COMMISSION IMPLEMENTING DECISION (EU) 2015/2119

of 20 November 2015

establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the production of wood-based panels

(notified under document C(2015) 8062)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) ([1]), and in particular Article 13(5) thereof,

Whereas:

(1) The Commission established a forum composed of representatives of Member States, the industries concerned and non-governmental organisations promoting environmental protection by Decision of 16 May 2011 establishing a forum for the exchange of information pursuant to Article 13 of Directive 2010/75/EU on industrial emissions ([2]).

(2) In accordance with Article 13(4) of Directive 2010/75/EU, the Commission obtained the opinion of that forum on the proposed content of the BAT reference document for the production of wood-based panels on 24 September 2014 and made it publicly available.

(3) The BAT conclusions set out in the Annex to this Decision are the key element of that BAT reference document and lay down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures.

(4) BAT conclusions are the reference for setting permit conditions for installations covered by Chapter II of Directive 2010/75/EU and competent authorities should set emission limit values that ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques as laid down in the BAT conclusions.

(5) The measures provided for in this Decision are in accordance with the opinion of the Committee established by Article 75(1) of Directive 2010/75/EU,

HAS ADOPTED THIS DECISION:

Article 1

The BAT conclusions for the production of wood-based panels, as set out in the Annex, are adopted.

Article 2

This Decision is addressed to the Member States.

Done at Brussels, 20 November 2015.

For the Commission

Karmenu VELLA

Member of the Commission

([1]) OJ L 334, 17.12.2010, p. 17.
([2]) OJ C 146, 17.5.2011, p. 3.

ANNEX

BAT CONCLUSIONS FOR THE PRODUCTION OF WOOD-BASED PANELS

SCOPE

These BAT conclusions concern the activities specified in Section 6.1(c) of Annex I to Directive 2010/75/EU, namely:

— production in industrial installations of one or more of the following wood-based panels: oriented strand board, particleboard or fibreboard with a production capacity exceeding 600 m^3 per day.

In particular, these BAT conclusions cover the following:

— the manufacture of wood-based panels;

— on-site combustion plants (including engines) generating hot gases for directly heated dryers;

— the manufacture of impregnated paper with resins.

These BAT conclusions do not address the following activities and processes:

— on-site combustion plants (including engines) not generating hot gases for directly heated dryers;

— the lamination, lacquering or painting of raw board.

Other reference documents which are relevant for the activities covered by these BAT conclusions are the following:

Reference document	Subject
Monitoring of Emissions to air and water from IED installations (ROM)	Monitoring of emissions to air and water
Large Combustion Plants (LCP)	Combustion techniques
Waste Incineration (WI)	Waste incineration
Energy Efficiency (ENE)	Energy efficiency
Waste Treatment (WT)	Waste treatment
Emissions from Storage (EFS)	Storage and handling of materials
Economics and Cross-Media Effects (ECM)	Economics and cross-media effects of techniques
Large Volume Organic Chemical industry (LVOC)	Production of melamine, urea-formaldehyde resins and methylene diphenyl diisocyanate

GENERAL CONSIDERATIONS

BEST AVAILABLE TECHNIQUES

The techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection.

Unless stated otherwise, the BAT conclusions are generally applicable.

EMISSION LEVELS ASSOCIATED WITH BAT (BAT-AELs) FOR EMISSIONS TO AIR

Unless stated otherwise, the BAT-AELs for emissions to air given in these BAT conclusions refer to concentrations expressed as mass of emitted substance per volume of waste gas under standard conditions (273,15 K, 101,3 kPa) and on a dry basis, expressed in the unit mg/Nm^3.

The reference oxygen levels are the following:

Emission source	Reference oxygen levels
Directly heated PB or directly heated OSB dryers alone or combined with the press	18 % oxygen by volume
All other sources	No correction for oxygen

The formula for calculating the emission concentration at the reference oxygen level is:

$$E_R = \frac{21 - O_R}{21 - O_M} \times E_M$$

where: E_R (mg/Nm^3): emission concentration at the reference oxygen level;
O_R (vol-%): reference oxygen level;
E_M (mg/Nm^3): measured emission concentration;
O_M (vol-%): measured oxygen level.

The BAT-AELs for emissions to air refer to the average over the sampling period, meaning the following:

Average value of three consecutive measurements of at least 30 minutes each ([1])

([1]) A more suitable measurement period may be employed for any parameter where, due to sampling or analytical limitations, a 30-minute measurement is inappropriate.

EMISSION LEVELS ASSOCIATED WITH BAT (BAT-AELs) FOR EMISSIONS TO WATER

The BAT-AELs for emissions to water given in these BAT conclusions refer to values of concentrations (mass of emitted substances per volume of water), expressed in the unit mg/l.

