Integrated Pollution Prevention and Control

BAT Guidance note

WOOD and _FURNITURE

Estonia
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Prepared by IPPC project, Estonia

BAT NOTE ON WOOD AND FURNITURE INDUSTRY

Table of Contents:

1. Introduction

This Note is designed to provide guidance for future permitting of Furniture Industry in Estonia. It compiles US and Ireland BAT definitions concerning the wood and furniture industry. Also Estonian BAT specifications elaborated at branch-specific workshop in Autumn 1998 are added as a separate annex.

It should be noted that noise and vibration is not included within the scope of this work and guidance on this parameter will be issued separately. But still noise and vibration issues shall not be discarded in permitting process as those can also create serious environmental problems.

This Guidance Note comprises six main sections and List of used literature. Following this introduction, Section 2 contains a general note on the interpretation of Best Available Techniques (BAT) and status of the Guidance Note. The industrial activity covered by the terms of this note is given in Section 3, which is divided into two parts: a) description of industrial processes; b) the emissions from the common processes. In Section 4, BAT measures to control emissions are listed and in Section 5 the specific emission limit values (ELVs) are given. Section 6 contains comments on compliance monitoring requirements.

All applicants for Integrated Pollution Prevention and Control (I.P.P.C) licences covered by this note, should carefully examine the information laid down in this Guidance Note, and should use this information to assist in the making of a satisfactory application for an I.P.P.C. license for Regional Environmental Department (RED).

It should be clearly understood that achieving the emission limit values does not, by itself, meet the overall requirements in the relation to I.P.P.C. In addition to meeting such values the applicant will also be required to demonstrate the waste minimisation is a priority objective and to put in place particular abatement measures to reduce overall mass emissions and pollutant load where this is necessary to protect the ambient environment.

The techniques and the associated emission limit values (ELVs) identified in this Guidance Note are, in the time of writing, regarded as representing BAT for new activities. BAT is not a static quality and will change as technologies, environmental factors and costs alter with the passage of time.

The information contained in this Guidance Note is intended to be used as a tool to assist in determining the BAT for an operation in this sector and should not be taken to be a definitive authority on the BAT for this sector.

This Note should not e considered as a legal document.

2. Interpretation of BAT

According to the I.P.P.C. Directive *the Best Available Technique* (BAT) means the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values (ELVs) designed to prevent and, where it is not practicable, generally to reduce emissions and the impact on the environment as a whole

Techniques include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned, including also training. **Available** techniques means those developed on a scale which allows implementation in industrial sector under economically and technically viable conditions, taking into consideration the costs and advantages. **Best** means most effective in achieving a high general level of protection of the environment as a whole.

The objective of the BAT Guidelines is to provide a list of techniques, including technologies, which will provide guidance to the regional environmental departments and the industries when determining BAT for an activity. The BAT identified in this Guidance note is used as a basis for setting emission limit values. It is intended to update these guidelines in order to incorporate technological advances as they occur.

In the identification of BAT, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimisation, rather than end-of-pipe treatment. Consideration should be given to energy efficient technologies and practices and to efficient use of raw materials, chemicals and water. Whenever economically and technically feasible dangerous substances should be substituted to less dangerous or non-dangerous substances. Measures such as in-plant changes, process recycling and improved material handling and storae practices, may be also employed to effect reduction in emissions.

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, which may achieve the same emission. The entire range would not necessarily be appropriate in specific cases. The specific choice depends on a wide range of circumstances but the crucial factor is that the selected regime achieves BAT. When deciding the technology, Ambient Quality Norms must always be respected where set.

As well as providing for the installation of equipment and the operation of procedures for the reduction of possible emissions, BAT will also necessitate the adoption of an on-going programme of environmental management and control, which will focus on continuing improvements aimed at prevention, elimination and/or progressive reduction of emissions.

As described in the Act on Environmental Permits, application of BAT will be used to prevent, eliminate or, where that is not practicable, limit, abate, or reduce an emission from an activity. BAT is defined as the provision and proper maintenance, operation, use and supervision of facilities, which are the most suitable for the purposes.

When determining best available techniques generally or in specific cases, bearing in mind the likely costs and benefits of a measure and the principles of precaution and prevention, account must be taken of:

1) the use of low-waste technology,
2) the use of less hazardous substances,
3) the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate,
4) comparable processes, facilities or methods of operation which have been tried with success on an industrial scale,
5) technological advances and changes in scientific knowledge and understanding,
6) the nature, effects and volume of the emissions concerned,
7) the commissioning dates for new or existing installations,
8) the length of time needed to introduce the best available technique,
9) the consumption and nature of raw materials (including water) used in the process and their energy efficiency,
10) the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it,
11) the need to prevent accidents and to minimise the consequences for the environment, the information published by the European Commission on best available techniques for certain industrial sectors, by international organisations or national authorities.

The techniques and the associated emission limit values (ELVs) identified in this Guidance Note are regarded as representing BAT for a ***new activity***. However, it is also generally intended that ***existing facilities*** will progress towards attainment of similar emission limit values, but the specific ELV requirements and associated time frames will be identified on a case by case basis when the licence application is being processed.

Furthermore, for ***all facilities***, additional and more stringent requirements may be specified on a site-specific bases whenever environmental protection so requires. Hence the BAT guidelines are not the sole basis on which licence emission limit values are to be set, since information from other sources and legal Acts will also be considered, including site-specific environmental and technical data, and other relevant information.

3. Description.

3.1. Description of processes.

This section describes the major industrial processes within:

a) The Lumber and Wood Products industry, which includes sawmills, planing mills, plywood mills, establishments engaged in manufacturing finished articles made entirely or mainly of wood or related materials such as reconstituted wood panel products manufactures, and wood preserving;
b) The Wood Furniture and Fixtures industry.

It is divided into the following sections: sawn lumber, paneling (including veneer and plywood and reconstituted wood panel products), engineered lumber, wood preserving, wood furniture industry.

Sawn Lumber
Sawn lumber is softwood or hardwood trimmed at a sawmill and destined for a future use such as construction, industrial, or furniture products.

The lumber production process is following:

Logs are delivered to sawmills from the forest and stored in ponds or on land. If stored on land, the logs are usually sprayed with water to keep them moist and prevent cracking. The raw logs are debarked and then cut into cants (partially cut lumber) which are trimmed into raw lumber. As the logs are debarked, bark is used as hog fuel for boilers or sold as mulch. Shavings, sawdust and chips can also be used at paper mills and reconstituted wood panel manufacturing plants.

The cants are cut to specific lengths or finished further depending on the final destination of the lumber product. Most lumber is dried to specific moisture content through air or kiln drying.

Sawmills frequently perform surface protection operations to protect lumber against sapstaining that may occur during temporary storage. Sapstains do affect the surface, colouring it with dark blue or black stains. This discoloration may decrease the value of the wood and its acceptance of finishes.

Three major processes are used to apply surface protection chemicals to wood by sawmills: the dip process, the spray process, and the green chain process. Dipping is a batch process; green chain and spray operations are continuous processes.

