness.

### *8.1.2.3 Washing*

Woodchips produced for the manufacture of MDF may be washed or cleaned using screening and density separation device to remove impurities such as grit and residual bark.

## 8.1.3 Screening

Following comminution wafers and wood chips are screened in order to remove oversized particles and sawdust. Oversized particles can be re-introduced into the comminution stage or recovered along with sawdust to fuel on site combustion processes. Some processors deliberately produce excess particles at this stage in order to produce solid fuel for on site thermal processes such as drying.

## 8.1.4 Fiberisation

In MDF manufacture comminuted chips are compacted using a screwfeeder, then fed into a defibrator. The defibrator typically consists of two counter-rotating plates each with radial grooves that get smaller as they get closer to the circumference. These plates function to reduce the wood chips to a wood fibre.

### 8.1.5 Drying

The control of the moisture content of the finished product is of paramount importance in the processing of panel boards. Wet wood particulate must be dried to the required moisture content prior to being formed into a mat and pressed. In MDF manufacture resins are added prior to or post drying of the fibre stream, whereas with particleboard and OSB manufacture wood particulate is dried prior to the addition of resins. Drying can be achieved through direct fire furnaces, primarily wood fuelled, or indirect heat sources such as steam or thermal oil systems.

### 8.1.6 Blending with Resins

Resins such as phenol formaldehyde, polymeric MDI, melamine formaldehyde and urea formaldehyde can all be utilised in the manufacture of panel boards. Resins are typically atomised and then applied to the wood particulate in enclosed containers.

### 8.1.7 Forming

Following resin addition MDF, particleboard and OSB products are formed into mats using extruding heads. Mats are typically formed through the placing layers of un-pressed wood particulate in a continuous process on a moving conveyor. The mat edges are trimmed to avoid wastage and un-pressed wood material is typically recycled back to an earlier stage of the process. A moving saw is typically used to cut the mats into required section lengths prior to pressing.

### 8.1.8 Pressing

Following forming, mats are fed into the press, where they are subjected to pressing at high temperatures and pressures. Typically the temperatures applied are in the region of 200$^{o}$C and at a pressure of 3500MPa depending on product type, thickness and required moisture content.

### 8.1.9 Cooling

Cooling is normally allowed to occur prior to subsequent finishing. Cooling can be achieved with an appropriate length of conveyor, or through the employment of a board carousel.

### 8.1.10 Finishing

Wide ranges of finishing processes are conducted in the board industry, these can include the addition of veneers, sanding, addition of tongue and groove profiles, edge painting and application of laminate finishes.

## 8.2 RISK TO THE ENVIRONMENT

The key environmental issues associated with this sector are:-

- Emissions of volatile organic compounds (VOCs) including aldehydes.
- Waste waters with potential for high loads of biodegradable organic compounds and suspended solids.

- Noise.
- Nuisance dust emissions.
- Nuisance odour emissions.
- Consumption of raw materials.
- Solid waste generation.
- Energy demand.
- Water usage.

### 8.2.1 Emissions to Atmosphere

Emissions to atmosphere from the panel board sector are primarily derived from the dryers and presses and include; particulate matter, formaldehyde and other aldehydes and VOCs. Secondary emissions include phenol (where phenol formaldehyde resin is used); isocyanate (where pMDI is used); water vapour from the presses, dryers, scrubbers and Wet Electro-Static Precipitators (WESPs); and ammonia (where urea formaldehyde is used).

### 8.2.2 Emissions to Water

Emissions to water from this sector include soluble and insoluble biodegradable organic compounds. Suspended solids can also be present in significant quantities. Emissions to water from the panel board industry arise from chip washing/steaming (MDF manufacture), wet scrubbers and WESPs, surface water run-off, yard and plant washing.

### 8.2.3 Waste

Solid and liquid waste generated by this sector includes waste resins, waste containing resins, ash, reject products, sludge from wastewater treatment, packaging waste and general municipal type waste.

### 8.2.4 Water Consumption

Water consumption in this sector is mainly used for washing of raw materials, resin make up, cooling, scrubber make-up, fire suppression, and process operations.

### 8.2.5 Energy Use

This sector is highly energy intensive, with energy use primarily associated with fibre drying, processing, pollution control and utilities (heating, ventilation, air conditioning and humidity control, etc.) and electrically driven process equipment. Primary heat requirements are often satisfied through the combustion of surplus biomass and energy recovery from process wastes such as uncontaminated trimmings and timber off cuts as described in Section 8.1 above.