These BAT-AELs refer to the average of samples obtained during one year, meaning the flow-weighted average of all 24-hour flow-proportional composite samples, taken in one year with the minimum frequency set for the relevant parameter and under normal operating conditions.

The formula for calculating the flow-weighted average of all 24-hour flow-proportional composite samples is:

$$c_w = \sum_{i=1}^{n} c_i q_i / \sum_{i=1}^{n} q_i$$

where: c_w = flow-weighted average concentration of the parameter;
n = number of measurements;
c_i = average concentration of the parameter during ith time period;
q_i = average flow rate during ith time period.

Time-proportional sampling can be used provided that sufficient flow stability can be demonstrated.

All BAT-AELs for emissions to water apply at the point where the emission leaves the installation.

DEFINITIONS AND ACRONYMS

For the purpose of these BAT conclusions, the following definitions apply:

Term	Definition
COD	Chemical oxygen demand; the amount of oxygen needed for the total oxidation of the organic matter to carbon dioxide (normally in reference to analysis with dichromate oxidation).
Continuous measurement	Continuous determination of a measurand using a permanently installed 'automated measuring system' (AMS) or 'continuous emission monitoring system' (CEM).
Continuous press	A panel press that presses a continuous mat.
Diffuse emissions	Non-channelled emissions that are not released via specific emission points such as stacks.
Directly heated dryer	A dryer where hot gases from a combustion plant, or any other source, are in direct contact with the particles, strands or fibres to be dried. The drying is achieved by convection.
Dust	Total particulate matter.
Existing plant	A plant that is not a new plant.
Fibre	Lignocellulosic components of wood or other plant materials derived by mechanical or thermo-mechanical pulping using a refiner. Fibres are used as the starting material for the production of fibreboard.

Term	Definition
Fibreboard	As defined in EN 316 i.e. 'panel material with a nominal thickness of 1,5 mm or greater, manufactured from lignocellulosic fibres with application of heat and/or pressure'. Fibreboards include wet process boards (hardboard, medium board, softboard) and dry-process fibreboard (MDF).
Hardwood	Group of wood species including aspen, beech, birch and eucalyptus. The term hardwood is used as an opposite to the term softwood.
Indirectly heated dryer	A dryer where the drying is exclusively achieved by radiation and conduction heat.
Mat forming	The process of laying out particles, strands or fibres to create the mat, which is directed to the press.
Multi-opening press	A panel press that presses one or more individually formed panels.
New plant	A plant first permitted at the site of the installation following the publication of these BAT conclusions or a complete replacement of a plant following the publication of these BAT conclusions.
NO_X	The sum of nitrogen oxide (NO) and nitrogen dioxide (NO_2), expressed as NO_2.
OSB	Oriented strand board, as defined in EN 300 i.e. 'multi-layered board mainly made from strands of wood together with a binder. The strands in the external layer are aligned and parallel to the board length or width. The strands in the internal layer or layers can be randomly orientated or aligned, generally at right angles to the strands in the external layers'.
PB	Particle board, as defined in EN 309 i.e. 'panel material manufactured under pressure and heat from particles of wood (wood flakes, chips, shavings, saw-dust and similar) and/or other lignocellulosic material in particle form (flax shives, hemp shives, bagasse fragments and similar), with the addition of an adhesive'.
PCDD/F	Polychlorinated dibenzo-dioxins and -furans
Periodic measurement	Measurement at specified time intervals using manual or automated reference methods.
Process water	Waste water derived from processes and activities within the production plant, excluding surface run-off water.
Recovered wood	Material predominantly containing wood. Recovered wood can consist of 'reclaimed wood' and 'wood residues'. 'Reclaimed wood' is a material predominantly containing wood derived directly from post-consumer recycled wood.
Refining	Transforming wood chips into fibres using a refiner.
Roundwood	A wood log.
Softwood	Wood from conifers including pine and spruce. The term softwood is used as an opposite to the term hardwood.
Surface run-off water	Water from precipitation run-off and drainage, collected from outdoor log yard areas, including outdoor process areas.
TSS	Total suspended solids (in waste water); mass concentration of all suspended solids as measured by filtration through glass fibre filters and gravimetry.

Term	Definition
TVOC	Total Volatile Organic Compounds, expressed as C (in air).
Upstream and downstream wood processing	All active handling and manipulation, storage or transport of wood particles, chips, strands or fibres and of pressed panels. Upstream processing includes all wood processing from the point that the wood raw material leaves the storage yard. Downstream processing includes all processes after the panel leaves the press and until the raw panel or the value-added panel product is directed to storage. Upstream and downstream wood processing do not include the drying process or the pressing of panels.