Panel Products

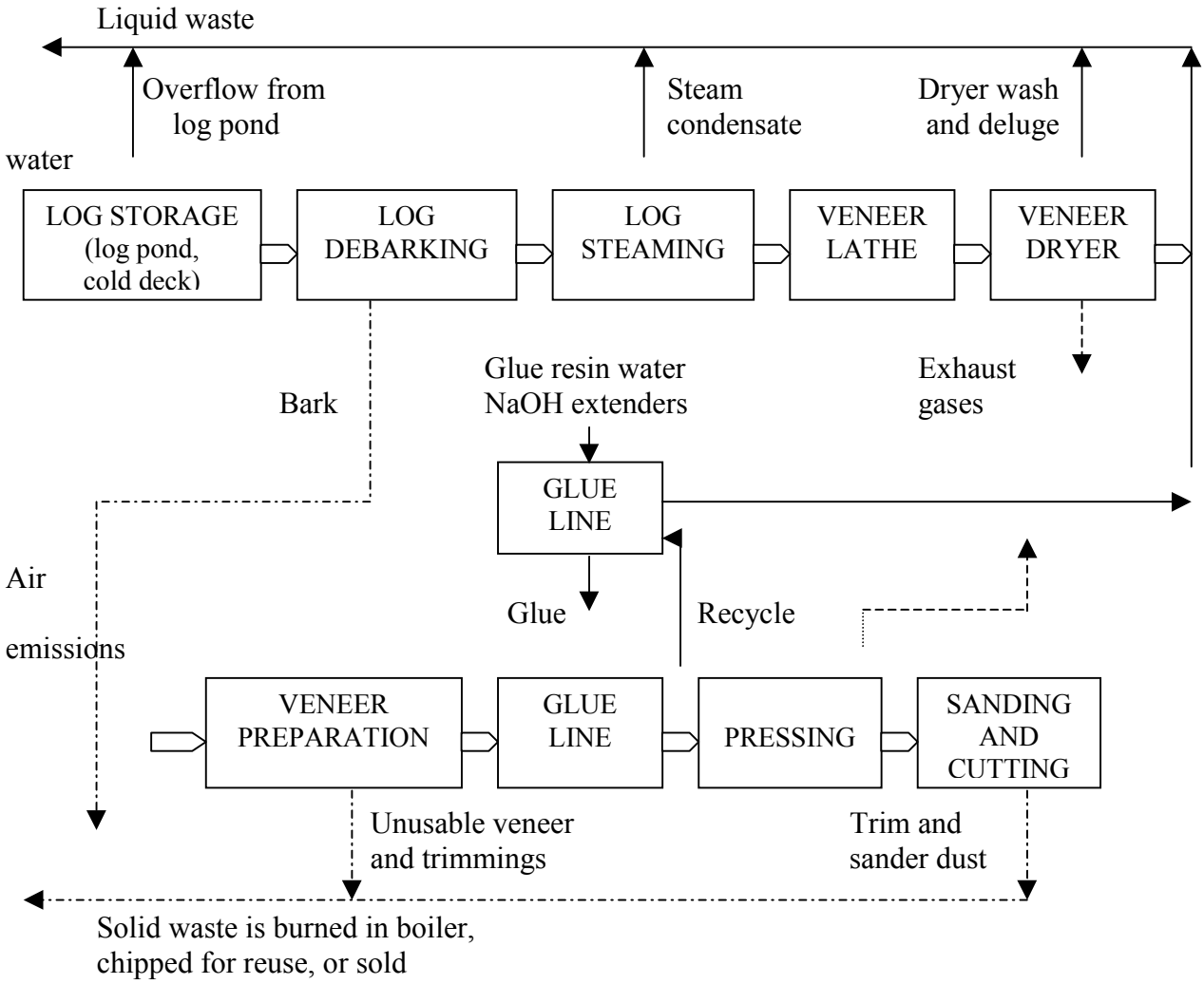
This section describes two classes of panel products: (1) hardwood veneer, softwood veneer, and plywood; and (2) reconstituted wood products.

(1) Hardwood Veneer and Softwood Veneer and Plywood

Veneer is a thin sheet of wood peeled or sliced from blocks of lumber called flitches or logs. Veneer is glued together to form plywood. Softwood veneer and plywood is typically used for structural and industrial applications. Hardwood veneer and plywood is used typically for decorative applications and for making interior panelling, components for furniture and cabinets, etc.

The general process for making softwood and hardwood plywood are the same: log debarking, log steaming and or soaking, veneer cutting, veneer drying, veneer preparation, glue application, pressing, panel trimming, and panel sanding. These basic processes are illustrated in Figure 1.

Figure 1. Flow Diagram of Veneer and Plywood Production



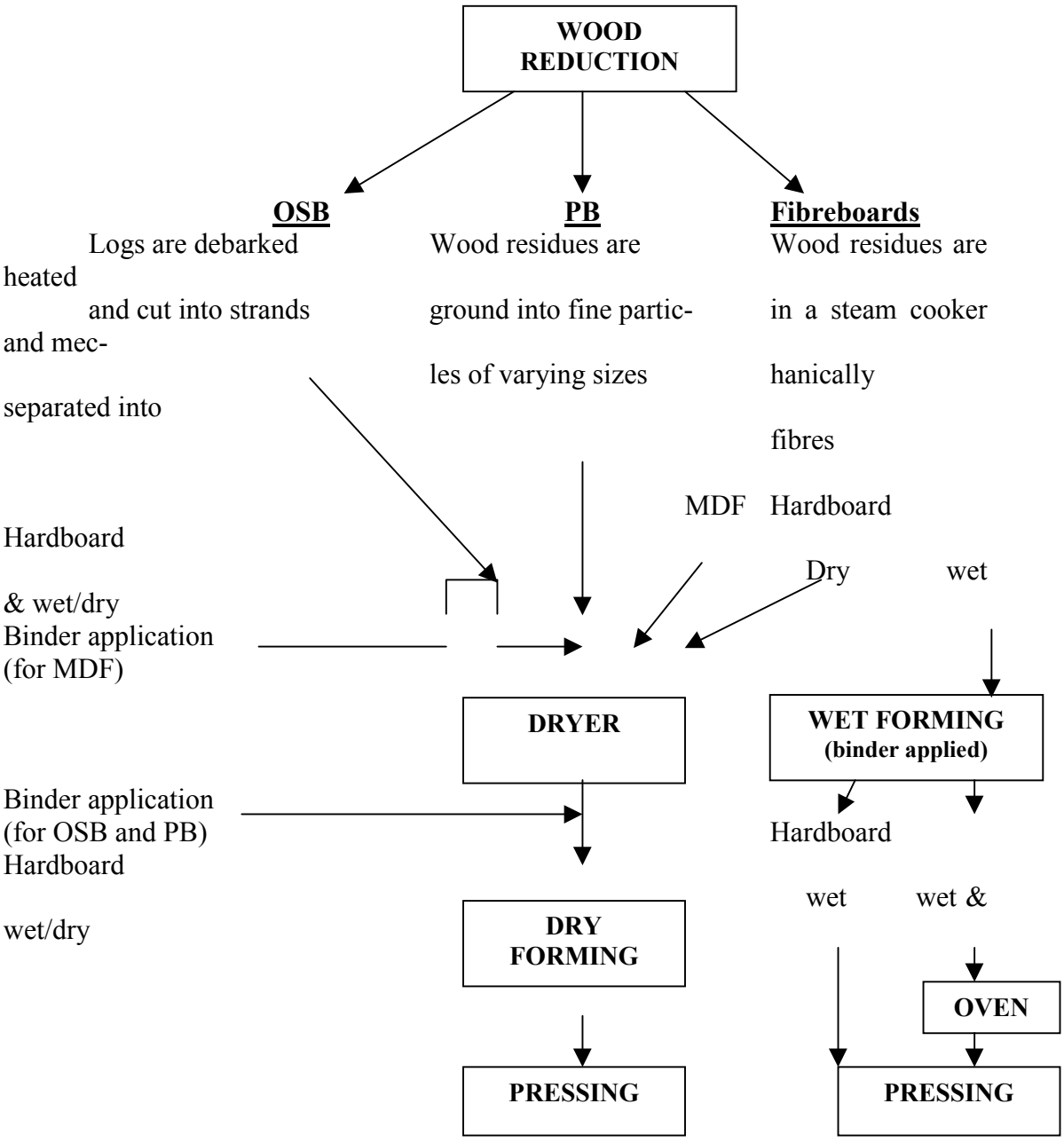
(2) Reconstituted Wood Products

Reconstituted wood products, such as particleboard (PB), medium density fibreboard (MDF), hardboard (HB), and oriented strandboard (OSB), is composed of furnish, or raw wood, that is combined with resins and other additives and formed into a mat,

which is then pressed into a board. The manufacturing processes of these boards differ, as do the raw materials used. For example, particleboard consists of finely ground wood particles of various sizes, while OSB is manufactured using specially prepared strands of wood.