## 8.3 CONTROL TECHNIQUES

The existing or possible measures for eliminating, reducing and controlling emissions are described in this Section under the following headings: -

- General Preventative Techniques and Prevention of Environmental Impact.

- Minimisation of Environmental Impact.
- Management and Treatment of Residues.

## 8.3.1 General Preventative Techniques and Prevention of Environmental Impact

### *8.3.1.1 Resource Use Efficiency*

The efficient use of energy, raw materials, and water can considerably enhance the environmental performance of a facility. The use of uncontaminated off size particulate, off cuts, sawdust, edge trimmings and scrap/reject product for dryer or boiler fuel is an important aspect of the operation of the panel board sector. The re-use of water within closed loop systems for cooling, wet-scrubbers, WESPs and log washes enhances environmental performance.

### *8.3.1.2 Integration of Environmental, Health and Safety Considerations into Process Development and Design*

The likelihood of successful prevention and minimisation of the environmental impact of a process increases if Environment, Health and Safety are considered early in the development process. The assessment is based on prevention, minimisation, making harmless and aims to design out environmental issues and to provide an auditable trail for environmental issues.

### *8.3.1.3 Raw Material Selection*

Raw material selection, particularly in the use of recycled fibres can prevent significant releases to the environment. It is possible to replace virgin wood with clean recycled wood in many instances. The collection and reuse of wood dusts generated during processing reduces raw material consumption and reduces releases to the environment. Different resins are used depending on the required product. Urea-formaldehyde resins tend to be used in boards intended for interior applications. Phenol-formaldehyde resins are generally used in boards 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.

### *8.3.1.4 Prevention of Major Accidents and Releases to the Environment*

Environmental hazard identification and risk assessment during process design to determine consequences and implement appropriate control measures (contingency plans) to prevent major accidents and associated releases to the environment.

### *8.3.1.5 Environmental Management Systems*

An effective Environmental Management System (EMS) is a key technique for ensuring that effective environmental techniques are delivered on an integrated and reliable basis. An EMS in the form of written instructions; based on the facility’s environmental aspects, which incorporate environmental considerations into process operation, emergency situations, design, construction, capital projects and purchasing policy should be present.

#### *8.3.1.6 Site Selection*

Consider environmental issues during selection of site location for product manufacture with a view to minimising environmental impact on sensitive receptors. This is a particular issue in relation to facilities that may present significant nuisance to nearby sensitive receptors.

### 8.3.2 Minimisation of Environmental Impact

#### *8.3.2.1 Plant Design*

Consider environmental issues during plant design to maximise efficient use of natural resources and thermal energy and minimise releases to the environment, such as fugitive emissions.

#### *8.3.2.2 Raw Material Selection*

*Timber Selection*

Timber should be selected to minimise contamination by plastic, paint, oil, coatings, rubber or plastic.

*Resin Selection*

During resin selection, consideration should be given to the environmental performance of particular resins, including its propensity to generate odours.

#### *8.3.2.3 Low Temperature Drying*

Drying should be completed at the lowest practical temperature in order to reduce energy consumption and limit emissions to atmosphere.

#### *8.3.2.4 Combined Heat and Power*

Where plant process conditions, such as temperature and heat demands permit, combined heat and power should be utilised in order to improve efficiency of operation, reduce costs and improve overall environmental performance.

#### *8.3.2.5 Minimisation of Air Emissions*

All operations that generate emissions to air should be contained and adequately extracted to suitable abatement plant, where this is necessary to meet specified emission limit values. Stack heights should be sufficient to ensure adequate dispersion under normal conditions.

#### *8.3.2.6 Minimisation of Fugitive Emissions*

Operations such as handling, storage and transfer of dusty material, finishing and handling of odorous raw materials should be controlled to minimise dusty emissions. Dusty materials should be kept under cover where possible. Double handling of dusty materials should be minimised where possible.

### 8.3.3 Management and Treatment of Residues

The sector generates wood and non-wood residues. The segregation of residues is essential to facilitate options for re-use, recycling and energy recovery.

#### *8.3.3.1 Wood Residues*

Wood residues can comprise sawdust, bark, sander dust, edge trimmings and reject board. Typically wood-processing residues can be used as raw material for other products.