1.1. GENERAL BAT CONCLUSIONS

1.1.1. **Environmental management system**

BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:

I. commitment of the management, including senior management;

II. definition of an environmental policy that includes the continuous improvement of the installation by the management;

III. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;

IV. implementation of procedures paying particular attention to:

(a) structure and responsibility

(b) recruitment, training, awareness and competence

(c) communication

(d) employee involvement

(e) documentation

(f) effective process control

(g) maintenance programmes

(h) emergency preparedness and response

(i) safeguarding compliance with environmental legislation;

V. checking performance and taking corrective action, paying particular attention to:

(a) monitoring and measurement (see also the Reference Report on Monitoring)

(b) corrective and preventive action

(c) maintenance of records

(d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;

VI. review of the EMS and its continuing suitability, adequacy and effectiveness by senior management;

VII. following the development of cleaner technologies;

VIII. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life;

IX. application of sectoral benchmarking on a regular basis.

In some cases, the following features are part of the EMS:

X. waste management plan (see BAT 11);

XI. quality control plan for recovered wood used as raw material for panels and used as a fuel (see BAT 2b);

XII. noise management plan (see BAT 4);

XIII. odour management plan (see BAT 9);

XIV. dust management plan (see BAT 23).

Applicability

The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.

1.1.2. **Good housekeeping**

BAT 2. In order to minimise the environmental impact of the production process, BAT is to apply good housekeeping principles using all of the techniques given below.

	Description
a	Careful selection and control of chemicals and additives.
b	Application of a programme for the quality control of recovered wood used as raw material and/or as fuel ([1]), in particular to control pollutants such as As, Pb, Cd, Cr, Cu, Hg, Zn, chlorine, fluorine and PAH.
c	Careful handling and storage of raw materials and waste.
d	Regular maintenance and cleaning of equipment, transport routes and raw material storage areas.
e	Review options for the reuse of process water and the use of secondary water sources.

([1]) *EN 14961-1:2010 can be used for the classification of solid biofuels.*

BAT 3. In order to reduce emissions to air, BAT is to operate the waste gas treatment systems with a high availability and at optimal capacity during normal operating conditions.

Description

Special procedures can be defined for other than normal operating conditions, in particular:

(i) during start-up and shut-down operations;

(ii) during other special circumstances which could affect the proper functioning of the systems (e.g. regular and extraordinary maintenance work and cleaning operations of the combustion plant and/or of the waste gas treatment system).

1.1.3. **Noise**

BAT 4. In order to prevent or, where that is not practicable, to reduce noise and vibrations, BAT is to use one or a combination of the techniques given below.

	Description	Applicability
Techniques for the prevention of noise and vibrations		
a	Strategic planning of the plant layout in order to accommodate the noisiest operations, e.g. so that on-site buildings act as insulation.	Generally applicable in new plants. The layout of a site may limit the applicability on existing plants
b	Applying a noise reduction programme which includes noise source mapping, determination of off-site receptors, modelling of noise propagation and evaluation of the most cost-effective measures and their implementation.	Generally applicable
c	Performing regular noise surveys with monitoring of noise levels outside the site boundaries.	
Techniques for reduction of noise and vibrations from point sources		
d	Enclosing noisy equipment in housing or by encapsulation and by soundproofing buildings.	Generally applicable
e	Decoupling individual equipment to pre-empt and limit propagation of vibrations and resonance noise.	
f	Point source insulation using silencer, damping, attenuators on noise sources, e.g. fans, acoustic vents, mufflers, and acoustic enclosures of filters.	
g	Keeping gates and doors closed at all times when not in use. Minimising the fall height when unloading roundwood.	
Techniques for reduction of noise and vibrations at the site level		
h	Reducing noise from traffic by limiting the speed of internal traffic and for trucks entering the site.	Generally applicable
i	Limiting outdoor activities during the night.	
j	Regular maintenance of all equipment.	
k	Using noise protection walls, natural barriers or embankments to screen noise sources.	

1.1.4. **Emissions to soil and groundwater**

BAT 5. In order to prevent emissions to soil and groundwater, BAT is to use the techniques given below.

I. load and unload resins and other auxiliary materials only in designated areas that are protected against leakage run-off;

II. whilst awaiting disposal, collect all material and store in designated areas protected against leakage run-off;

III. equip all pump sumps or other intermediary storage facilities from which spillages may occur with alarms activated by high levels of liquid;

IV. establish and implement a programme for the testing and inspection of tanks and pipelines carrying resins, additives and resin mixes;

V. carry out inspections for leaks on all flanges and valves on pipes used to transport materials other than water and wood; maintain a log of these inspections;

VI. provide a containment system to collect any leaks from flanges and valves on pipes used to transport materials other than water and wood, except when the construction of flanges or valves is technically tight;

VII. provide an adequate supply of containment booms and suitable absorbent material;

VIII. avoid underground piping for transporting substances other than water and wood;

IX. collect and safely dispose of all water from firefighting;

X. construct impermeable bottoms in retention basins for surface run-off water from outdoor wood storage areas.

1.1.5. **Energy management and energy efficiency**

BAT 6. In order to reduce energy consumption, BAT is to adopt an energy management plan, which includes all of the techniques given below.