In general, the manufacturing processes involve wood size reduction followed by drying (except for wet process boards), adhesive application, pressing at elevated temperatures. Figure 2 compares the process flows for some reconstituted wood product manufacturing processes.

Figure 2. Reconstituted Wood Panel Process Flow



Engineered Lumber

Several composite wood products, intended as substitutes for lumber as well as other structural materials, are now on the world market. Parallel strand lumber, made from

long strands of veneer, is extruded with phenol-formaldehyde (PF) resin into various cross sections and widths. Parallel laminated veneer, or laminated veneer lumber (LVL), is constructed of veneers that are bonded together with PF adhesive resin to form a laminate.

Glulam beams are also emerging as a substitute for lumber. Glulam is short for glued-laminated structural timber - large beams fabricated by bonding layers of specially selected lumber with resorcinol or resorcinol/PF adhesives and timber. Glulam timbers are used with structural wood panels for many types of heavy timber construction.

Wood preserving

Wood is treated with preservatives to protect it from mechanical, physical and chemical influences. Preserved wood is used primarily in the construction, railroad and utilities industries to prevent rotting when wood is exposed to damp soil, standing water or rain, and as protection against insects and marine borers. The most common preservatives include water-borne inorganics like chromated copper arsenate (CCA) and ammoniacal copper zinc arsenate (ACZA), and oil-borne organics like pentachlorophenol (PCP) and creosote.

Preservatives are applied using similar processes. More than 90 % of the wood preservation in the USA is performed using pressure treatment processes. The penetration required to adequately preserve wood can be achieved only if the wood has been conditioned properly; that is, if the moisture content of the fresh-cut wood is reduced to a point where the preservative can penetrate and be retained by the wood. Open air drying is typically used to prepare large stock for treatment with oil-borne preservatives. Other methods for conditioning wood prior to treatment with oil-borne preservatives include steaming, heating and vapour-drying. Kiln drying is used primarily for water-borne treatment. Conditioning is a major source of wastewater in the wood preserving industry.

After the moisture content of the wood has been reduced, the wood is preserved using either non-pressure or pressure methods. Non-pressure processes include brushing, spraying, dipping, soaking and thermal processes.

There are two basic types of pressure treatment processes, distinguished by the sequence in which vacuum and pressure are applied. These are "empty-cell" and "full-cell" or modified full cell" processes. The terms "empty" and "full" are measures of the level of preservative retained by the wood cells.

Process materials inputs and pollution outputs for above mentioned processes is presented in Table 1.

Table 1. Summary of Process Materials Inputs and Pollution outputs in The Wood and Lumber Products Industry.

Process	Material input	Air emissions	Process waste	Other waste
Logging	Trees, diesel,	VOCs, CO, NO_x	Not applicable	Waste wood

	gasoline	Particles, <10µm		particles
Sawing	Wood logs, diesel, gasoline	VOCs, CO, NO_x Particles, <10µm	Not applicable	Waste wood particles
Surface protection	Wood, IPBC*, DDAC**	IPBC, DDAC, ethyl alcohol, petroleum naphtha	Dripped formulation mixed with rainwater and facility washdown water	Sawdust, wood chips, sand, dirt, stones, tar, emulsified or polymerised oils
Plywood and veneer	Veneer, resins, sodium hydroxide, ammonium sulphate, acids, ammonia	VOCs, CO, NO_x Particles, <10µm, formaldehyde, phenols, wood dust, condensable hydrocarbons, terpenes, methanol, acetic acid, ethanol, furfural	Not applicable	Waste wood particles, adhesive residues
Reconstituted wood products	Wood particles, strands, fibre, resins	VOCs, CO, NO_x Particles, <10µm, formaldehyde, phenols, wood dust, condensable hydrocarbons, terpenes, methanol, acetic acid, ethanol, furfural	Not applicable	Waste wood particles, adhesive residues
Wood preserving	Wood, pentachlorophenol, creosote, borates, ammonium compounds, inorganic formulations of copper, chromium and arsenic, carrier oils	Pentachlorophenol, polycyclic organics, creosote, ammonia, boiler emissions, airborne arsenics, VOC	Dripped formulation mixed with rainwater and facility washdown water, kiln condensate, contact cooling water	Bottom sediment sludges, process residuals

* 3-Iodod-2-Propynyl Butyl Carbamate

** Didecyl Dimethyl Ammonium Chloride (DDAC)

The Wood Furniture and Fixtures Industry

The wood furniture manufacturing process consists of following processes.
Firstly, purchased (or sawed on-site) lumber is dried. The drying steps was described in Sawn Lumber process description.

Once the lumber is dried, it is sawed into a shape of the approximate dimensions of the final furniture part. Types of power saws used in furniture manufacturing include circular saws, band saws and scroll saws. After sawing, the surfaces of the wood, which will be flat in the final product, are planed. The primary outputs from the sawing and planing processes are wood chips.

The design of some furniture pieces requires that certain wooden parts be bent. This usually involves the application of pressure in conjunction with a softening agent and

increased atmospheric pressure. The actual bending is accomplished by compressing the wood into the desired shape and then drying it to remove excess moisture.

After the wood parts have been planed and, if necessary, bent, they are assembled to form one furniture part, such as tabletop. The assembly process usually involves the use of adhesives (either synthetic or natural) in conjunction with other joining methods, such as nailing. The wood furniture manufacturing industry uses adhesive formulations containing solvents (typically used for upholstered wood furniture) and hot melts polyvinyl acetate (used for non-upholstered wood furniture).

The next step in the production process may be the application of veneer. The veneer is applied to the furniture part using adhesives, some of which require the use of heat and/or pressure.

Then the furniture part is sanded to ensure that its surface is smooth as possible for the finishing stages of the production process. Sanding is usually accomplished by a disk, belt or roller sanding machine using either open- or closed-coated sand paper. After initial sanding, an even smoother surface is attained by spraying, sponging, or dipping the furniture part with water, which causes the fibres of the wood to swell and "raise". After the surface is dried, a solution of glue resin is applied and allowed to dry, causing the raised fibres to become more brittle. The raised fibres are then sanded down to form a particularly smooth surface.

Coating application: there are various coating application techniques used by the wood furniture industry for applying finishing coatings. The two principal methods are flatline finishing and spay application. The two principal ways of performing flatline finishing are roll coating and curtain coating. Roll coating involves the transfer of coating material by roller or series of rollers, while curtain coating involves passing the furniture part through a cascade or curtain of coating material.

The methods used to apply spray include air, airless, air-assisted airless, high-volume-low-pressure, etc. techniques.

Wood finishing processes include coating, drying and sanding the furniture in a series of steps, which are repeated until the desired final appearance is achieved.

Process materials inputs and pollution outputs for Wood Furniture Industry processes are presented in Table 2.

Table 2. Summary of Process Materials Inputs and Pollution outputs in The Wood Furniture Industry.