Uncontaminated clean residues or used products, which cannot be recycled or re-used, can usually be burned as a source of energy. In some instances uncontaminated clean wood residues are intentionally created in order to provide fuel for heating requirements.

#### *8.3.3.2 Non Wood Residues*

Non-wood residues include: -

- Scrubber liquor.
- Chemical and oil containers.
- Packaging waste.
- Scrap metal.
- Abatement plant consumables such as spent bag filters.
- General industrial wastes.
- Office and canteen wastes.
- Cured Resin waste.
- Waste oil.
- Ash.

Scrubber liquor can be recirculated with solids constantly removed by using centrifuge/decanter. Chemical and oil containers as well as general industrial wastes are disposed of by local authority approved waste disposal agents. Packaging waste, office and canteen wastes is disposed of or recycled by local authority approved waste disposal/recycling agents. Waste oil is hazardous and must be disposed of by a hazardous waste disposal contractor approved by the local authority. Packaging waste and scrap metal can usually be recycled by a local authority approved waste recycling agent. Waste water treatment plant sludge is regarded as non-wood residue, where contaminated wood waste is used in the process. Waste water treatment plant sludge either disposed of by local authority approved waste disposal agent or where suitable used for energy recovery. Abatement plant consumables such as spent bag filters can be washed and reused or disposed of as appropriate.

# 9. BAT FOR THE MANUFACTURE OF BOARD

## 9.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BAT but obviously does so in the absence of site specific information. Accordingly, it represents the requirements expected of any new activity covered by the Note, and ultimately the requirement expected of existing facilities, but exclude additional requirements, which may form part of the granting of a licence for a specific site.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly, or in combination, the measures represent BAT solutions when implemented in the appropriate circumstances. The circumstances depend on the nature of process, plant scale, fuels used, etc.

## 9.2 BAT: GENERAL PREVENTATIVE MEASURES AND PREVENTION OF ENVIRONMENTAL IMPACT

For all panel board manufacturing plants, BAT are as follows: -

- Operate an environmental management system, including training, and where practicable, regular sectoral benchmarking.
- Use a planned maintenance programme.
- Operate the minimum number of controlled emission points for all large dedicated plants.
- Separate collection of storm water and process effluents in order to permit appropriate treatment options.
- Maximum use of covered storage for wood chips, sawdust, etc.
- Avoidance of excessive drier temperatures.
- Selection of most environmentally favourable resins and adhesives.
- Recovery of uncontaminated wood residues to meet primary heat requirements, where practicable.

### 9.2.1 Energy Efficiency

Energy efficiency techniques should be followed, such as: -

- Heat recovery from different parts of the processes.
- Minimisation of water use and closed circulating water systems.
- Good insulation.
- Phase optimisation of electronic control motors.
- Optimised efficiency measures for combustion plant e.g. air/feedwater preheating, excess air, etc.
- Plant layout to reduce pumping distances.

Energy supply techniques should be considered such as: -

- Use of Combined Heat and Power (CHP).
- Generation of energy from uncontaminated waste wood.
- Use of less polluting fuels.

## 9.3 BAT: Minimisation of Environmental Impact

### 9.3.1 Waste Water

Effluent generation should be minimised by recycling and re-use wherever possible. Cooling water, storm water, bund water and effluents of different origin may be separated in order to permit appropriate treatment/recycling options. The use of lower quality water may be possible for log washing, resin make up, dust suppression and washing may be possible in some instances.

### 9.3.2 Dust

BAT for reducing dust emissions includes: -

- Storage of dusty materials under cover.
- Application of cyclones.
- Use of fabric filter systems with burst detection systems.
- Use of WESP (see Section 8.2.1 above).
- Transport of dusty materials should be carried out so as to prevent or minimise airborne dust emissions.
- Spillages of dusty materials should be cleared as soon as possible using vacuum or wet removal techniques.

### 9.3.3 Odour

Operators should assess the likely sources of odour and carry out olfactory assessments at the site boundary. Odour control should be carried out in the following order of priority: -

- Prevention – substitution.
- Containment and extraction.
- Abatement.

Implementation of the Best Available Techniques should ensure that offensive odours do not cause a nuisance beyond the site boundary. It may be necessary to include additional controls to avoid offensive odours, for example where local meteorological conditions frequently lead to poor dispersion conditions.