I. use a system to track energy usage and costs;

II. carry out energy efficiency audits of major operations;

III. use a systematic approach to continuously upgrade equipment in order to increase energy efficiency;

IV. upgrade controls of energy usage;

V. apply in-house energy management training for operators.

BAT 7. In order to increase the energy efficiency, BAT is to optimise the operation of the combustion plant by monitoring and controlling key combustion parameters (e.g. O_2, CO, NO_x) and applying one or a combination of the techniques given below.

	Technique	Applicability
a	Dewater wood sludge before it is used as a fuel	Generally applicable
b	Recover heat from hot waste gases in wet abatement systems using a heat exchanger	Applicable to plants with a wet abatement system and when the recovered energy can be used
c	Recirculate hot waste gases from different processes to the combustion plant or to preheat hot gases for the dryer	Applicability may be restricted for indirectly heated dryers, fibre dryers or where the combustion plant configuration does not allow controlled air addition

BAT 8. In order to use energy efficiently in the preparation of wet fibres for fibreboard production, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a	Cleaning and softening of chips	Mechanical cleaning and washing of raw chips	Applicable to new refiner plants and major retrofits
b	Vacuum evaporation	Recovering hot water for steam generation	Applicable to new refiner plants and major retrofits
c	Heat recovery from steam during refining	Heat exchangers to produce hot water for steam generation and chip washing	Applicable to new refiner plants and major retrofits

1.1.6. **Odour**

BAT 9. In order to prevent or, where that is not practicable, to reduce odour from the installation, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:

I. a protocol containing actions and timelines;

II. a protocol for conducting odour monitoring;

III. a protocol for response to identified odour events;

IV. an odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.

Applicability

The applicability is restricted to cases where an odour nuisance in residential or other sensitive areas (e.g. recreational areas) can be expected and/or has been reported.

BAT 10. In order to prevent and reduce odour, BAT is to treat waste gas from the dryer and the press, according to BAT 17 and 19.

1.1.7. **Management of waste and residues**

BAT 11. In order to prevent or, where that is not practicable, to reduce the quantity of waste being sent for disposal, BAT is to adopt and implement a waste management plan as part of the environmental management system (see BAT 1) that, in order of priority, ensures that waste is prevented, prepared for reuse, recycled or otherwise recovered.

BAT 12. In order to reduce the quantity of solid waste being sent for disposal, BAT is to use one or a combination of the techniques given below.

	Technique	Applicability
a	Reuse internally collected wood residues, such as trimmings and rejected panels, as a raw material.	The applicability for reject fibreboard panel products may be limited.
b	Use internally collected wood residues, such as wood fines and dust collected in a dust abatement system and wood sludge from waste water filtration, as fuel (in appropriately equipped on-site combustion plants) or as a raw material.	The use of wood sludge as a fuel may be restricted if the energy consumption needed for drying outweighs the environmental benefits.
c	Use ring collection systems with one central filtration unit to optimise the collection of residues, e.g. bag filter, cyclofilter, or high efficiency cyclones.	Generally applicable for new plants. The layout of an existing plant may limit the applicability.

BAT 13. In order to ensure the safe management and reuse of bottom ash and slag from biomass-firing, BAT is to use all of the techniques given below.

	Technique	Applicability
a	Continuously review options for off-site and on-site reuse of bottom ash and slag.	Generally applicable.
b	An efficient combustion process which lowers the residual carbon content.	Generally applicable.
c	Safe handling and transport of bottom ash and slag in closed conveyers and containers, or by humidification.	Humidification is only necessary when bottom ash and slag are wetted for safety reasons.
d	Safe storage of bottom ash and slag in a designated impermeable area with leachate collection.	Generally applicable.

1.1.8. **Monitoring**

BAT 14. BAT is to monitor emissions to air and water and to monitor process flue-gases in accordance with EN standards with at least the frequency given below. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

Monitoring of emissions to air from the dryer and for combined treated emissions from the dryer and the press

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
Dust	EN 13284-1	Periodic measurement at least once every six months	BAT 17
TVOC (1)	EN 12619		BAT 17
Formaldehyde	No EN standard available (6)		BAT 17
NO_X	EN 14792		BAT 18
HCl (4)	EN 1911		—
HF (4)	ISO 15713		—
SO_2 (2)	EN 14791	Periodic measurement at least once a year	—
Metals (3) (4)	EN 13211 (for Hg), EN 14385 (for other metals)		—
PCDD/F (4)	EN 1948 parts 1, 2 and 3		—
NH_3 (5)	No EN standard available		—

(1) Methane monitored according to EN ISO 25140 or EN ISO 25139 is subtracted from the result when using natural gas, LPG, etc. as a fuel.
(2) Not relevant when using mainly wood-derived fuels, natural gas, LPG, etc. as a fuel.
(3) Including As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl and V.
(4) Relevant if contaminated recovered wood is used as fuel.
(5) Relevant if SNCR is applied.
(6) In the absence of an EN standard, the preferred approach is isokinetic sampling in an impinging solution with a heated probe and filter box and without probe washing, e.g. based on the US EPA M316 method.