Process	Material input	Air emissions	Process waste	Other waste
Drying				
Ovens/Drying kilns	Raw lumber	Water, possible chemicals used in pretreatment of raw lumber		
Machining				

Sawing / Planing / Sanding	Dried lumber	Wood chips, sawdust	Wood chips, sawdust	Wood chips, sawdust
Bending / Drying	Lumber	Water, possible chemicals used in pretreatment of raw lumber		
Assembly				
Gluing / Veneer application	Hot melts, polyvinyl acetate, solvent-based adhesives	Solvent emissions		Spent solvent-based adhesives
Sanding	Assembled furniture	Wood chips, sawdust	Wood chips, sawdust	Wood chips, sawdust
Pre-finishing				
Watering / Sanding	Assembled furniture, water, adhesives, resins		Wood chips, saw dust, adhesive and resin particles	Wood chips, saw dust, adhesive and resin particles
Bleaching	Bleaching agents		Spent bleaching agents	Spent bleaching agents

Table 2. (Continued). Summary of Process Materials Inputs and Pollution outputs in The Wood Furniture Industry.

Process	Material input	Air emissions	Process waste	Other waste
Finishing				
Staining	Mineral spirits, alcohol, solvents, pigments	Solvent emissions		Pigment wastes
Washcoating	Nitrocellulose based lacquers, acrylic lacquers, varnish, shellac, polyurethane, solvents	Solvent emissions		Spent solvents and lacquers, shellac, polyurethane, varnish
Filling	Pigments	Solvent emissions		Spent solvents, stains, drying oils, synthetic resins, thinners, pigments
Sealing	Nitrocellulose based lacquers, acrylic lacquers, varnish, shellac, polyurethane, solvents	Solvent emissions		Spent solvents and lacquers, shellac, polyurethane, varnish
Priming	Fungicide, water repellent			

Painting	Toluene, pigments, epoxy-ester resins, aromatic hydrocarbons, glycol ether, halogenated hydrocarbons, vinyl acetate, acrylic	Solvent emissions		Spent solvents, pigments, resins, etc.
Topcoat application	Denatured alcohols, resins, stellac, petroleum distillates, toluene, diisocyanate	Solvent emissions		Spent denaturated alcohols, resins, shellac, etc.

Table 2. (Continued). Summary of Process Materials Inputs and Pollution outputs in The Wood Furniture Industry.

Process	Material input	Air emissions	Process waste	Other waste
Finishing (continued)				
Sanding (intermittently between each of the above finishing applications	Finished piece of furniture	Particulates that include wood, adhesive, resin, lacquers, etc.	Particulates that include wood, adhesive, resin, lacquers, etc.	Particulates that include wood, adhesive, resin, lacquers, etc.
Rubbing / Polishing	Lubricants, detergents, petroleum based thin oils, pumice, tripoli, diamaceous earth			Spent lubricants, detergents, oils
Cleanup operations				
Brush cleaning Spray-gun cleaning	Solvents, mineral spirits, alcohols	Solvent emissions	Spent solvents, etc.	Spent solvents, mineral spirits, alcohols
Boilers				
Boilers	Wood and coating material particulates from the finishing process	Boiler ash particulates Gaseous emissions		Boiler ash

3.2. Emissions from the common processes.

This Guidance Note covers (drafted from BATNEEC Guidance Notes of Irish EPA):

1. Manufacture of fibre-board, particle board and plywood in installations with a production capacity equal to or exceeding 25,000 tonnes of product per year.

2. Use of coating materials in process with a capacity to use at least 10 tonnes per year of organic solvents in Wood and Furniture industry.

3. The treatment or protection of wood, involving the use of preservatives, with a capacity exceeding 10 tonnes of wood per day.

4. The burning of any fuel in a boiler or furnace with a nominal heat output exceeding 50 MW.

In this section, the major sources of emissions to air and water and of waste generation are identified. It should be borne in mind that the identified list of sources is not all encompassing, nor will every plant falling with an individual sector have every one of the emissions, which are associated with the sector as a whole.

Emissions are considered under the following headings: fugitive and unscheduled emissions and specific process emissions. Some of the latter are considered to have little potential environmental significance and these are designated as minor (m). However, obviously there could be specific plants where the designation of minor may not be correct. Such emissions must then be examined on an individual basis during the licensing process.

The substances most likely to be present in the releases to the environment and of principal concerns in the processes covered by this Note are given in tables below. A licence applicant should identify and quantify all environmentally significant emissions (including heat discharges) from the process.

3.2.1. Manufacture of fibre-board, particle board and plywood.

Sources of Emission to Air

Fugitive and Unscheduled emissions:

- Vapour losses during storage and filling of bulk storage tanks (including hose decoupling).
- Fugitive emissions of particulate matter from open storage, loading and unloading of solid materials.
- Bursting disks and relief valves discharges.
- Leakages from flanges, pumps, seals, valve glands, etc.
- Building losses (through door, window, etc.).
- Emergency overheat dump emissions.

Process Emissions (Table 3.1.)

Table 3.1. Summary of Sources and Emissions to Air from board manufacturing.

Source	Emissions
Resin and wax storage and make-up tanks	Resins (e.g. melamine urea formaldehyde, urea formaldehyde, phenol formaldehyde, MDI urea). Paraffins Ammonia Formic Acid
Press emissions	VOCs Particulates Formaldehyde MDI
Drier emissions	Particulates Carbon monoxide VOCs NO_x Aldehydes
Trimming and sanding	Particulates
Pneumatic conveying systems	Particulates
Intermediate wafer/fibre storage	Particulates
Finishing Material handling and storage	Ammonia Solvents (paints) Adhesives (laminates) Formaldehyde Particulates
Boiler/heater emissions	Particulates Carbon monoxide VOCs NO_x SO_2

+ Building ventilation gases (*minor*).

Sources of Emissions to Water

Spills and Diffuse Sources, etc.:

- Contaminated stormwaters.
- Chemical tank leaks.
- Pipework leaks.
- Spillages.
- Bund drains.
- Leakages from flanges, pumps, seals, valve glands, etc.

Process Emissions:

- Pump seal cooling water (m).
- Log wash waters.
- Laboratory effluent (m).
- Fiberiser.
- Abatement systems.
- Boiler blowdown (m).

Summary of sources and emissions to water is given in Table 3.2.

Table 3.2. Summary of Sources and Emissions to Water from board manufacturing.

Source	Emissions
Contaminated stormwaters	Particulates Dissolved organics
Fiberiser	Dissolved organics (sap water) Phenols Trace organics
Abatement systems	Particulates Trace organics Ammonia
Log wash waters	Particulates, grit, stones

Sources of Waste

Summary of waste generation is given in Table 3.3.

Table 3.3. Summary of Other Releases from board manufacturing.

Source	Emissions
Sludges from Waste Water Treatment Plants	Organics Inorganics
Sludges from abatement systems and settling ponds	Solids (wood chips, fibres, mud, etc.)
Reject chemicals	Resins, waxes, etc.
Contaminated drums, filters, equipment, packaging and protective clothing	Resins, waxes, etc.
Spent adsorbents	Activated carbon, etc.
Shake down dusts from filters	Solids (wood fibre, dust)
Boilers	Ash

3.2.2. Use of coating materials.

Sources of Emission to Air

Fugitive and Unscheduled emissions:

- Stripping of volatile compounds from waste water treatment plants (WWTP) resulting in releases to air and/or odour problems.
- Storage tank vents.
- Vapour losses during storage, filling and emptying of bulk solvent tanks and drums (including hose decoupling).
- Leakages from flanges, pumps, seals, valve glands, etc.
- Building losses (through door, window, etc.).
- Workspace ventilation losses.

Process Emissions (Table 3.4.):

Table 3.4. Summary of Sources and Emissions to Air from use of coating materials.