#### *9.3.3.1 Prevention*

Operators should seek to prevent and minimise odours from the installation by prevention, i.e. by reducing the production of odorous chemicals.

#### *9.3.3.2 Minimisation*

Where odour generation is not preventable, odours should be minimised at source and/or contained with effective treatment prior to discharge.

#### *9.3.3.3 Containment, Extraction and Abatement*

The odour impact should be assessed to determine whether additional controls are required such as extraction and abatement are needed in order to minimise the odour impact.

### 9.3.4 Groundwater Protection

BAT is to design, build, operate and maintain facilities, where substances (usually liquids) which represent a potential risk of contamination of ground and groundwater / surface waters, are handled in such a way that no spills occur. Facilities have to be sealed, stable and sufficiently resistant against possible mechanical, thermal or chemical stress.

BAT is to ensure leakages are quickly and reliably identified and to carry out prompt maintenance to prevent further leakage.

BAT is to provide sufficient retention volumes to safely retain leaking substances in order to enable treatment or disposal.

BAT is to provide sufficient retention volume to safely retain fire fighting water and contaminated surface water.

BAT is to apply the following:-

- Carry out loading and unloading only in designated areas protected against leakage run-off.
- Store and collect materials awaiting disposal in designated areas protected against leakage run-off.
- Fit all pump sumps or other treatment plant chambers from which spillage might occur with high level liquid alarms or ensure regular supervision of same.
- Establish programmes for testing and inspection of tanks and pipelines where tanks and pipes are not situated in bunded areas.

### 9.3.5 Noise and Vibration

BAT is to design, build, operate and maintain facilities, where noise emissions, which represent a potential risk of nuisance to sensitive receptors, are contained in such a way that no nuisance occurs. Key plant with potential to give rise to significant noise emissions should be identified and measures taken as necessary to mitigate noise emissions. Maintenance of existing plant and equipment should be undertaken as necessary to minimise noise emissions.

BAT is to apply the following:-

- Minimise night-time deliveries, where noise nuisance can arise as a result of the delivery.
- Minimise drop heights for all deliveries.
- Use acoustic screens and enclosures to contain noise sources.
- Use directional or localised sound sources for back up alarms.
- Maintain a closed door policy.
- Debarking and chipping should be carried out in enclosed areas.

## 9.4 BAT - MANAGEMENT AND TREATMENT OF RESIDUES

### 9.4.1 Waste

The recovery and reuse of collected wood particulate and trimmed materials in the process is considered BAT. Where collected uncontaminated dusts are not re-useable due to moisture content or particle size, the recovery as fuel on site is considered BAT.

# 10. BAT ASSOCIATED EMISSION LEVELS

## 10.1 EMISSION LEVELS FOR DISCHARGES TO AIR

Achievable emission levels for discharges to air based on BAT are given in Table 10.1 below.

**Table 10.1 BAT Associated Emission Levels for Discharge to Air**

| Constituent Group or Parameter | Source | Limits |
|---|---|---|
| Particulate matter | All contained sources other than wood dryers and Medium Density Fibreboard (MDF) production. | 50 mg/m$^3$ |
| Particulate matter | Medium Density Fibreboard (MDF) production – all contained sources. | 20 mg/m$^3$ |
| Particulate matter | Wood dryers | 20 mg/m$^3$ |
| Condensible VOCs (excluding particulate matter) (as Carbon) | Press and Dryer emissions | 130 mg/m$^3$ |
| Total Ammonia | Wood dryers | 30 - 70 mg/m$^3$ |
| Formaldehyde (as formaldehyde) | | 5 - 20 mg/m$^3$ |
| Total Aldehydes (as Carbon) | Each emission to air from wood dryers | 20 mg/m$^3$ |
| Phenol | Presses and dryers | 2 - 5 mg/m$^3$ |
| Isocyanate | Presses and dryers | 0.1 mg/m$^3$ |

## 10.2 EMISSION LEVELS FOR DISCHARGES TO WATER

The following table sets out emission levels that are achievable using BAT for wastewater treatment. However establishing emission limit values within a licence for direct discharges to surface water from wastewater treatment plant and stormwater discharges must ensure that the quality of the receiving water is not impaired or that the current Environmental Quality Standards (EQS) are not exceeded.

All discharges to sewer are subject to approval from the Water Services Authority.