Monitoring of emissions to air from the press

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
Dust	EN 13284-1	Periodic measurement at least once every six months	BAT 19
TVOC	EN 12619		BAT 19
Formaldehyde	No EN standard available (2)		BAT 19

Monitoring of emissions to air from paper impregnation drying ovens

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
TVOC (1)	EN 12619	Periodic measurement at least once a year	BAT 21
Formaldehyde	No EN standard available (2)		BAT 21

(1) Methane monitored according to EN ISO 25140 or EN ISO 25139 is subtracted from the result when using natural gas, LPG, etc. as a fuel.
(2) In the absence of an EN standard, the preferred approach is isokinetic sampling in an impinging solution with a heated probe and filter box and without probe washing, e.g. based on the US EPA M316 method.

Monitoring of channelled emissions to air from upstream and downstream processing

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
Dust	EN 13284-1 (1)	Periodic measurement at least once a year (1)	BAT 20

(1) Sampling from bag filters and cyclofilters can be replaced by continuous monitoring of the pressure drop across the filter as an indicative surrogate parameter.

Monitoring of combustion process flue-gas that is subsequently used for directly heated dryers (1)

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
NO_X	Periodic: EN 14792 Continuous: EN 15267-1 to 3 and EN 14181	Periodic measurement at least once a year or continuous measurement	BAT 7
CO	Periodic: EN 15058 Continuous: EN 15267-1 to 3 and EN 14181		BAT 7

(1) The measurement point is before the mixing of the flue-gas with other airstreams and only if technically feasible.

Monitoring of emissions to water from wood fibre production

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
TSS	EN 872	Periodic measurement at least once a week.	BAT 27
COD ([1])	No EN standard available		BAT 27
TOC (Total organic carbon, expressed as C)	EN 1484		—
Metals ([2]), if relevant (e.g. when recovered wood is used)	Various EN standards available	Periodic measurement at least once every six months.	—

([1]) There is a tendency to replace COD with TOC for economic and environmental reasons. A correlation between the two parameters should be established on a site-specific basis.
([2]) Including As, Cr, Cu, Ni, Pb and Zn.

Monitoring of emissions to water from surface run-off water

Parameter	Standard(s)	Minimum monitoring frequency	Monitoring associated with
TSS	EN 872	Periodic measurement at least once every three months ([1])	BAT 25

([1]) Flow-proportional sampling can be replaced by another standard sampling procedure if the flow is insufficient for representative sampling.

BAT 15. In order to ensure the stability and efficiency of techniques used to prevent and reduce emissions, BAT is to monitor appropriate surrogate parameters.

Description

The surrogate parameters monitored may include: waste gas airflow; waste gas temperature; visual appearance of emissions; water flow and water temperature for scrubbers; voltage drop for electrostatic precipitators; fan speed and pressure drop across bag filters. The selection of surrogate parameters depends on the techniques implemented for the prevention and reduction of emissions.

BAT 16. BAT is to monitor key process parameters relevant for emissions to water from the production process, including waste water flow, pH and temperature.

1.2. EMISSIONS TO AIR

1.2.1. **Channelled emissions**

BAT 17. In order to prevent or reduce emissions to air from the dryer, BAT is to achieve and manage a balanced operation of the drying process and to use one or a combination of the techniques given below.

	Technique	Main pollutants abated	Applicability
a	Dust abatement of inlet hot gas to a directly heated dryer in combination with one or a combination of the other techniques listed below	Dust	Applicability may be restricted, e.g. in cases of existing smaller wood dust burners.
b	Bag filter ([1])	Dust	Applicable to indirectly heated dryers only. Due to safety concerns, special care should be taken when using exclusively recovered wood.

	Technique	Main pollutants abated	Applicability
c	Cyclone (1)	Dust	Generally applicable.
d	UTWS dryer and combustion with heat exchanger and thermal treatment of discharged dryer waste gas (1)	Dust, volatile organic compounds	Not applicable to fibre dryers. Applicability may be limited for existing combustion plants not suitable for post-combustion of the partial dryer waste gas flow.
e	Wet electrostatic precipitator (1)	Dust, volatile organic compounds	Generally applicable.
f	Wet scrubber (1)	Dust, volatile organic compounds	Generally applicable.
g	Bioscrubber (1)	Dust, volatile organic compounds	Applicability may be limited by high dust concentrations and high temperatures in the waste gas from the dryer.
h	Chemical degradation or capture of formaldehyde with chemicals in combination with a wet scrubbing system	Formaldehyde	Generally applicable in wet abatement systems.