Source	Emissions
Pre-treatment (e.g. degreasing, sanding, cleaning, etc.)	Acids, Alkalis, Particulates
Coating	VOCs, Particulates (paint)
Dryers Solvent recovery	VOCs Odours

Sources of Emissions to Water

Spills and Diffuse Sources, etc.:

- Storage tank leaks.
- Pipework leaks.
- Spillages.
- Bunds..

- Leakages from flanges, pumps, seals, valve glands, etc.

Minor process emissions to water:
- Boiler blowdown.
- Laboratory effluent.

Process Emissions (Table 3.5.):

Table 3.5. Summary of Sources and Emissions to Water from use of coating materials.*

Source	Emissions
Spent pre-treatment liquors Wash waters	Acids, alkalis, metals, phosphates, suspended solids, nitrates, ammonia, organics, oils (m)
Scrubber and abatement system liquors Contaminated water arising from cleaning plant	Acids, alkalis, metals, oils (m) Organics

* including coating both of metal and wooden parts.

Sources of Waste
Summary of waste generation is given in Table 3.6.

3.2.3. Treatment and preservation of wood.

Sources of Emission to Air
Fugitive and Unscheduled emissions:
- VOC and odour losses during filling and emptying of process vessels.
- Stripping of VOCs and odorous compounds from waste water treatment plants (WWTP) resulting in releases to air and/or odour problems.
- Leakages from flanges, pumps, seals, valve glands, etc.
- VOC and odour losses from storage of treated timber.

Process Emissions:
- Material handling and storage (*minor*).
- Vacuum pump discharges (*minor*).

Table 3.6. Summary of Other Releases from use of coating materials.

Source	Emissions
Spent solutions	Acids, alkalis, metals, ammonia, suspended solids, oils, nitrates, phosphates
Sludges from WWTP and abatement systems	Metals, phosphates, oils, Trace VOCs
Contaminated drums, equip-ment, packaging and protective clothing	Process and treatment plant chemicals
Still bottom residues	Polymeric residues

	Oils/fat/grease Solvent
Dust from abatement plant	Coating solids (incl. metals)
Spent solvent and coating material	VOCs Coating solids (incl. metals)
Filters	Polymers, Coating solids VOCs

* including coating both of metal and wooden parts.

Sources of Emissions to Water

Spills and Diffuse Sources, etc.:

- Storage tank leaks.
- Pipework leaks.
- Spillages.
- Leakages from flanges, pumps, seals, valve glands, etc.

Process Emissions (Table 3.7.):

Table 3.7. Summary of Sources and Emissions to Water from wood treatment.

Source	Emissions
Contaminated stormwaters Bund drains Contaminated water arising from cleaning plant	Chemical preservative (e.g. creosote, arsenic, etc.) Organics

+ Boiler blowdown (m).

Sources of Waste

Summary of waste generation is given in Table 3.8.

Table 3.8. Summary of Other Releases from wood treatment.

Source	Emissions
Sludges from interceptors and sumps Contaminated drums, equip-ment, packaging and protective clothing Spillage clean-up	Chemical preservative (e.g. creosote, arsenic, etc.)
Sludges from WWTP	Biological solids Oil/fat/grease Biocides

4. BAT possibilities

4.1. Introduction.

The approach to be used in selecting BAT is based on the following hierarchy:

- Process design/redesign changes to **prevent** emissions and **eliminate** wastes that might pose environmental problems.
- **Substitution** of materials /resins etc. by environmentally less harmful ones.
- Demonstration of waste **minimisation** by means of process control, inventory control and end-of-pipe technologies, etc.

The existing or possible measures for preventing, reducing and controlling emissions are described in this section. These range from relatively simple containment measures to sophisticated recovery and end-of-pipe technologies and include:

(i) Prevention and minimisation techniques
(ii) Containment
(iii) Recovery/Recycle
(iv) Emission reduction
(v) Waste treatment and disposal.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly or in combination, the measures listed below represent BAT solutions when implemented in the appropriate circumstances. The circumstances depend on plant scale, chemicals used, nature of the products made, number of different products produced, etc. A summary of the treatments for various emissions is given at the end of the section.

Note that where hazardous (including asphyxiant) dusts and vapours occur, safety procedures (acceptable to the Health and Safety Authority) should be adopted. In these and any other matters concerning safety, appropriate safe working practices should be adopted and nothing in this note should be construed as advice to the contrary.

Venting of gaseous fuels should be only carried out in accordance with Health and Safety Authority requirements, and odour nuisance should be avoided where gases containing high levels of H_2S are vented.

Most of the given examples are applicable also to other technological processes of wood and furniture industry, not described in details in Chapter 2.

4.2. Manufacture of fibre-board, particle board and plywood.

Prevention and minimisation techniques.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Inventory control.
- Optimisation of water usage, e.g. dry equipment cleaning and vacuum systems, where feasible.
- Optimisation of energy usage
- Separation of cooling water, storm water and process effluents of different origin in order to permit appropriate treatment options.
- Use of low NO_x burner technology.
- Maximum use of covered storage for wood chips, sawdust, etc.
- Avoidance of excessive drier temperatures.
- Substitution of dangerous chemicals.
- Optimisation of heat recovery (including abatement systems).

Containment techniques.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Enclosure of material storage (other than logs and bulk liquids), handling, processing and transfer within a suitable building.
- Bunding of tanks.
- Overground pipelines and transfer lines.
- Check system to avoid mixing incompatible materials.
- Bunding of all stored materials with separate bunding for incompatibles.
- Prevention of rain ingress, wind entrainment, etc. for stored materials.
- Overfilling protection of bulk storage tanks.

Techniques for recovery and recycle.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Recycle of waferised/fiberised material
- Reuse of trimmings, collected dusts, bark and sludges (as appropriate) as fuel
- Chemically treated wood (e.g. sander dust and off cuts) should only be burned where suitable combustion conditions are assured.
- Ducting of burner exhausts to drier inlets.
- Reuse in other industry (e.g. bark, chippings, etc.).

Techniques for treating air emissions.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Minimum number of controlled emission points
- Local extraction systems as appropriate e.g. at sanders, surface coating, trimming, etc.

Summary of techniques for treating different types of air emissions is given in Table 4.1.

Table 4.1. Summary of techniques for treating air emissions from board manufacturing industry.

Emission type	Technology
Large particulates	Cyclones
Small particulates (< 10 μm)	Bag filters Wet electrostatic precipitators
Organics (VOCs, adhesives, phenols, Aldehydes, etc.)	Wet electrostatic precipitators Vapour incineration Wet scrubbers Biofilters as final air treatment
Ammonia	Wet scrubbers
Carbon monoxide	Vapour incineration
NO_x	-

Techniques for treating water emissions.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Primary treatment
- Coagulation/flocculation/precipitation.
- Sedimentation/filtration/floatation.

Secondary treatment
- Biofilters.
- Activated sludge/aeration lagoons.
- Extended aeration.
- Nitrification/denitrification.

Tertiary treatment
- Filtration/coagulation/precipitation.

Summary of technologies for treating different types of water emissions is given in Table 4.2.

Table 4.2. Summary of techniques for treating water emissions in board industry.

Emission type	Technology
Organics (incl. phenols)	Coagulation/flocculation/precipitation Sedimentation/filtration/floatation Biofilters Activated sludge/aeration lagoons Extended aeration
Ammonia/Nitrate	Nitrification/denitrification

Trace organics	Filtration/coagulation/precipitation

Specific techniques for the treatment and disposal of wastes
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Sludge treatment
- Gravity thickening.
- Dissolved air floatation.
- Filtration.
- Centrifugation.
- Sludge digestion.
- Drying.