Compliance with the Water Framework Directive (2000/60/EC) is required where relevant, in particular
Article 16.

**Table 10.2 BAT Associated Emission Levels for Discharges to Water ***

| Constituent Group or Parameter | Emission Levels | Percentage Reduction [3] | Notes |
|---|---|---|---|
| pH | 6 - 9 | - | |
| Toxicity | 5 - 10 TU | | 1 |
| $BOD_5$ | 25 - 50 mg/l | >90% | |
| Suspended Solids | 10 - 35mg/l | | |
| Total Ammonia (as N) | 10mg/l | | |
| Total Nitrogen (as N) | 15 mg/l | >80% | 2, 4 |
| Total Phosphorus (as P) | 2mg/l | >80% | 4 |
| Oils Fats and Greases | 10mg/l | | |
| Mineral Oil (from interceptor) | 20mg/l | | |
| Mineral Oil (from biological treatment) | 1.0mg/l | | |
| Phenols | 1.0mg/l | | 5 |
| Metals | | | 5 |
| Organohalogens | | | 5 |
| Priority Substances (as per Water Framework Directive) | | | 5 |
| Cyanides | | | 5 |
| Other | | | 5, 6 |

* All values refer to daily averages based on a 24-hour flow proportional composite sample, except where stated to the contrary and for pH, which refers

to continuous values. Levels apply to effluent prior to dilution by uncontaminated streams e.g. storm water, cooling water, etc.

* Temperature measured downstream of a point of thermal discharge must not exceed the unaffected temperature by more than 1.5$^{o}$C in salmonid waters and 3$^{o}$C in cyprinid waters (Freshwater Fish Directive 79/659/EEC).

Note 1: The number of toxic units (TU) = 100/x hour EC/LC50 in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

Note 2: Total Nitrogen means the sum of Kjeldahl Nitrogen, Nitrate N and Nitrite N.

Note 3: Reduction in relation to influent load.

Note 4: Limits will depend on the sensitivity of the receiving waterbody.

Note 5: BAT associated emissions levels are highly dependent on production process, wastewater matrix and treatment. These parameters shall be considered on a site-specific basis when setting emission limit values.

Note 6: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

# 11. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from the sector are set out below. Licence requirements may vary from those stated below due to site-specific considerations, sensitivity of receiving media, and scale of the operations.

## 11.1 MONITORING OF EMISSIONS TO AIR

- 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 and oxygen.
- Continuous monitoring of key abatement equipment parameters (e.g. voltage and temperature on WESPs and pressure and integrity of baghouse filters).
- Sampling points on new plant should be designed to comply with CEN or Other Standards. e.g. EN 13284-1 or BS ISO 9096: 2003 for sampling particulate matter in stacks.
- Monitoring of minor boiler stack emissions for SOx, NOx, CO and particulates, as required by the licence, taking account of the nature, magnitude and variability of the emission and the reliability of the controls.
- Monitoring of boiler combustion efficiency in accordance with the manufacturer's instructions at a frequency determined by the Agency.
- Periodic monitoring of driers, and filter exhausts for particulates.
- Where appropriate, periodic monitoring of driers and press exhausts for MDI (NCO group).
- Periodic monitoring of driers and press exhausts for formaldehyde and phenol.
- Where appropriate periodic monitoring of driers and press exhausts for condensable VOCs (CVOCs).
- Continuous monitoring on main emissions where technically feasible (e.g. Particulates, CO, $SO_2$, NOx).
- Periodic monitoring of total aldehydes.
- Periodic monitoring of stacks for other parameters as determined by the Agency.
- Periodic ambient dust deposition monitoring.
- Periodic ambient noise monitoring.
- Monitor resin usage by annual mass balance reports and use to determine fugitive emissions.
- Olfactory (sniff) assessment for odours should be carried out daily or as directed by the Agency at a minimum at four boundary locations and at the nearest odour sensitive locations to be agreed with the Agency.
- Results exceeding the emission limit value from any monitoring activity (both continuous and non-continuous) and malfunction or breakdown leading to abnormal emissions should be investigated and corrective action taken immediately. The operator should ensure that the regulator is notified without delay identifying the cause and corrective action taken. Where there is immediate danger to human health, operation of the activity should be suspended.