(1) Descriptions of the techniques are given in Section 1.4.1.

Table 1

BAT-associated emission levels (BAT-AELs) for emissions to air from the dryer and for combined treated emissions from the dryer and the press

Parameter	Product	Dryer type	Unit	BAT-AELs (average over the sampling period)
Dust	PB or OSB	Directly heated dryer	mg/Nm³	3–30
		Indirectly heated dryer		3–10
	Fibre	All types		3–20
TVOC	PB	All types		< 20–200 (1) (2)
	OSB			10–400 (2)
	Fibre			< 20–120
Formaldehyde	PB	All types		< 5–10 (3)
	OSB			< 5–20
	Fibre			< 5–15

(1) This BAT-AEL does not apply when using pine as the predominant raw material.
(2) Emissions below 30 mg/Nm³ can be achieved using UTWS dryer.
(3) When using almost exclusively recovered wood, the upper end of the range may be up to 15 mg/Nm³.

The associated monitoring is in BAT 14.

BAT 18. In order to prevent or reduce NO_X emissions to air from directly heated dryers, BAT is to use technique (a) or technique (a) in combination with technique (b).

	Technique	Applicability
a	Efficient operation of the combustion process using air- and fuel-staged combustion, while applying pulverised combustion, fluidised bed boilers or moving grate firing	Generally applicable
b	Selective non-catalytic reduction (SNCR) by injection and reaction with urea or liquid ammonia	Applicability may be limited by highly variable combustion conditions

Table 2

BAT-associated emission levels (BAT-AELs) for NO_x emissions to air from a directly heated dryer

Parameter	Unit	BAT-AELs (average over the sampling period)
NO_x	mg/Nm^3	30–250

The associated monitoring is in BAT 14.

BAT 19. In order to prevent or reduce emissions to air from the press, BAT is to use in-duct quenching of collected press waste gas and an appropriate combination of the techniques given below.

	Technique	Main pollutants abated	Applicability
a	Select resins with a low formaldehyde content	Volatile organic compounds	Applicability may be restricted, e.g. due to demands for a specific product quality
b	Controlled operation of the press with balanced press temperature, applied pressure and press speed	Volatile organic compounds	Applicability may be restricted, e.g. due to the operation of the press for specific product qualities
c	Wet scrubbing of collected press waste gases using Venturi scrubbers or hydrocyclones, etc. ([1])	Dust, volatile organic compounds	Generally applicable
d	Wet electrostatic precipitator ([1])	Dust, volatile organic compounds	
e	Bioscrubber ([1])	Dust, volatile organic compounds	
f	Post-combustion as the last treatment step after application of a wet scrubber	Dust, volatile organic compounds	Applicability may be restricted for existing installations where a suitable combustion plant is not available

([1]) Descriptions of the techniques are given in Section 1.4.1.

Table 3

BAT-associated emission levels (BAT-AELs) for emissions to air from the press

Parameter	Unit	BAT-AELs (average over the sampling period)
Dust	mg/Nm^3	3–15
TVOC	mg/Nm^3	10–100
Formaldehyde	mg/Nm^3	2–15

The associated monitoring is in BAT 14.

BAT 20. In order to reduce dust emissions to air from upstream and downstream wood processing, conveying of wood materials and mat forming, BAT is to use either a bag filter or a cyclofilter.

Applicability

Due to safety concerns, a bag filter or a cyclofilter may not be applicable when recovered wood is used as a raw material. In that case a wet abatement technique (e.g. scrubber) may be used.

Table 4

BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from upstream and downstream wood processing, conveying of wood materials and mat forming

Parameter	Unit	BAT-AELs (average over the sampling period)
Dust	mg/Nm^3	< 3–5 ([1])

([1]) When a bag filter or a cyclofilter is not applicable, the upper end of the range can be up to 10 mg/Nm^3.

The associated monitoring is in BAT 14.

BAT 21. In order to reduce emissions of volatile organic compounds to air from the drying ovens for the impregnation of paper, BAT is to use one or a combination of the techniques given below.

	Technique	Applicability
a	Select and use resins with a low formaldehyde content	Generally applicable
b	Controlled operation of ovens with balanced temperature and speed	
c	Thermal oxidation of waste gas in a regenerative thermal oxidiser or a catalytic thermal oxidiser ([1])	

	Technique	Applicability
d	Post-combustion or incineration of waste gas in a combustion plant	Applicability may be restricted for existing installations where a suitable combustion plant is not available on site
e	Wet scrubbing of waste gas followed by treatment in a biofilter ([1])	Generally applicable

([1]) Description of the technique is given in Section 1.4.1.