Disposal
- Engineered landfill of wastes.
- Landspreading of wastes (as fertiliser).
- Recycle of process wastes to other industries.

4.3. Use of coating materials.

Prevention and minimisation techniques.

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Inventory control.
- Optimisation of water usage.
- Dry equipment cleaning and dry vacuum systems, where feasible (dry sweeping to be avoided).
- Separation of cooling water, storm water and process effluents of different origin in order to permit appropriate treatment options.
- (Water based cleaning systems to be selected instead of solvent based systems.)
- Where practicable, use of non-nitrogenated pre-treatment chemicals.
- Except where unavoidable, the following shall not be used:
  - (i) Halogenated substances.
  - (ii) Aromatic solvents.
  - (iii) Organic solvents containing compounds classified as Carcinogens, Mutagens, or Toxic to Reproduction under Regulation of Ministry of Social Affairs 11.12.1998 No. 64 (with sign T and relevant phrases on labels, R phrases R45, R49, R60, R61 in safety data sheets).
  - (iv) Chlorine based oxidising substances.
  - (v) Solvents containing formaldehyde or n-hexane.
- (In-plant measures to extend the service life of pre-treatment baths, e.g. filtration, oil skimming, etc.)
- (Use of countercurrent rinsing and suitable techniques to minimise drag-out.)
- Spray application to be selected instead of bath immersion where appropriate.
- (Shot blasting is preferred to sand blasting.)
- Ultrasonic cleaning.
- Substitution of solvent based coatings with water based coatings.
- Use of organic pigments rather than metal based pigments.
- (Use of Chrome III rather than Chrome VI in chromating.)
- Use of high solid content coating materials.
- Use of hot melt adhesives.
- Radiation cure (e.g. UV, electron beam) rather than oven cure.
- Optimisation of mixing procedure to minimise VOC emissions (e.g. reduced mixing times, cooling of mixer, etc.)
- Oven temperature to be controlled to minimise the emission of organic coating breakdown products.

- Where practicable, spray coatings to be applied using one of the following systems to achieve a transfer efficiency of > 65 %.
  - (i) High volume low pressure (HVLP)
  - (ii) Electrostatic application techniques.

Containment techniques.

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Enclosure of material storage (except bulk liquids), handling, processing and transfer within a suitable building.
- Bunding of tanks.
- Overground pipelines and transfer lines.
- Overfilling protection of bulk storage tanks.
- Heat recovery to be used where practicable.
- Minimisation of tank filling losses by e.g. vapour return systems.
- Check system to avoid mixing incompatible materials.
- Use of closed transfer systems and lidded holding vessels.
- Solvent vapour emissions to be contained by e.g. refrigerated freeboards, covered baths, etc.
- The cleaning of plant and equipment to be carried out in a dedicated system with VOC capture and recovery.
- Curing ovens emissions to be suitably contained by e.g. zone exhaust ventilation or air curtains.
- Flash-off zones and coating application areas to be extracted by local exhaust ventilation.
- Ovens and ductwork should be maintained gas tight if under positive pressure and leakproof if under negative pressure.

Techniques for recovery and recycle.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Solvent recovery plant.
- VOC abatement with solvent recovery (e.g. carbon adsorption and regeneration).

Techniques for treating air emissions.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Local extract and abatement systems as appropriate e.g. dryers, coating and pre-treatment areas, etc.
- Single controlled emission point for all plants.

Summary of techniques for treating different types of air emissions is given in Table 4.3.

Table 4.3. Summary of techniques for treating air emissions from industry using coating materials.

Emission type	Technology
Particulates	Filtration (fabric or paper filters normally adequate) Wet scrubbers Cyclones
Odours	Condensation Vapour incineration (thermal, catalytic and regenerative) Wet scrubbers

	Carbon adsorption Biofilters
Acids/Alkalis	Wet scrubbers
VOCs	Condensation Vapour incineration (thermal, catalytic and regenerative) Carbon adsorption (Biofilters)

Techniques for treating water emissions.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Pre- treatment
- Reduction.

Treatment
- pH Correction / neutralisation.
- Coagulation / flocculation / precipitation.
- Sedimentation / filtration / flotation.
- Centrifugation.

Polishing
- Resin beds.
- Reverse osmosis.

Summary of techniques for treating different types of water emissions is given in Table 4.4.

Table 4.4. Summary of techniques for treating water emissions in industry using coating materials.

Emission type	Technology
Acids/Alkalis	pH Correction / neutralisation
Phosphates	Coagulation / flocculation / precipitation
Ammonia/Nitrates	-
Suspended solids	Coagulation / flocculation / precipitation Sedimentation / filtration / flotation Centrifugation
Metals	Reduction Coagulation / flocculation / precipitation Resin beds Reverse osmosis
Oils	Sedimentation / filtration / flotation

Specific techniques for the treatment and disposal of wastes
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Sludge treatment
- Gravity thickening.
- Filtration.
- Centrifugation.

Disposal
- Engineered landfill of wastes.
- Incineration. (Incineration emissions are subject to a separate note).
- Waste encapsulation.
- Reuse in another industry (e.g. as fuel).

4.4. Treatment and preservation of wood.

Prevention and minimisation techniques.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Inventory control.
- Optimisation of impregnation process to ensure minimum wastage.
- Substitution of arsenic, creosote.
- VOC minimisation as appropriate (e.g. by reduced number of treatment cycles; vessel purging prior to timber discharge, etc.).

Containment techniques.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Roofing and bunding of impregnation and immediate post-impregnation areas.
- Interceptor discharges to WWTP prior to fresh water discharge.
- Bunding of tanks.
- Design of hardstanding, bunding and unloading areas to prevent groundwater contamination from impregnated log storage, etc.
- Overground pipelines and transfer lines.
- Bunding of all stored materials with separate bunding for incompatibles.
- Site organisation to ensure segregation of potentially contaminated surface waters from uncontaminated area.
- Chemical off-loading to be designed and carried out so as to avoid spillages, etc. (e.g. bunding).
- All chemical containers to be properly labelled and sealed when not in use.
- Sawdust handling and containment to be designed so as to prevent sawdust ingress to surface water drainage and watercourses.

Techniques for recovery and recycle.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

- Recycle of collected drainage liquors from impregnation and post-impregnation stages.

Techniques for treating air emissions.
Emissions from vacuum pump exhausts and tank vents should pass through a coalescing filter.

Specific techniques for treating water emissions.
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Primary treatment

- Coagulation / flocculation / precipitation.
- Sedimentation / filtration / flotation.

Secondary treatment

- Activated sludge / aeration lagoons.
- Extended aeration.

Tertiary treatment
- Ozonation / oxidation.
- Activated carbon polishing.

Summary of techniques for treating different types of water emissions is given in Table 4.5.

Table 4.5. Summary of techniques for treating water emissions in wood treatment industry.

Emission type	Technology
Preservative (e.g. creosote, arsenic, etc.)	Activated sludge / aeration lagoons Extended aeration Ozonation / oxidation Activated carbon polishing
Organics	Coagulation / flocculation / precipitation Sedimentation / filtration / flotation Activated sludge / aeration lagoons Extended aeration

Specific techniques for the treatment and disposal of wastes
(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints)

Sludge treatment
- Gravity thickening.
- Dissolved air floatation.
- Filtration.
- Centrifugation.
- Sludge digestion.
- Drying

Disposal
- Engineered landfill.
- Solidification.
- Incineration.

5. Emission Limit values

5.1. Reference conditions.

The reference conditions for concentrations of substances to air from contained sources are:

All sources except Direct Fired Wood Driers:
Temperature 273 K; Pressure 101.3 kPa; no correction for water vapour content.