## 11.2 MONITORING OF AQUEOUS EMISSIONS

- Continuous monitoring of flow, volume, pH, temperature and any other relevant parameters deemed necessary by the Agency, taking account of the nature, magnitude and variability of the emissions and the reliability of the control technique.
- Establish existing conditions prior to start-up of key emission constituents and salient flora and fauna.
- Monitoring of influent and effluent for the wastewater treatment plant to establish % BOD and COD reduction and early warning of any difficulties in waste water treatment, or unusual loads.
- The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.
- Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter.
- Online TOC measurement should be carried out if residual acute toxicity is identified as a concern.
- 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 sensitivity of the receiving water
  - the volume of discharge compared to the percentage dry river flow of the receiving water.

## 11.3 MONITORING OF EMISSIONS TO GROUNDWATER

- There should be no direct emissions to groundwater, including during extraction and treatment of groundwater.

## 11.4 MONITORING OF SOLID WASTE

- The recording in a register of the types, quantities, date and manner of disposal/recovery of all wastes.
- Leachate testing of sludges and other material as appropriate being sent for landfilling.
- Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials.

# Appendix 1

## PRINCIPAL REFERENCES


### 1. European Commission and UK

1.1 European Commission (December 2001) Integrated Pollution Prevention and Control (IPPC) Reference Document on BAT in the Pulp and Paper Industry.

1.2 Department for Environment, Food and Rural Affairs (September 2006) Sector Guidance Note IPPC SG, Integrated Pollution Prevention and Control (IPPC), Secretary of State's Guidance for A2 Particleboard, Oriented Strand Board and Dry Process Fibreboard Sector.

1.3 Council Directive 2008/1/EC concerning Integrated Pollution Prevention and Control.

### 2. Ireland

2.1 Environmental Protection Agency (1996) Integrated Pollution Control Licensing BATNEEC Guidance Note for Board Manufacture.

2.2 Environmental Protection Agency (2003) Environmental Noise Survey Guidance Document.

# Appendix 2

## GLOSSARY OF TERMS AND ABBREVIATIONS

| | |
|---|---|
| AOX | Adsorbable Organic Halogens |
| BAT | Best Available Techniques |
| BATNEEC | Best Available Technology not Entailing Excessive Costs |
| BOD | Biological Oxygen Demand |
| CEN | European Committee for Standardization |
| CHP | Combined Heat and Power |
| $CH_3CH$ | Methyl Mercaptan |
| CO | Carbon Monoxide |
| COD | Chemical Oxygen Demand |
| CTMP | Chemi Thermo Mechanical Pulp |
| CVOC | Condensable Volatile Organic Compound |
| ECF | Elemental Chlorine Free |
| EC/LC 50 | Effective Concentration/Lethal Concentration 50 percent |
| EHS | Environmental Health and Safety |
| ELV | Emission Limit Value |
| EMS | Environmental Management System |
| EPA | Environmental Protection Agency |
| EQS | Environmental Quality Standard |
| HCl | Hydrogen Chloride |
| $H_2S$ | Hydrogen Sulphide |
| IPPC | Integrated Pollution Prevention and Control |
| K | Kelvin ($0^oC = 273.15$ K) |
| kg | Kilogram |
| kPa | Kilo Pascal |
| MDF | Medium Density Fibreboard |
| MDI | Diphenylmethane Diisocyanate |
| mg | Milligram |
| m3 | Cubic Metre |
| N | Nitrogen |
| NCO | Isocyanate group |

| | |
|---|---|
| NH3 | Ammonia |
| NOx | Nitrogen Oxides |
| $^{o}C$ | Degree Celsius |
| OFA | Over Fire Air Technique |
| OSB | Oriented Strand Board |
| P | Phosphorus |
| PCDD/PCDF | Polychlorinated Dibenzo Dioxins/Dibenzofurans |
| pMDI | Polymeric Diphenylmethane Diisocyanate |
| RCF | Recycled Fibre |
| S | Sulphur |
| SNCR | Selective Non-Catalytic Reductions |
| $SO_2$ | Sulphur Dioxide |
| TCF | Total Chlorine Free |
| TOC | Total Organic Carbon |
| TRS | Total Reduced Sulphur |
| TSS | Total Suspended Solids |
| TU | Toxic Unit |
| VOC | Volatile Organic Compound |
| WESP | Wet Electrostatic Precipitator |
| WWTP | Wastewater Treatment Plant |