Table 5

BAT-associated emission levels (BAT-AELs) for TVOC and formaldehyde emissions to air from a drying oven for the impregnation of paper

Parameter	Unit	BAT-AELs (average over the sampling period)
TVOC	mg/Nm^3	5–30
Formaldehyde	mg/Nm^3	< 5–10

The associated monitoring is in BAT 14.

1.2.2. **Diffuse emissions**

BAT 22. In order to prevent or, where that is not practicable, to reduce diffuse emissions to air from the press, BAT is to optimise the efficiency of the off-gas collection and to channel the off-gases for treatment (see BAT 19).

Description

Effective collection and treatment of waste gases (see BAT 19) both at the press exit and along the press line for continuous presses. For existing multi-opening presses the applicability of enclosing the press may be restricted due to safety reasons.

BAT 23. In order to reduce diffuse dust emissions to air from the transport, handling, and storage of wood materials, BAT is to set up and implement a dust management plan, as part of the environmental management system (see BAT 1) and to apply one or a combination of the techniques given below.

	Technique	Applicability
a	Regularly clean transport routes, storage areas and vehicles	Generally applicable
b	Unload sawdust using covered drive-through unloading areas	
c	Store sawdust dust-prone material in silos, containers, roofed piles, etc. or enclose bulk storage areas	
d	Suppress dust emissions by water sprinkling	

1.3. EMISSIONS TO WATER

BAT 24. In order to reduce the pollution load of the collected waste water, BAT is to use both of the techniques given below.

	Technique	Applicability
a	Collect, and treat separately, surface run-off water and process waste water	Applicability may be restricted on existing plants due to the configuration of the existing drainage infrastructure
b	Store any wood except roundwood and slabs ([1]) on a hard-surfaced area	Generally applicable

([1]) An outer piece of wood, with or without the bark removed, from the first cuts in a sawing process to render the log into lumber (timber).

BAT 25. In order to reduce emissions to water from surface run-off water, BAT is to use a combination of the techniques given below.

	Technique	Applicability
a	Mechanical separation of coarse materials by screens and sieves as preliminary treatment	Generally applicable
b	Oil-water separation ([1])	Generally applicable
c	Removal of solids by sedimentation in retention basins or settlement tanks ([1])	There may be restrictions to the applicability of sedimentation due to space requirements

([1]) Descriptions of the techniques are given in Section 1.4.2.

Table 6

BAT-associated emission levels (BAT-AELs) for TSS for the direct discharge of surface run-off water to a receiving water body

Parameter	Unit	BAT-AELs (average of samples obtained during one year)
TSS	mg/l	10–40

The associated monitoring is in BAT 14.

BAT 26. In order to prevent or reduce the generation of process waste water from wood fibre production, BAT is to maximise process water recycling.

Description

Recycle process water from chip washing, cooking and/or refining in closed or open loops by treating it at the refiner plant level by mechanical removal of solids, in the most appropriate manner, or by evaporation.

BAT 27. In order to reduce emissions to water from wood fibre production, BAT is to use a combination of the techniques given below.

	Technique	Applicability
a	Mechanical separation of coarse materials by screens and sieves	Generally applicable
b	Physico-chemical separation, e.g. using sand filters, dissolved air flotation, coagulation and flocculation ([1])	
c	Biological treatment ([1])	

([1]) Descriptions of the techniques are given in Section 1.4.2.

Table 7

BAT-associated emission levels (BAT-AELs) for the direct discharge to a receiving water body of process waste water from wood fibre production

Parameter	BAT-AELs (average of samples obtained during one year)
	mg/l
TSS	5–35
COD	20–200

The associated monitoring is in BAT 14.

BAT 28. In order to prevent or reduce the generation of waste water from wet air abatement systems that will need treatment prior to discharge, BAT is to use one or a combination of the techniques given below.

Technique ([1])	Applicability
Sedimentation, decanting, screw and belt presses to remove collected solids in wet abatement systems	Generally applicable
Dissolved air flotation. Coagulation and flocculation followed by removal of floccules by flotation aided by dissolved air	

([1]) Descriptions of the techniques are given in Section 1.4.2.

1.4. DESCRIPTION OF TECHNIQUES

1.4.1. **Emissions to air**

Technique	Description
Biofilter	A biofilter degrades organic compounds by biological oxidation. A waste gas stream is passed through a supporting bed of inert material (e.g. plastics or ceramics) on which organic compounds are oxidised by naturally occurring microorganisms. The biofilter is sensitive to dust, high temperatures or high variation in the waste gas inlet temperature.
Bioscrubber	A bioscrubber is a biofilter combined with a wet scrubber that preconditions the waste gas by removing dust and lowering the inlet temperature. Water is recycled continuously, entering the top of the packed bed column, from where it trickles down. Water collects in a settlement tank where additional degradation takes place. Adjustment of pH and the addition of nutrients can optimise degradation.