Direct Fired Wood Driers:

Temperature 273 K; Pressure 101.3 kPa; no correction for water vapour content; oxygen 17 % v/v.

These units and reference conditions may not be suitable for continuous monitoring methods and may, by the Agreement with the Regional Department, be converted, for day-to-day control purposes, into values more suitable for the available instrumentation.

5.2. Air emissions.

Board manufacturing industry
All emissions to air should be free from persistent mist, fume and droplets and, other than steam or water vapour, should be colourless. Emission Limit Values representing BAT are given in Table 5.1.

Use of coating materials
Emission Limit Values representing BAT for coating materials are given in Tables 5.2 - 5.4.

Treatment and preservation of wood
Site and plant to be operated in a manner such that air emissions and/or odours do not result in significant impairment of, or significant interference with amenities or the environment beyond the site boundary.

Where emissions to air arise from a particular site these may be subject to specific licence requirements.

For all installations emission limit values of solvents to be achieved: 100 mgC/Nm^3 (except for treatment with creosote), fugitive emissions 45 % of solvent input and total emission values 11 kg/m^3.

5.1. Emission Limit Values for Emissions to Air from Board Manufacturing Industry

Parameter		Emission Limit
Particulates (wood driers and MDF plants)		20 mg/m^3
Particulates (other than above)		50 mg/m^3
Condensible VOCs (as C), excluding . particulate matter		130 mg/m^3
CO		To be determined at time of licencing
Formaldehyde (excluding Wood Driers)		5 mg/m^3
Formaldehyde (Wood Driers)		20 mg/m^3
Total Aldehydes (Wood Driers) (as C)		20 mg/m^3
Total Ammonia		70 mg/m^3
MDI (as NCO group)		0.1 mg/m^3 (2 hour mean)
NO_x	Pulverised Fuel fired plant (> 20 MW) Or Grate Fired plant (not burning coated residues)	400 mg/m^3

All other plant	500 mg/m^3
Phenol	20 mg/m^3
Odour	No detectable odour nuisance beyond site boundary

Note: Achievement of ELV concentration by the introduction of dilution air is not permitted.

Table 5.2. Emission limit values for emissions to air for all sources of coating materials derived emissions. [BATNEEC Ireland]. Table 5.3 also applies as appropriate.

Emission Source	Total Solvent Use or Consumption	Limit Values for Waste Gas Discharges (mg/m^3)
All sources	Above the threshold (tonnes/annum) given in Tables 5.3 - 5.4	[1]Class A (total): 2 (for mass emissions > 10 g/h of Class A compounds) [2]Class B (total): 20 (for mass emissions > 100 g/h of Class B compounds) Particulates (spray painting operations): 3 Other emissions: See Tables 5.3 - 5.4
All sources	Below the threshold (tonnes/annum) given in Tables 5.3 - 5.4	[1]Class A (total): 2 (for mass emissions > 10 g/h of Class A compounds) Other emissions plus Class B compounds: 150 (as C) (for mass emissions > 3 kg/h total) Particulates (spray painting operations): 3

Notes for Table 5.2:

[1] **Class A** compounds are substances with the risk phrases R45, R46, R49, R60 or R61 (Carcinogens, Mutagens, or Toxic to Reproduction) as classified under Regulation of Ministry of Social Affairs 11.12.1998 No.64. Examples of these are:

R45 benzene; 1,2-dichloroethane; 2-nitropropane; 1,2-dibromomethane;
1,3-dichloro-2-propanol

R60-61 2-methoxyethanol; 2-ethoxyethanol; 2-methoxyethylacetate; 2-ethoxyethylacetate.

[2] **Class B** compounds are chlorinated organic solvents with the risk phrase R40 (*võib põhjustada pöördumatuid kahjustusi)* as classified under under Regulation of Ministry of Social Affairs 11.12.1998 No.64. Examples of these are 1,1,2,2-tetrachloroethane, dichloromethane, tetrachloromethane, tetrachloroethylene.

Table 5.3. Emission Limit Values for Emissions to Air from Coating Processes.
(These values apply in addition to those in Table 5.2. as appropriate)

Emission Source	Solvent Use or Consumption	Limit Values for Waste Gas Discharges, (mg/m^3)	Total Emission Limit (as solvent usage)
Wood laminating	> 5 tonnes/annum		30 g/m^2
Leather	10-25		< 85 g/m^2 of total

coating	tonnes/annum > 25 tonnes/annum > 10[(1)] tonnes/annum	- - -	coated surface < 75 g/m^2 of total coated surface < 150 g/m^2 *
Wood coating	15-25 tonnes/annum > 25 tonnes/annum	Coating and drying Total organics (as C): 150 / 100 Coating Total organics (as C): 100 / 75 Drying Total organics (as C): 50 / 50	**Fugitive emissions values:** 25 20 (% of solvent input):
Adhesives coating	> 10 tonnes/annum	Coating and drying Total organics (as C): 150 (absorption and reuse) 50 (incineration)	**Fugitive emissions values:** 25 (5-15 t/a) 20 (> 15 t/a) (% of solvent input):

[1] For leather coating activities in furnishing and particular leather goods used as small consumer goods.

5.3. Releases to water.

Effluents should be minimised by recovery of materials wherever practicable. The use of lower quality water may be possible for some parts of the process rather than fresh water.

All releases to waters are subject to a licence from the Regional Environmental Department (RED). However, for any discharge to a sewer, the RED are also required to obtain the consent of the sanitary authority. BAT to minimise the release of substances will generally include minimisation at source and either specific treatment of contaminated waste streams to remove particular substances or co-treatment of combined effluent streams or both.

Board Manufacturing Industry
The Emission Limit Values for effluent discharges to waters of Board Manufacturing Industry are set out in Table 5.4.

Notes for Table 5.4. - 5.6.:

1. The daily raw waste load for BOD is defined as the average daily mass arising for treatment over any three month period. Calculations of the removal rated for BOD should be based on the differences between the waste loads arising for disposal and those discharges to the receiving waters. The amounts removed by treatment (chemical, physical, biological) may be included in the calculation.
2. Toxicity Unit (TU) = 100/x hour E(L)C 50 in percentage vol/vol, where x is defined by the test procedure. The toxicity of the process effluent to at least two appropriate aquatic species shall be determined. Higher TU values reflect greater levels of toxicity.

3. No substances shall be discharged in a manner which, or at concentration which, following initial dilution, causes tainting of fish or shellfish, interferes with normal patterns of fish migration or which accumulates in sediments or biological tissues to the detriment of fish, wildlife or their predators.
4. Consent conditions for these parameters for discharge to municipal treatment plants can be established with the Licensing Authority, and different values may apply.
5. Reduction in relation to influent load. Total nitrogen means the sum of total of Kjeldahl-Nitrogen plus nitrate-nitrogen plus nitrite-nitrogen.

Use of coating materials

The Emission Limit Values for effluent discharges to waters of coating materials using industry are set out in Table 5.5.

Table 5.4. Emission Limit Values for Discharge to Water from Board Manufacturing Industry.*

Constituent Group or Parameter	Irish BAT Limit Value	Estonian Limit Value[2]	Note
pH	6 - 9	6 - 9	4
BOD	> 90 % removal **or** 50 mg/l	> 80 % removal, 25 mg/l	1, 4
COD		> 75 % removal, 125 mg/l	
Suspended solids		> 75 % removal, > 35 mg/l	
Total Ammonia (mg/l as N)	10		4
Total Nitrogen (as N)	> 80 % removal **or** 15 mg/l		4, 5
Total Phosphorus (as P)	> 80 % removal **or** 2 mg/l		4, 5
Oils, fats and grease (mg/l)	10		4
Fish Tainting	No tainting		3, 4
Mineral Oil (Interceptor) (mg/l)	20		4
Toxic units	5		2, 4
Phenols (mg/l)	1		4

* All values refer to daily averages, except otherwise stated to the contrary, and except for pH which refers to continuous values. Limits apply to effluent prior to dilution by any uncontaminated streams, e.g. cooling waters, storm water, etc.