Technique	Description
Cyclone	A cyclone uses inertia to remove dust from waste gas streams by imparting centrifugal forces, usually within a conical chamber. Cyclones are used as a pretreatment before further dust abatement or abatement of organic compounds. Cyclones can be applied alone or as multicyclones.
Cyclofilter	A cyclofilter uses a combination of cyclone technology (to separate coarser dust) and bag filters (to capture finer dust).
Electrostatic precipitator (ESP)	Electrostatic precipitators operate such that particles are charged and separated under the influence of an electrical field. The ESP is capable of operating over a wide range of conditions.
Wet electrostatic precipitator (WESP)	The wet electrostatic precipitator consists of a wet scrubber stage, which scrubs and condenses the waste gas, and an electrostatic precipitator operating in wet mode in which the collected material is removed from the plates of the collectors by flushing with water. A mechanism is usually installed to remove water droplets before discharge of the waste gas (e.g. a demister). Collected dust is separated from the water phase.
Bag filter	Bag filters consist of porous woven or felted fabric through which gases pass to remove particles. The use of a bag filter requires the selection of a fabric appropriate for the characteristics of the flue-gas and the maximum operating temperature.
Catalytic thermal oxidiser (CTO)	Catalytic thermal oxidisers destroy organic compounds catalytically over a metal surface and thermally in a combustion chamber where a flame from combustion of a fuel, normally natural gas, and the VOCs present in the waste gas, heat the waste gas stream. The incineration temperature is between 400 °C and 700 °C. Heat can be recovered from the treated waste gas before release.
Regenerative thermal oxidiser (RTO)	Thermal oxidisers destroy organic compounds thermally in a combustion chamber where a flame from the combustion of a fuel, normally natural gas, and the VOCs present in the waste gas, heat the waste gas stream. The incineration temperature is between 800 °C and 1 100 °C. Regenerative thermal oxidisers have two or more ceramic packed bed chambers where the combustion heat from one incineration cycle in the first chamber is used to preheat the packed bed in the second chamber. Heat can be recovered from the treated waste gas before release.
UTWS dryer and combustion with heat exchanger and thermal treatment of discharged dryer waste gas	UTWS is a German acronym: 'Umluft' (recirculation of dryer waste gas), 'Teilstromverbrennung' (post-combustion of partial directed dryer waste gas stream), 'Wärmerückgewinnung' (heat recovery of dryer waste gas), 'Staubabsheidung' (dust treatment of air emission discharge from the combustion plant). UTWS is a combination of a rotary dryer with a heat exchanger and a combustion plant with recirculation of dryer waste gas. The recirculated dryer waste gas is a hot vapour stream that enables a vapour drying process. The dryer waste gas is reheated in a heat exchanger heated by the combustion flue-gases and is fed back to the dryer. Part of the dryer waste gas stream is continuously fed to the combustion chamber for post-combustion. Pollutants emitted from the wood drying are destroyed over the heat exchanger and by the post-combustion. The flue gases discharged from the combustion plant are treated by a bag filter or electrostatic precipitator.
Wet scrubber	Wet scrubbers capture and remove dust by inertial impaction, direct interception and absorption in the water phase. Wet scrubbers can have various designs and operating principles, e.g. spray scrubber, impingement plate scrubber or Venturi scrubber, and can be used as a dust pretreatment or a stand-alone technique. Some removal of organic compounds may be achieved and can be further enhanced by using chemicals in the scrubbing water (achieving chemical oxidation or another conversion). The resulting liquid has to be treated by separating the collected dust by sedimentation or filtration.

1.4.2. **Emissions to water**

Technique	Description
Biological treatment	The biological oxidation of dissolved organic substances using the metabolism of microorganisms, or the breakdown of organic content in waste water by the action of microorganisms in the absence of air. The biological action is usually followed by the removal of suspended solids, e.g. by sedimentation.
Coagulation and flocculation	Coagulation and flocculation are used to separate suspended solids from waste water and are often carried out in successive steps. Coagulation is carried out by adding coagulants with charges opposite to those of the suspended solids. Flocculation is carried out by adding polymers, so that collisions of microfloc particles cause them to bond to produce larger flocs.
Flotation	The separation of large flocs or floating particles from the effluent by bringing them to the surface of the suspension.
Dissolved air flotation	Flotation techniques relying on the use of dissolved air to achieve separation of coagulated and flocculated material..
Filtration	The separation of solids from a waste water carrier by passing them through a porous medium. It includes different types of techniques, e.g. sand filtration, microfiltration and ultrafiltration.
Oil-water separation	The separation and extraction of insoluble hydrocarbons, relying on the principle of the difference in gravity between the phases (liquid-liquid or solid-liquid). The higher density phase settles and the lower density phase floats to the surface.
Retention basins	Large surface area lagoons for the passive gravitational settlement of solids.
Sedimentation	The separation of suspended particles and material by gravitational settling.