[2] From Governmental Regulation 20.01.98 No. 11 (RT I 1999, 15, 237) for discharge over 100 human equivalents (1human equivalent is equal to 70 g/24 h of BOD_7). For more information according to enterprise BOD_7 see the above mentioned regulation.

Treatment and preservation of wood

The Emission Limit Values for effluent discharges to waters of treatment and preservation of wood industry are set out in Table 5.6.

Table 5.5. Emission Limit Values for Discharge to Water from Coating Materials Using Industry.*

Constituent Group or Parameter	Irish BAT Limit Value	Estonian Limit Value	Note
pH	6 - 9	6 – 9	4
BOD	25 mg/l	> 80 % removal, 25 mg/l [2]	4
COD		> 75 % removal, 125 mg/l [2]	
Suspended solids		> 75 % removal, > 35 mg/l [2]	
Fish tainting	No tainting		3, 4
Total Nitrogen (as N)	> 80 % removal **or** 15 mg/l		4, 5
Total Phosphorus (as P)	> 80 % removal **or** 2 mg/l		4, 5
Ammonia (mg/l as N)	10		4
Oil (mg/l)	20		4
Organohalogens (mg/l as Cl) - tetrachloromethane - chloroform - 1,2-dichloroethane - trikloroethylene - - perchloroethylene	0.1 (monthly average)	1.0 (as AOX) 1.5 mg/l 0.5 mg/l 1.0 mg/l 0.5 mg/l 0.5 mg/l	4
Zinc (mg/l)	0.5	2.0	4
Chromium VI (mg/l)	0.1	0.04	4
Chromium (total Cr, mg/l)	0.5	0.7	4

(for Notes see page 35)

* All values refer to daily averages, except otherwise stated to the contrary, and except for pH which refers to continuous values. Limits apply to effluent prior to dilution by any uncontaminated streams, e.g. cooling waters, storm water, etc.

[2] From Governmental Regulation 20.01.98 No. 11 (RT I 1999, 15, 237) for discharge over 100 human equivalents (1human equivalent is equal to 70 g/24 h of BOD_7). For more information according to enterprise BOD_7 see the above mentioned regulation

Table 5.6. Emission Limit Values for Discharge to Water from Wood Treatment and Preservation Industry.*

Constituent Group or Parameter	Irish BAT Limit Value	Estonian Limit Value	Note
pH	6 - 9	6 - 9	4
BOD	> 90 % removal **or** 25 mg/l	> 80 % removal, 25 mg/l [2]	4
COD		> 75 % removal, 125 mg/l [2]	
Suspended solids		> 75 % removal, > 35 mg/l [2]	
Ammonia (mg/l as N)	10		4
Oils, fats, greases (mg/l)	10		4
Fish tainting	No tainting		3, 4
Mineral oil (interceptors) (mg/l)	20		4
Mineral oil (biological treatment) (mg/l)	1		4
Organohalogens (mg/l as Cl)	0.1	1.0 (as AOX)	4
Phenols (mg/l)	1		4
Arsenic (mg/l)	0.5	0.2 [3]	4
Chromium VI (mg/l)	0.1	0.04 [3]	4
Chromium (total Cr, mg/l)	0.5	0.7 [3]	4

(for Notes see page 35)

* All values refer to daily averages, except otherwise stated to the contrary, and except for pH which refers to continuous values. Limits apply to effluent prior to dilution by any uncontaminated streams, e.g. cooling waters, storm water, etc.

[2] From Governmental Regulation 20.01.98 No. 11 (RT I 1999, 15, 237) for discharge over 100 human equivalents (1human equivalent is equal to 70 g/24 h of BOD_7). For more information according to enterprise BOD_7 see the above mentioned regulation

[3] From Regulation of MoE 04.06.1999 No. 55 (RTL 1999, 98, 1199)

6. Compliance Monitoring

The methods proposed for monitoring the emissions from these sectors are set out below.

6.1. Air emissions.

Board Manufacturing Industry

1. Where practicable, particulate matter shall be continuously monitored. Where this is not practicable, continuous recording of key process parameters, e.g. drier temperature, abatement temperature (incineration), abatement plate voltage and current (Wet ESP), etc. may suffice.
2. Periodic stack sampling as required by licence, taking account of the nature, magnitude and variability of the emission, and the reliability of the control technologies.

Use of coating materials

1. **Continuous monitoring** (during the period of operation of the plant processes) of total organic carbon should be required for all emissions exceeding 10 kg/h (determined as an 8 hour moving average). **Periodic monitoring** of total organic carbon should be required where the emissions exceed 1 kg/h. In addition, periodic monitoring of individual organic compounds will be required where the sum of Class A compunds (risk phrases R45, R46, R49, R60 or R61 or Carcinogens, Mutagens, Toxic to Reproduction as classified under Regulation of Ministry of Social Affairs 11.12.1998 No. 64). emitted exceed 0.01 kg/h or the sum of Class B compounds (risk phrase R40) exceed 0.1 kg/h. Where periodic monitoring is required at least three valid measurements shall be taken per twelve month period.
2. The temperature of ovens should be **continuously** monitored and either:
    (i) Results continuously recorded.
    (ii) *Or* Fitted with an alarm activating if temperature exceeds design limits.
    (iii) *Or* Interlocked to ensure that excessive oven temperatures are prevented.
3. All installations covered by this guidance note should prepare an annual solvent management plan in accordance with licence requirements.

6.2. Waste water discharges.

1. Establish existing conditions prior to start-up, of key emission constituents, and salient flora and fauna.
2. Daily monitoring of flow and volume, continuous monitoring of pH. Monitoring of other relevant parameters as set up by the RED taking account of the nature, magnitude and variability of the emission, and the reliability of the control technologies.
3. Monitoring of influent and effluent from the waste water treatment plant to establish % BOD reduction and early warning of any difficulties in waste water treatment plant, or unusual loads. (**except Wood Treatment Industry, Energy production)**
4. The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.
5. Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter. (**for Board Manufacturing Industry and Wood Treatment)**.
6. Periodic fish tainting and toxicity tests where appropriate taking account the nature, magnitude and variability of the emission, and the reliability of control technologies. **(for Wood Treatment Industry)**.

6.3. Solid waste monitoring.

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

PRINCIPAL REFERENCES

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   EPA/310-R-95-003, Washington D.C., 1995.

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3. Integrated Pollution Control Licensing
   Batneec Guidance Note For Board Manufacture.
   EPA No. LC 11(2/96), Environmental Protection Agency, 1996.

4. Integrated Pollution Control Licensing
   Batneec Guidance Note For Manufacture or Use of Coating Materials.
   EPA No. LC 22, Environmental Protection Agency, 1997.

5. Integrated Pollution Control Licensing
   Batneec Guidance Note For Wood Treatment and Preservation.
   EPA No. LC 25, Environmental Protection Agency, 1997.

6. Integrated Pollution Control Licensing
   Batneec Guidance Note For Production of Energy. ***Draft document***
   EPA No. LC (/97), Environmental Protection Agency, 1997.

European Council

7. Council Directive 1999/13/EC of 11 March on the limitation of emissions volatile organic compounds due to the use of organic solvents in certain activities and installations.
   Official Journal of the European Communities 99/L 85/01.